EDUCATION AND NEW DEVELOPMENTS

2024
Volume 1

Edited by

Mafalda Carmo

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Edited by Mafalda Carmo, World Institute for Advanced Research and Science (WIARS), Portugal

Published by inScience Press, Rua Tomas Ribeiro, 45, 1º D, 1050-225 Lisboa, Portugal

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BRIEF CONTENTS

FOREWORD

This book contains the full text of papers and posters presented at the International Conference on Education and New Developments (END 2024), organized by the World Institute for Advanced Research and Science (WIARS).

Education is a fundamental right that accompanies us from the very beginning of our lives. It encompasses every experience we encounter, influencing and shaping our thoughts, emotions, and actions. Whether we engage in formal education within classrooms or learn from the world around us, the process of acquiring knowledge plays a vital role in our personal growth and development. It equips us with the tools to navigate the complexities of life, broadens our perspectives, and empowers us to make informed decisions. This International Conference seeks to provide some answers and explore the processes, actions, challenges and outcomes of learning, teaching and human development. Our goal is to offer a worldwide connection between teachers, students, researchers and lecturers, from a wide range of academic fields, interested in exploring and giving their contribution in educational issues.

We have brought together a diverse group of individuals with various backgrounds to contribute their unique perspectives and knowledge on Education. By including people from different nationalities and cultures, we aim to create a rich plethora of experiences that can broaden our understanding of human nature and behavior. The exchange of ideas and experiences among our participants helps to cultivate personal and academic development, providing a platform for the exploration of new insights and discoveries.

END 2024 received 729 submissions, from more than 50 different countries, reviewed by a double-blind process. Submissions were prepared to take form of Oral Presentations, Posters, Virtual Presentations and Workshops. The conference accepted for presentation 284 submissions (39% acceptance rate).

The conference also includes one Keynote presentation by Dr. Ipek Kocoglu, Kean University, USA. We would like to express our gratitude to our invitee.

This conference addressed different categories inside the Education area and papers are expected to fit broadly into one of the named themes and sub-themes. To develop the conference program, we have chosen four main broad-ranging categories, which also covers different interest areas:

• In **TEACHERS AND STUDENTS**: Teachers and Staff training and education; Educational quality and standards; *Curriculum* and Pedagogy; Vocational education and Counselling; Ubiquitous and lifelong learning; Training programs and professional guidance; Teaching and learning relationship; Student affairs (learning, experiences and diversity; Extra-curricular activities; Assessment and measurements in Education.

• In **PROJECTS AND TRENDS**: Pedagogic innovations; Challenges and transformations in Education; Technology in teaching and learning; Distance Education and eLearning; Global and sustainable developments for Education; New learning and teaching models; Multicultural and (inter)cultural communications; Inclusive and Special Education; Rural and indigenous Education; Educational projects.

• In **TEACHING AND LEARNING**: Critical, Thinking; Educational foundations; Research and development methodologies; Early childhood and Primary Education; Secondary Education; Higher Education; Science and technology Education; Literacy, languages and Linguistics (TESL/TEFL); Health Education; Religious Education; Sports Education.

• In **ORGANIZATIONAL ISSUES**: Educational policy and leadership; Human Resources development; Educational environment; Business, Administration, and Management in Education; Economics in Education; Institutional accreditations and rankings; International Education and Exchange programs; Equity, social justice and social change; Ethics and values; Organizational learning and change, Corporate Education.

The contributions were published across two volumes, and this is the Volume 1 of the book titled *Education and New Developments 2024*, that showcases the outcomes of dedicated research and developments undertaken by authors who are driven by their passion to enhance research methods that directly relate to teaching, learning, and the practical applications of education in the present day. Within its pages, you will find a diverse array of contributors and presenters who expand our perspectives by delving into various educational matters.

This first volume focuses on the main areas of TEACHERS AND STUDENTS and TEACHING AND LEARNING, being the contributions of the other two areas published in Volume 2.

We would like to express thanks to all the authors and participants, the members of the academic scientific committee, and of course, to our organizing and administration team for making and putting this conference together.

Hoping to continue the collaboration in the future.

Respectfully,

Mafalda Carmo
World Institute for Advanced Research and Science (WIARS), Portugal
Conference and Program Chair

Porto, Portugal, 15 - 17 June, 2024

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KEYNOTE LECTURE

"REVOLUTIONIZING LEARNING: THE IMPACT OF ARTIFICIAL INTELLIGENCE ON EDUCATIONAL PARADIGMS"

Dr. Ipek Kocoglu
Kean University, USA

Abstract

The integration of Artificial Intelligence (AI) in education is revolutionizing traditional teaching methods and curriculum development by facilitating personalized and adaptive learning experiences. This research paper explores the transformative role of AI in enhancing educational paradigms by optimizing learning outcomes tailored to individual needs. Drawing from a range of studies, the paper examines the effectiveness and challenges of AI applications within various educational settings. Our findings indicate that AI significantly boosts educational performance by adapting content delivery to match individual learning styles and needs, thus reshaping educational strategies and personalizing the learning experience. Furthermore, AI-driven adaptive learning systems not only customize educational content but also streamline administrative tasks for educators, enhancing overall efficiency. However, this technological advancement also introduces challenges, including ethical concerns and privacy issues that necessitate thorough scrutiny and careful implementation. The paper emphasizes the importance of comprehensive teacher training and ongoing ethical evaluation to ensure responsible use of AI in education. Through a nuanced understanding of AI's potential and limitations, this study provides actionable insights for educators and policymakers aiming to harness AI technologies to foster more dynamic and responsive educational environments.

Keywords: Artificial intelligence, adaptive learning, educational technology, curriculum development.

Biography

Dr. Ipek Kocoglu is an assistant professor of Strategy and Organization Theory in the Department of Management at Kean University. Following her doctoral studies in Management and Organization Theory, Dr. Kocoglu completed her post-doctoral research at Stevens Institute of Technology through a prestigious fellowship. She combined her background in industrial engineering and technology and innovation management to advance a framework that uses abductive research for new idea generation. Dr. Kocoglu's research focuses on gender diversity and sustainability. She has published in top-tier journals listed in the Financial Times 50 including the Academy of Management Review, The Leadership Quarterly, Management Decision, International Journal of Production Research, and Engineering Management Journal. Her research addresses critical issues like the effect of social context on women leaders' perceived competence, and the impact of extreme threats on organizational risk-taking. In her recent project Dr. Kocoglu develops a framework for digital sustainability solutions by leveraging Information Systems to mitigate the effects of climate change. Her contributions to academia have earned her numerous accolades, including the Excellence in Scholarship Award from Kean University and the Eschenbach Award for Best Paper from the American Society of Engineering Management. A recognized leader in open education, Dr. Kocoglu has been instrumental in pioneering the Open Education Resources (OER) conference at Kean University. She passionately advocates for using OER to close the educational equity gap for minorities and first-generation students. Dr. Kocoglu continues to inspire students in courses on entrepreneurship, organizational behavior, and strategic management. She is the author of a textbook on Organizational Theory and several influential book chapters on digital business models and strategies for developing digital government platforms. Beyond her academic achievements, Dr. Kocoglu serves as the Global Ambassador for inclusive research at the Diversity, Equity, and Inclusion Division of the Strategic Management Society. She is an active reviewer for esteemed journals, including Academy of Management Discoveries and Management Decision. Dr. Kocoglu's research has garnered over a thousand citations and has been featured in popular media such as Psychology Today, underscoring their impact on both academic and public spheres.

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DEVELOPMENT OF DIDACTICS AND PEDAGOGY IN THE DANISH PEDAGOGY PROGRAM THROUGH CRAFT ACTIVITIES

Astrid Margrehe Hestbech, & Louise Hvitved Byskov
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Abstract

This research project has explored how craft activities can contribute to the learning of pedagogy students in their education and the subsequent impact of working with these activities on their practical experiences in schools and after-school care. Design-based research methodology is applied in this research project. The craft activities are aiming towards achieving two primary objectives: 1) To enhance students' learning capabilities. This proposition is formed, among other sources, such as prior research conducted by Dr. Anne Kirketerp, which has shown that craft activities involve repetitive movements conducive to training conscious focus on the present moment and strengthening attention these findings are supported by recent research in Craft Psychology (Kirketerp, 2020); 2) To strengthen pedagogy students' didactic and practical skills and competencies in conducting craft activities with children in school and leisure settings, ensuring that children have enjoyable and educational experiences with crafting.

Keywords: Craft activities, pedagogy, student affairs.

1. Theoretical framework and motivation

This paper presents an analysis of how engagement in craft activities can contribute to enhancing learning, and mental health among students, and instilling a love for craftsmanship in children. In a world characterized by rapid technological advancements and constant disruptions, the increased acceleration, speed, and numerous disturbances have impacted our ability to immerse ourselves and work with concentration (Rosa, 2010). Consequently, we have explored novel methods to promote focus, attention, and positive emotions. Craft activities, such as painting, knitting, sewing, and ceramics, have proven to offer opportunities for improved concentration and depth of engagement (Bjarkam, 2023). This paper focuses on identifying and analyzing the elements of craft activities that contribute to strengthening present-moment focus and generating positive emotions.

Craft activities involve repetitive movements that are conducive to training conscious focus on the present, enhancing attention, and simultaneously contributing to the creation of positive emotions. Additionally, these activities empower young individuals to feel that they are making a positive difference (Kirketerp, 2020, p. 30-35). The deep concentration required by craft activities can lead to an enhanced ability to remain in the present. We have explored how these activities can function as a form of meditation, supporting the development of attention skills. The project emphasizes creating haptic activities, focusing on engaging the senses, particularly the sense of touch, often designed to provide a hands-on experience.

2. Method

This research project contributes to knowledge about the use of craft activities to support student learning and the ripple effect on practice, as well as the exploration of innovative teaching methods. The project is rooted in "design-based research." This method was selected because it actively intervenes in and with practice, comprising iterative processes: design testing, evaluation, analysis, improvement, collaboration, and application-oriented approaches (Reeves, 2006). Data collection involved observations, interviews, gathered materials, photographs, and meeting notes.

3. Craft activities in higher education instruction - To enhance students' learning capabilities

This section of the project has investigated the potential use of craft activities in the instruction of pedagogy students as a method to strengthen present-moment focus, increase attention, and promote positive emotions in teaching sessions. Over 6 months in their education, students experimented with engaging in craft activities while participating in theoretical instruction during their internship module in the pedagogy program.

Following the instructional sessions, students were interviewed regarding their experiences with teaching incorporating craft activities. Several students mentioned a positive correlation between the activities and their ability to focus. Engaging in craft activities was viewed positively, but challenges were also noted in balancing the execution of activities while maintaining focus. The opportunity to be active and participate in craft activities was considered beneficial for concentration and engagement. One student stated, "It's nice to have some variety, and it's easier to stay focused as we're not just sitting and getting tired of staring at the board." Several students found it easy to multitask and follow the instructions, but for some, it could be challenging at times. One student mentioned, "Enjoyable, but the activity became occasionally challenging when I had to listen simultaneously." However, craft activities during instruction were generally seen by students as a way to make it easier to focus and engage. They expressed appreciation for teaching methods that incorporated variation and active participation, emphasizing the importance of versatile instructional approaches.

Based on the students' interviews, it can be concluded that students perceive craft activities in instruction as positive, offering a pleasant and diverse way of learning. Activities with practical applications are valued, and the diversity in teaching methods is considered positive. However, it is also observed that not all students benefit equally from instruction involving craft activities. Therefore, in the planning, execution, and evaluation of instruction, educators need to consider students' diverse preferences and strike a balance in encouraging students to use craft activities during the learning process. In traditional teaching formats such as lectures, it may make sense to support students in engaging in an activity to optimize their focus, but it may not always be necessary; perhaps note-taking or a specific focus on a visual element is more appropriate, where it would be inconvenient for students to look away. Students learning in higher education is not only about intellectual skills and competencies in their field of study; it is also important to consider the body as part of the learning process. Craft activities contribute to addressing this aspect. Sitting still for extended periods during instruction is often challenging; having the opportunity for movement has proven to be significant for learning. However, instructors must bear in mind that both the intellect and the body contribute to the learning process (Fredens, 2018).

Through this project, we have observed that pedagogy students have gained more varied educational experiences than previous students. One student expressed, "It's great with activities in teaching, especially activities we can use in practice." Craft activities thus serve multiple purposes, providing students with better outcomes from their education, offering concrete and physical experiences with craft activities, and providing students with ideas and skills relevant to their practice in internships and future professional life.

4. Integration of craft skills in pedagogical practice: Engaging children in after-school programs through craft activities

This section of the paper explores the application of pedagogy students' use of craft activities in after-school programs, with a one-hour painting workshop on one afternoon used as an example. The Danish public school system primarily focuses on academic skills (EVA, 2015). This emphasis is also reflected in Danish pedagogy programs, where vocational subjects have been de-emphasized over the past decades. This limitation results in children having limited exposure to crafts. As argued, there is potential for children to immerse themselves in a craft by interacting with physical materials and tools. Therefore, it is crucial to introduce pedagogy students to crafts so that they can instill joy in craft activities in children while enhancing their ability to concentrate.

A group of pedagogy students was tasked with introducing children to the craft of painting through a workshop. To qualify for this task, they received instruction for a day at a painting vocational school, where they were introduced to painting tools and various painting techniques. In the project, we take the professional aspects of craftsmanship seriously, enabling students to convey the professionalism of painting to children, inspiring them to engage in crafts, and broadening their horizons (Byskov et al., 2023). We consider this an essential aspect of the work of educators.

At the after-school program where the students conducted the painting workshop, they expressed a desire for a sign for their building visible to passersby. Based on this information and the students' visit to the painting vocational school, the pedagogy students strategically planned how the painting workshop could be facilitated for a group of children.

In the after-school program, the students translated their acquired skills from the painting vocational school into the following authentic task for the children: "Paint a sign for the after-school program together." The students and children collaboratively painted a colorful sign. In this context, the children learned to use painter's tape and paint using a dabbing technique. They also had the opportunity to be creative by deciding what to paint on the sign. This means the children both acquired new skills and had the opportunity for influence. Furthermore, the children also experienced professional pride in the joy of creating the sign and others' appreciation of it when the sign was used in the after-school program. This example illustrates the integration of craft skills into pedagogical practice and emphasizes the value of practical experiences for both pedagogy students and children.

The students have benefited from working systematically with didactics. They set goals for both process and product. The students were active participants in the process, guiding the use of painting tools and introducing children to techniques reminiscent of traditional apprenticeship learning. Additionally, pedagogy students and children collaborated in creating the sign, providing them with a shared endeavor and shared engagement (Lave & Wenger, 2011). For the students, the process has been rewarding as it opened their eyes to the potential of working with children and crafts. The serious consideration of craftsmanship in terms of incorporating painting traditions and using the craft produced (the sign) stands in contrast to the usual practice in Danish after-school programs, where children often paint on paper that is shortly discarded. Different groups of students visited various after-school programs; other students engaged in activities like flower arranging, cake baking, and playing as electricians. The students collectively reflected that craft-inspired activities could offer good variation in children's daily lives. The students expressed a desire to continue engaging in craft activities with children in the future.

5. Summary

The students are part of an educational environment characterized by a singular focus on developing intellectual competencies while simultaneously experiencing numerous disruptions and increased acceleration, both in their education and private lives. Therefore, in this project, we have attempted to create alternative learning opportunities where students can work on more facets of themselves than just the intellectual, strengthening their ability to focus and to systematically plan, execute, and evaluate activities involving craft for children didactically.

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PRE-SERVICE TEACHERS' KNOWLEDGE BASE FOR TEACHING MATHEMATICS: THE DEVELOPMENT OF SYNTACTIC AND SUBSTANTIVE KNOWLEDGE

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Abstract

The purpose of this study is to analyze pre-service teachers' knowledge base in terms of their substantive subject matter knowledge and syntactic subject matter knowledge. The study involves 20 students from a program course for K-3 teachers, *Advanced Math Development* (Semester 6) and 25 from a program course for teachers in Grades 4-6, *Mathematics 4* (Semester 6). The data collection includes pre-service teachers' reflections upon their written analysis of teaching observations as mathematical content and written examples of how to implement a teaching moment (content) that they had created themselves. The crucial content for the study is algebraic patterns, rational numbers (fractions), proportionality, and combinatorics. The findings from the study identify and highlight areas to be developed, especially with respect to student teachers' knowledge base and what they need to explore concerning subject-specific content for teaching mathematics, as well as crucial relevant content (substantive knowledge) and how to apply this in teaching (syntactic knowledge). Generally speaking, the study highlights the challenges student teachers face in grappling with mathematical concepts when they describe their observations, as well as in their own construction of a teaching moment. This means that in teacher education for mathematics, more attention ought to be paid to developing a knowledge base founded on the transformation of substantive knowledge to syntactical knowledge and its impact on student teachers' learning of mathematics for teaching purposes. The study can also provide a deeper understanding of student teachers' learning process and challenges related to the knowledge base, e.g., its substantive and syntactic components.

Keywords: Pre-service teachers, knowledge base, substantive subject matter knowledge, syntactic subject matter knowledge, mathematics for teaching.

1. Introduction

Pre-service teachers' knowledge of mathematics is an important issue in mathematics education and has been an active research field over the last decades. Teachers' mathematical knowledge, as well as its conceptual meaning with regard to what student teachers should learn, has been described by such researchers as Shulman (1986) and Ma (1999). They developed a basis for research orientation and constructed the theoretic model of Pedagogical Content Knowledge and its extension, via Subject Matter Knowledge, to Mathematical Content Knowledge for Teaching. Empirical studies of teachers' knowledge claim that pre-service teachers must transition from a student's perspective to a teachers' perspective in order to understand mathematical content themselves and grasp how students learn the same content based on different abilities, knowledge, and conditions for development. Pre-service teachers also learn mathematics and mathematical content in different ways, such as education activities, teaching evaluation, and the construction of teaching activities. According to Dewey (1998), each learner's knowledge base is founded on reflection and the analysis of situations, which they carry out themselves on the basis of their own experiences. The same starting point is described by other researchers with regard to teachers' subject-related, content-specific professional development via critical reflection and self-reflection (Mezirow & Taylor, 2009; Hardy, Decristan, & Klieme, 2019). Against this background, pre-service teachers' reflections related to practice and analysis of the teaching experiences of their peers is a particularly important part of their own development of a mathematical identity. According to researchers, a continuous connection between the development of student teachers' knowledge of mathematics and teaching practices ensures a relationship with the subject of mathematics that can positively impact their learning of mathematics (Boaler, 2002). The construction of knowledge from practical examples of

teaching supports pre-service teachers in identifying the relationship between practice and theoretical knowledge. At the same time, the evaluation of practice presupposes a theoretical knowledge that Shulman (1987) called "scientific knowledge for teaching as a diverse disciplinary knowledge and its interrelations as a framework for a knowledge base for teaching." In the context of pre-service teachers' education, the study of knowledge bases for teaching is important and timely, both for research regarding pre-service teachers' learning for the purpose of teaching mathematics and for current research discussions about teaching and its impact on student learning (Darling-Hammond & Bransford, 2005; Hordern & Tatto, 2018). Leikin and Zazkis (2010) posit that there is both a subject content knowledge component and an epistemological knowledge component to students' learning. A successful combination of these components can be achieved by a learning discourse for pre-service teachers in which their subject matter knowledge within specific mathematical fields can serve as a logical starting point for constructing teaching activities and conceptual structures for teaching. According to researchers, a responsive relationship between subject mathematics knowledge field and teaching provides an understanding of what to teach and how to teach it, as well as principles for students' learning and understanding of how this contributes to students' continuous and progressive learning. This kind of knowledge is an increasingly important part of pre-service teachers' preparation for their future profession as teachers, both in terms of learning what constitutes subject matter and with regard to mathematical concepts and the connection between mathematical concepts related to teaching and learning mathematics (Jakobsen, Thames, & Ribeiro, 2013; Norton, 2019). This study examines pre-service teachers' learning of subject matter and its conceptual meaning with regard to Shulman's theory of substantive and syntactic subject matter knowledge structure.

The purpose of the study is to analyze pre-service teachers' knowledge base and its development related to substantive subject matter knowledge and syntactic subject matter knowledge.

2. Theoretical background and starting points

The theoretical framework refers to the conceptualization of teachers' content knowledge for teaching, as defined by Shulman (1986, 1987) and consistent with the constitution of pedagogical content knowledge and subject matter knowledge (Ball, Thames, & Phelps, 2008). According to these researchers, as a practical realization of knowledge, skills and competencies for teaching, pre-service teachers' content knowledge leads to professional prosperity and expertise via theoretical study and practical experiences. To underline the relationship between them, pedagogical content knowledge, subject matter knowledge, and subject-specific content knowledge were defined as categories for a knowledge base (Shulman 1986), both in theoretical terms and when implemented in the context of teaching practice. The knowledge base, intended to differentiate between knowledge of mathematics as a subject discipline (procedural meaning) and knowledge about mathematics and its application in teaching and learning (what is created through conceptual meaning) (Goulding, Rowland, & Barber, 2002). The knowledge base consists of two primary parts, definition and significance, and two kinds of knowledge, substantive (SUB) and syntactic (SYN). In theory, comparing these parts provides a conceptual picture of how mathematics should be known and how it should be taught (Askew, 2020). SUB and SYN knowledge are important components of pre-service teachers' mathematics subject matter knowledge, in conjunction with theoretical-pedagogical design, i.e., their pedagogical content knowledge (Shulman, 1987; Zaslavsky, 2008; Venkat & Askew, 2018). Researchers argue that teaching mathematics is not an easy undertaking, and that preparing pre-service teachers to teach mathematics is thus a complex process that requires ample forethought and preparation. The development of pre-service teachers' professional knowledge of teaching mathematics is tied to their knowledge of fundamental mathematics and its application via explorative classroom-based. In terms of SUB and SYN contexts, having a knowledge base means that pre-service teachers should learn general principles for the construction of subject mathematics, i.e., "knowing that," and how they can organize teaching mathematics content, i.e., "knowing how" (Turner-Bisset, 1999). In a substantive sense, mathematics focuses on mathematical facts as mathematical structures, concepts and methods, their relationship within the subject of mathematics, as well as essential properties and the relationships between facts, mathematical structures and concepts in the context of conceptual mathematics and its application in counting. Insofar as it calls for epistemic knowledge, syntactic knowledge is about how mathematical structures and concepts originate from mathematical ideas. It has developed through history and in different cultural contexts. SYN knowledge provides the foundation for knowledge about what and how to teach and for developing of teaching experiences in progress (Anderson & Clark, 2012).

This paper examines what pre-service teachers should learn in order to effectively teach mathematics, using subject matter knowledge as a theoretical starting point and through the extension of SUB and SYN structures.

3. Methodology

3.1. Context and participants

The context of this study is a substantive and syntactic component concerning elementary school mathematics education for the K-3 program course *Advanced Math Development,* and the Grades 4-6 program course *Mathematics 4* (both bachelors' level programs). The study focuses on the student's individual work, such written analysis of observations regarding, e.g., teaching content and their own construction of a teaching moment. To track the development of pre-service teachers' mathematics knowledge base, the following conceptual chart is used (Figure 1).

Figure 1. Context for the study.
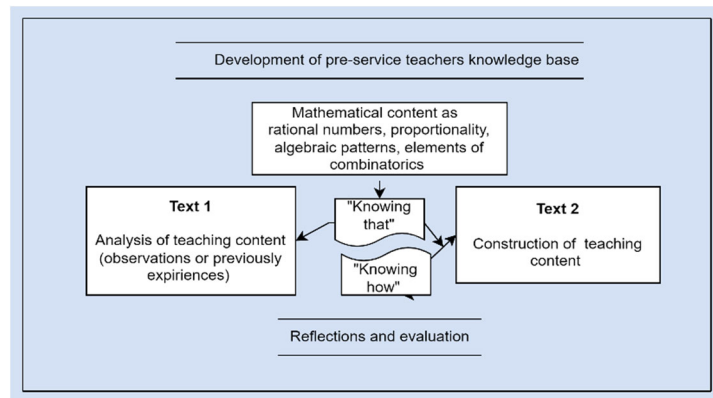
Both courses were conducted during Semester 6 of two elementary school teacher education programs, in the 2023 academic year. In both programs, most of the participants were female. Both courses had a length of five weeks and participants had no other courses during this time.

K-3 pre-service teachers had four days of practicum work involving observations and analysis of teaching content. After the practicum, the pre-service teachers were given two weeks to produce a written analysis of their observations. At the end of the course, the pre-service teachers presented their detailed plan for a teaching moment with mathematics–specific content. The crucial mathematical content from which to choose were algebraic patterns, rational numbers, proportionality, or basic combinatorics. For their second assignment, the pre-service teachers were asked to plan mathematical content with the same mathematical content as in the proposal for Text 1. The mathematical content for Texts 1 and 2 did not need to be the same.

The Grades 4-6 program course did not include a special practicum component. Instead, the student teachers used their experiences from observations during an earlier practicum (part of a school-based training course). At the end of the course, the pre-service teachers were asked to produce two written analyses (Text 1 and Text 2); see Figure 1. They could choose from the same crucial mathematical content as in the K-3 course. Pre-service teachers from the K-3 and 4-6 programs had different initial learning conditions, as well as direct access to practicum work and different timeframes for producing Text 1. The observation of fundamental differences and similarities concerning these different conditions was especially emphasized. The important part of the study entailed analyzing pre-service teachers' development of substantive and syntactic knowledge, as well as the relationship between them (see Figure 1).

3.2. Data collection and analysis

Data include anonymized copies of individual students' Text 1 and 2 assignments; twenty pre-service teachers' assignments from the K-3 teacher education program and twenty-five pre-service teachers' assignments from the Grades 4-6 program (Corbin & Strauss, 2008). These data were analyzed using a conceptual knowledge base comprising substantive and syntactic components, in order to examine how the pre-service teachers described knowledge in the substantive sense of "knowing that," i.e., mathematical facts and concepts (Text 1), and in the syntactical sense of "knowing how," i.e., the systematic analysis and evaluation of concepts in terms of teaching, argumentation and logical ability (Text 2). The first component addressed pre-service teachers' analysis of teaching content, and the second component addressed their construction of a teaching moment. Data were interpreted from the pre-service teachers' written texts.

4. Results

4.1. Findings: Substantive knowledge and Text 1

In total, clear elements of a substantive component were identified in twelve K-3 pre-service teachers' and ten Grades 4-6 pre-service teachers' assignments (Text 1). Among these, it was obvious that in the analytic process it was difficult for both K-3 and Grades 4-6 pre-service teachers to distinguish conceptual facts from teaching and facts related to subject mathematics, as well to organize a sequential description and analysis of concepts (SUB component). Even if observed teaching included elements of combinatorics or algebraic patterns, the written analysis focused on the limited, fact-based conceptual space, mostly on natural numbers and counting with natural numbers. These results were found both in the K-3 and the Grades 4-6 assignments (Text 1). It was obvious that it was difficult for pre-service teachers to relate their own knowledge of subject mathematics (SUB component) to teaching practice. Instead, they used the content they knew best, such as natural numbers and other easily understood content. The pre-service teachers had different timeframes in which to reproduce Text 1, but those differences had no evident impact on the quality of their texts. The K-3 pre-service teachers had two weeks to produce Text 1 (based on direct observations) and the Grades 4-6 pre-service teachers had five weeks to work on Text 1. Both groups were found to face the same challenges in expressing the substantive sense of knowledge.

4.2. Findings: Syntactic knowledge and Text 2

The analysis of Text 2, which consisted of pre-service teachers' detailed plan for a teaching moment, indicated a positive change in their achievement of SUB knowledge. Eighteen of twenty K-3 pre-service teachers and sixteen of twenty-five Grades 4-6 pre-service teachers were able to provide a theoretical account of a SUB component and showed signs of efforts to overlap SUB and SYN components in their texts. During the course, most of the student teachers made a conceptual development towards transformative SUB-based thinking and were able to interpret this in the content of their teaching moment. But it was still a challenge to systematically assimilate the content in a teaching situation. It was difficult for them to change perspective, i.e., to change the perspective of the analysis from a student perspective to that of a teacher and take on the role of a teacher. This led to the statement of mathematical facts, rather than the construction of a teaching moment. These findings indicate that subject-specific content knowledge is increasingly important to pre-service teachers' ability to construct syntactic knowledge.

5. Conclusion

The purpose of the study was to analyze pre-service teachers' knowledge base and its development in the context of substantive subject matter knowledge and the concept of syntactic subject matter knowledge. Some interesting findings emerged from this study. Firstly, mathematical content such as algebraic patterns, rational numbers and elements of combinatorics requires a certain conceptual level of knowledge on the part of pre-service teachers in order to be assimilated. Pre-service teachers' performance was weaker when it came to algebraic patterns and rational numbers. They tended to stick with the mathematical content they remembered from lectures and seminars in their analysis, rather than using it combinatorically. In short, they were able to imitate but not to create something of their own. At the same time, combinatorics was the best-described learning field for pre-service teachers. Our hypothesis is that they learnt combinatorics via experimentation (visualization), whereas algebraic patterns and rational numbers are more abstract forms of mathematics. This finding also indicates that pre-service teachers' knowledge of mathematics and how they learnt mathematics in school still has a strong impact on their learning with regard to both components but affects the SYN component much more. The study highlights the importance of paying more attention to how pre-service teachers learn mathematics for teaching. In summation, the results of the study reveal student teachers' challenges in grappling with mathematical concepts, as well in their development of SUB knowledge. This means that in education programs for mathematics teachers, more attention ought to be paid to developing pre-service teachers' knowledge base in the form of SUB knowledge and the transformation from a SUB to SYN thinking structure, as well as the impact of this transformation on student teachers' learning of mathematics for teaching. The study provides a broader understanding of the process by which student teachers learn mathematics for teaching purposes. It was clear that challenges related to the substantive and syntactic components of the knowledge base need further investigation. The study also illustrates that pre-service teachers' learning ability depended on their theoretical knowledge, and that practicum work was not sufficient for developing such a knowledge base. More research is needed to clarify an optimal relationship between the development of theoretical knowledge of mathematics for teaching and practicum, with a focus on advantages and disadvantages. This study has limitations that must be taken into account. Therefore, its findings are not generalizable and are tied to the specific context of the study. Still, they provide new knowledge about the preparation of pre-service teachers for teaching mathematics.

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CRITICAL THINKING IN LEARNING PROCESS OF MATH IN GRADES 5-6 IN LATVIA

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Abstract

The study was carried out to investigate the ability of students in grades 5-6 to think critically and creatively, analyse, evaluate and reason when solving mathematics problems, contributing to thedynamics of learning outcomes. To develop mathematics tasks and suggestions for their design toimprove critical and creative thinking skills. To develop support material and recommendations for teachers to implement critical thinking skills in solving mathematics tasks. Theoretical research on critical thinking is summarised, and a brief look at the history of the Latvian education system is given. Methods and approaches for the implementation of critical thinking in schools are summarised, based on the materials of the Latvian education reform and the latest scientific knowledge in modern pedagogy. The use of critical thinking tasks in mathematics for pupils in grades 5-6 is analysed and the results of the study are summarised. Research methods: analysis of scientific literature and documents, observation, survey and interviews. Results of the study: recommendations for teachers on the use of tasks that improve the critical thinking skills of pupils in grades 5-6. Applicability of the work: development of a support material for teachers to improve critical thinking and creativity skills in mathematics of pupils in grades 5-6. The material consists of sample tasks and methodological suggestions on how to modify the tasks found in pupils' textbooks so that they require critical thinking, reasoning and analysis from pupils.

Keywords: Critical thinking, analysis, competence, judgement, evaluation.

1. Introduction

The topic of this study is "Developing critical thinking in 5th-6th grade pupils in mathematics lessons in Latvia". The topic was chosen on the basis of the author's experience of working in schools for more than 30 years, teaching mathematics and being actively involved in the approbation of the new competency-based curriculum of the educational reform in Latvia.

Today's education focuses on the development of a wide range of skills, but one of the most fundamental is to reason, think, evaluate critically and make decisions. The changes in pedagogy and teaching methods that are currently taking place in the world and in Latvia mark a shift from the acquisition of knowledge and the "hammering out of facts" to the acquisition and development of competences that are strategically needed in the 21st century. Through various projects, teachers learn practical methods and real-life examples of how to design learning tasks so that students can purposefully develop the skills that are so relevant today and, more importantly, know how to apply them.Currently, Latvian students are generally good at tasks that require them to remember or act in familiar situations, but they lack the skills and experience to delve into and process diverse data, work in teams, propose solutions to non-standard situations, make connections between what they have learned in theory and what they have experienced in real life, analyse what they have done and set goals for future work. Students lack the skills to implement their ideas in new circumstances.The author's research has shown that the development of critical thinking skills cannot be studied in isolation from other skills. Perceptual skills play a special role in a student's growth, helping to retain knowledge in different contexts through different ways of thinking and self-directed learning, reinforcing its connection to personal experience. Students develop skills that are used in different learning domains and are able to solve a problem independently.

According to the National Centre for Education, Grade 9 pupils are able to complete half of the tasks correctly. In the last three years (2017-2019), the percentage of completed tasks is 58%, 54% and 56%. The author wants to investigate the reasons why students avoid solving text-based tasks and work in everyday life at school, to conduct research on how students can improve their academic performance by developing critical thinking skills.

Aim of the study: to investigate the skills of pupils in grades 5-6 to think critically and creatively, analyse, evaluate, justify when solving mathematics problems, promoting the dynamics of pupils' mathematics learning achievements and to develop a set of tasks and recommendations for the design of tasks to strengthen these skills.

Research base: 103 students and 3 teachers in grades 5-6 at School X.

2. Theoretical characteristics of critical thinking

The ideas of critical thinking date back to the 18th-19th centuries and many philosophers and educators have been working on it. In the 18th century. The Enlightenment theorised that a rational, enlightened person would be able to solve all the problems of his life and would create opportunities for the moral growth and economic development of humanity. (Rubene, 2008) The idea of social progress based on the use of critical reason, unrestricted faith in the possibilities of the developing mind, was emphasised.

Z. Rubene (2008) analysed the insights of various authors: Emanuel Kant believed that the main goal of critical thinking in moral education is to develop the faculties of the mind that would cultivate spiritual maturity and he was joined by J.F. Herbart in linking the basic principles of transcendental critique of the mind with the ordering of the contradictory experience of learning processes - the formation of self-responsible action as the goal of pedagogical activity. P.Notorps also puts forward the idea of using critical reasoning in social and pedagogical practice (Rubene, 2009).

From a learning perspective, critical thinking is characterised by reasoned, purposeful judgement and the use of cognitive strategies and skills that increase the reliability of the result obtained from the thinking activity. It can be developed through specific learning and applied in a wide variety of situations.

One of the pressing problems in contemporary pedagogy is to clarify the possibilities of developing critical thinking. Critical thinking is a concept in Latvian pedagogy that is the subject of much debate. It has involved both the part of the Latvian society connected with the theory and practice of pedagogy that supports the introduction of critical thinking into schools and the part that believes that this pedagogical model has been exported from America and is rather sceptical about the possibilities of its adaptation in Latvia. However, despite the polarisation of opinions, since the 1920s, the European Union has been the most active in the field of critical thinking. Critical thinking has been an important phenomenon in pedagogical practice in Latvia since the mid-1990s.

3. Key ideas and objectives of competence education in mathematics in Latvia

Critical thinking can be developed through moderate learning and through independent reflection on one's own work, by analysing mistakes and setting new goals, by analysing one's own experiences, the student develops critical reasoning. During lessons, the author has observed, the teacher does not always have enough time for feedback, but this is of great importance for the pupil's further development. Critical thinking is a question-oriented way of thinking where students are encouraged to think and express themselves critically. Critical thinking helps to develop decision-making and problem-solving skills. (Explanatory Dictionary of Educational Terms, 2000)

Latvia's schools are rapidly introducing new key ideas of competence education, which focus on the dynamics of student achievement, self-growth and self-fulfilment. Everything is being done to ensure that our schools produce young citizens who can not only adapt to the new demands of life, but also create new added values.

In the daily work of teachers, it is important to find a methodology that helps the pupil to develop. The basic aim of the process is to create the conditions to develop the ability to think critically. The teacher's task is to observe a number of conditions that help the pupil to develop the basic skills of critical thinking.

The method of critical inquiry helps students to tune their own minds to a particular scientific system. The critical method is a rule of thought that can only be obeyed by willingly accepting it. According to S. Hessen (cited in Rubene, 2009), it is not possible to assess whether a pupil has mastered the critical method either by questioning him or by asking him to solve one or more problems. (Rubene, 2009) Each subject uses the method in a unique way, discovering new features. To master the scientific method of thinking means to use it to solve a wide variety of questions, to be able to access new knowledge oneself. In the critical thinking approach, the key element of pupils' work is the performance of cognitive tasks, i.e. the acquisition and development of thinking activities. In parallel, the pupil develops his/her own system of attitudes, orientations and values. This is a huge body of skills and knowledge for which it is very difficult to find evaluation criteria.

Only through independent learning, independent reflection on one's own experience, can one develop critical reasoning skills; only by oneself can one learn to think critically (Rubene, 2008).

4. Analysis and data processing

To investigate how critical thinking tasks contribute to students' academic achievement, a study was carried out in primary mathematics classes at School X. The author conducted the study in grades 5-6 and collaborated with mathematics teachers at School X. Most of the research was carried out in the author's classroom, where mathematics is also taught. Daily life with these pupils and several mathematics lessons per week made it possible to carry out the study by observing the pupils in different situations and to see the realisation of each day's outcome and the dynamics of pupils' growth.

Participants were selected to include pupils in Year 5 who are in Year 6. The teachers involved in the study are mathematics teachers of the respective grades.

The research base was variable, as the diagnosis was carried out in all four classrooms, the observation and the task validation in one classroom, where the author works.

The work will lead to the development of support material for teachers to improve students' critical thinking skills in mathematics lessons for pupils in grades 5-6. The material will include sample tasks and methodological suggestions on how to modify the tasks in textbooks to engage students in critical thinking, reasoning, analysing, evaluating. In order to achieve the objective of the work, a set of activities is required.The author gained new theoretical insights from the research, which she used in her daily work at school, teaching mathematics to 5th and 6th grade students. The research was planned in stages and analysed.

Stage 1 - observation, document study and analysis, diagnostic work 1 in grades 5. While working in mathematics class 5b at school X, the author carried out research and observation of pupils. In her daily work it is important to understand the abilities, skills and knowledge of each pupil. An observation sheet was used for the observation.

The diagnostic work was prepared for all 5th grades of School X. A group of experts worked on the preparation of the work. The distribution of tasks was aimed at testing students' basic skills to see how well they have mastered the mathematics curriculum in Grades 1-4.After the test, an analysis of pupils' achievements by year group was carried out. The mathematics teachers at X School evaluated the pupils' work and organised the follow-up work according to the assessment of each class.

Stage 2 - observation, document research, task preparation.The author carried out observation in the classroom throughout the school year and used various critical thinking tasks, jigsaw tasks, open-ended tasks in her daily work.

Stage 3 - observation, document analysis, task preparation and validation, diagnostic work 2. Working with the class already in the 6th grade programme, the author continued the observation and used different types of tasks in the lessons, including for the development of critical thinking skills. Tasks requiring students' experience, ability to reason, explain, evaluate increased from 10% to 25%.

Seeing the big differences in the students' growth dynamics, the author was very interested to find out whether Teachers A and B worked on critical thinking or open-ended tasks.

In the questionnaire, both colleagues wrote that lack of time and lack of materials in the teaching book, stressing that recently the situation is improving, in the Skola2030 materials you can find ideas, especially in the 4th and 7th grade groups, that can be used also for 6th grade. The author proposed to use her ideas in 6th grades and to use them in her lessons, she shared her experience how to modify the tasks for everyday work in mathematics lessons. In the methodological sessions of the X school the author shared her experience with her colleagues, conducted master classes, open lessons.

Stage 4 - observation, document analysis, task preparation and validation, diagnostic work 3.

In Stage 4 of the study, special attention was paid to the validation of the tasks in Year 6, the cooperation and exchange of experience between teachers, and the evaluation of the monthly tests. During the lessons, the author continued to observe the pupils and found that they became more organised, self-disciplined, willing to engage in discussions, happy to collaborate in groups, work on research projects, understand the meaning of the outcomes, and create small descriptions of the outcomes. The dynamics of pupils' achievements can best be inferred from the 3rd diagnostic work.

Comparing the results of all classes, there was a dynamic change in students' knowledge and skills.

Figure 1. Results of diagnostic work in grades 6 (percentage).
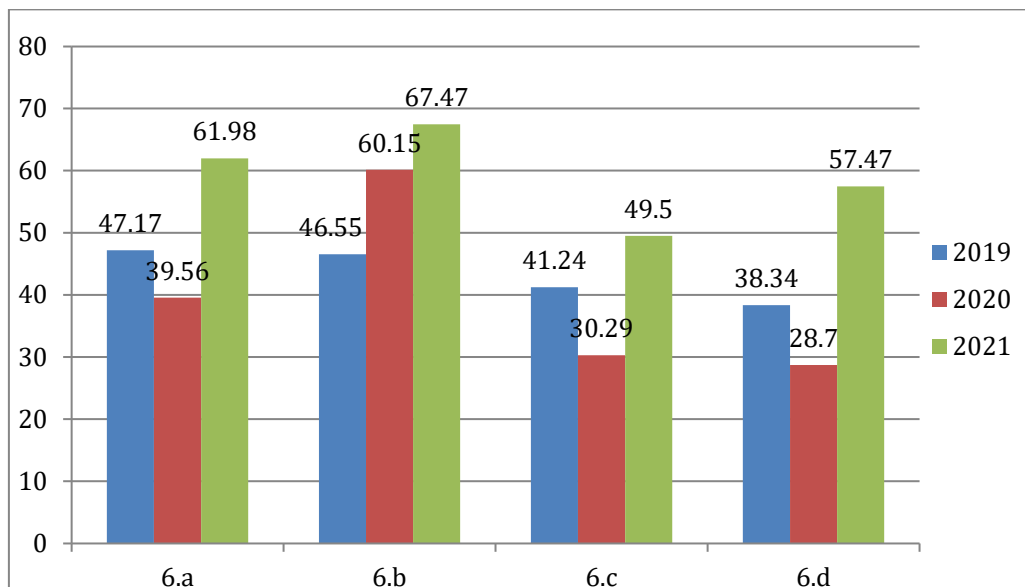
Comparing the dynamics of class achievement, we can see that the dynamics of class b is grade-low. In other classes, the results improved after the 2nd diagnostic work, when teachers also used more tasks requiring critical thinking in their work. The author interviewed both colleagues and verified that the exchange of experience and the use of tasks had produced obvious results. As one of the results of effective work, the colleagues highlighted the collaboration and development of a common methodology, the variety of tasks and the use of digital tools in distance learning.

Stage 5 - surveys, interviews, data collection.

After working for two years with class 6b, observing and analysing the tests, studying the tasks in the textbooks, the author came to the conclusion that the usual style of work in the classroom had to change, but first, the whole concept of assessment had to change.

The results of the diagnostic tests show that there is a dynamic change in pupils' achievements in all grades. Ideally, all these diagnostic exercises would be based on the same algorithm and prepared by the same team. Nevertheless, it is possible to conclude that the results of class 6b are more independent, as there is growth in the tasks that require evaluation, justification and explanation. In the other classes, the results in diagnostic work 2 are much lower. Teachers also admit that they have had little time to work on open-ended or higher-level tasks in lessons. The mathematics teachers at School X analysed each piece of work and teachers made adjustments to their work and chose more critical thinking tasks in lessons.

5. Basic principles of task design for promoting critical thinking and creativity in mathematics lessons for pupils in Years 5-6

When preparing the tasks for mathematics lessons, the author followed some basic rules on how to work with students on critical thinking tasks:

1. More time should be allowed for solving the problems, so that the pupil can think and look for solutions without anxiety.

2. Choose tasks that do not have a single solution so that there are more options and possibilities.

3. Not to give an algorithm for solving the problem, so that each pupil chooses his/her own strategy.

4. Schedule time for students' questions, discussions, exchanges of ideas.

5. Use diagrams, models to solve problems.

6. Use a variety of methods to solve the problems, create interest and try to keep it up until the problem is solved and even continue it in the next lesson or at home.

7. To provide reflection during the problem-solving process, the pupil must see his/her own mistakes and try to eliminate them.

It is very important to understand that when solving critical thinking tasks, everyone has the right to choose his/her own method of solving, based on the skills and knowledge of each student. But these skills and knowledge must grow and develop by doing, by exploring, by making mistakes, by seeking

answers to one's own questions. The teacher must have a special tolerance when dealing with such tasks and be able to motivate the pupil in order to strengthen his/her self-confidence and personal development.

After working for two years with class 6b, observing and analysing the tests, studying the tasks in the textbooks, the author came to the conclusion that the usual style of work in the classroom had to change, but first the whole concept of assessment had to change. There are high expectations for competence education, where the learner and his/her development are at the centre. It is important that the very idea - the teacher as counsellor and the pupil as a growing person, ready for life's challenges, able to solve problems and create new values - is not lost under the pretty words.

By observing the pupils, the author saw how the cooperation of the pupils in the classroom changes, how the pupils become more open. At the beginning of the study, pupils were reluctant to answer questions, afraid of making mistakes, unwilling to justify their answers, the shyest ones generally tried to keep quiet. After regular work, the classroom situation has changed dramatically. Pupils are eager to ask questions, express their opinions, even argue to prove they are right. This gives the teacher enormous satisfaction and the pupils' self-confidence and self-esteem grow.

6. Conclusions

1. Critical thinking tasks, which require students to find answers to questions, deal with unusual situations, reason, investigate, analyse and evaluate, have not been sufficiently explored in the context of mathematics learning in schools. Each teacher works within the limits of his/her enthusiasm and abilities. The author's research has shown that this type of tasks will contribute to the dynamics of pupils' achievement.

2. Critical thinking tasks should be included in the curriculum and regularly used in lessons to develop students' skills - to analyse, discuss, select information, use prior knowledge, express their opinions. These types of tasks help pupils to socialise, increase self-confidence and self-esteem.

3. Regular critical thinking tasks in mathematics lessons improve pupils' knowledge, skills and grades, and there is a clear dynamic.

4. For mathematics teachers in grades 5-6, there are few critical thinking tasks in the textbooks, but there are opportunities for teachers to modify and extend the tasks in the books to create higher-level tasks. The modification of tasks uses critical thinking questions and the basic principles of taxonomy or descriptions of levels of learning.

7. Recommendations

1. To include at least once a week critical thinking tasks in the planning of mathematics lessons for pupils in Years 5-6.

2. When assessing critical thinking in tests, it is recommended that pupils answer orally or record their answers using digital tools.

3. In the 5-6th grade group, use the 4th and 7th grade maths tasks developed by the Skola2030 project, or use the ideas and guidelines offered there.

4. Use the principles of taxo-nomy of learning objectives, descriptions of learning levels, critical thinking questions, own creativity and students' abilities when modifying tasks from textbooks.

5. In mathematics lessons, give students the opportunity to talk, discuss, ask questions and express their opinions. Teachers should encourage pupils to speak freely, to make mistakes and to correct them.

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ONE WON'T FIT ALL: DESIGNING A COLLABORATIVE WRITING MODEL TO PROMOTE L2 WRITING FOR LOW-LEVEL LEARNERS

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Abstract

L2 writing has always been a challenge for language learners and even a stumbling block for low-level EFL learners. This situation is salient in Macau, China where L2 writing and teaching researches receive little attention and local college students' English writing performance is not satisfactory. Additionally, motivated by the fact that low-level EFL learners requires special-designed assistance to succeed in their English learning, and that collaborative writing (CW) has been practiced in language classroom for decades but provide no operational model or guidelines for and (or) imposed limited effect on the less capable EFL learners, the current mixed research adopts the design-based research paradigm to design a CW model for the low-levels to meet their needs and challenges during the co-writing process. A total of 46 low-level EFL learners were involved in the four iterations. The first 3 iterations required participants to finish several co-writing tasks with the proposed CW model, including pre-and post-interviews and post-questionnaire conducted before and after each iteration. The 3rd iteration observed possible significant improvement in the participants' English writing followed by the final round which distinguished itself by operating a control and experimental group to further examine the effectiveness of the CW model on the learners' writing performance. Results showed that 1) the prescriptive CW model has significant contribution to the English writing performance of low-level EFL learners in terms of organization and vocabulary, and 2) participants are positive to the CW model and feel more confident in English writing. Moreover, the study also arrived at further conclusions: the CW model could weaken the observed low-low effect between less able learners as well peer feedback should be skillfully applied to the low-levels as they reported limited appreciation on such practice.

Keywords: *Collaborative writing, low-level EFL learners, design-based research.*

1. Introduction

As an emerging approach in second language writing, collaborative writing (CW) has been around and employed for decades in language classrooms with students completing written tasks in groups or pairs. In a majority of cases, there are little guidelines or no model of this joint practice to apply and students are often left unattended during the task. Low-level learners, who are linguistically and psychologically inferior to their more capable peers, indeed encounter challenges and suffer during the collaborative process. Existing CW practices could not cater to the less capable EFL learners' needs and a CW model is needed to scaffold them through the journey of mediation, negotiation, socialization and production.

Cooperative, peer-learning, interactive, and sociocultural qualities demonstrated in CW have been proved to be valuable and conducive to L2 learning (Elola & Oskoz, 2010; Yang, 2014, etc.). Interestingly, bodies of CW research at large are framed and being elucidated from a socio-cultural perspective. Perspectives from collaborative learning as well language socialization are missing. There is thus a need to include these theories to better interpret the phenomena within CW as well to develop a theoretically solid model.

The researcher proposed a CW model on the basis of the findings of a pilot study as well a synthesis of the three theoretical perspectives: collaborative learning (CL), language socialization (LS) and socio-cultural theory (SCT). In the pilot study, the observed 10 low-level learners were not in the habit of "planning" before writing, unable to find a way to start and behaved passively in corroboration and discussion. The findings echoed to observation discovered in earlier studies (e.g., Bereiter & Scardamalia, 1987; Raimes, 1985; Zimmerman & Bandura, 1994 etc.) and assumption that "low proficiency students may not benefit much from CW tasks" (De la Colina & García Mayo, 2007, p.95).

The present model was framed under the 3 prerequisite L2 writing stages—planning, generating and reviewing. A fourth stage "feedback" was added to perfect the CW process and more importantly, to meet the needs of the low-level EFL learners. It is believed that teacher feedback could serve as an effective interaction between teacher-student and student-student, which subsequently triggers revisions and mediation and fosters language improvement (Hyland, 1998; Ferris, 1997; Shvidko, 2018 etc.). In line with this notion, the feedback provided in this model no longer focuses only on the language and mechanics (of the writing) but also on the learners' interaction pattern (with their writing partner). Regarding the content of each stage, operational strategies were elucidated from crucial features of CL, LS and SCT. Table 1 showed the designed strategies disposed at each stage.

Table 1. Strategies disposed in each stage.

Stages	Strategies
Stage 1 Planning	CW guideline; Teacher-class brainstorming
Stage 2 Generating	CW guideline; Teacher-pair talk
Stage 3 Reviewing	Peer-peer talk
Stage 4 Feedback	Feedback on interactional pattern and language use

2. Methodology

The current study was a mixed research adopting a design-based research (DBR) approach. The researcher hypothesized that common CW practices might not be effective or suitable for less capable EFL learners and that a prescriptive CW model could be the remedy. In response, this study answered the following research questions: 1) How is the CW model designed? and 2) Is the CW model effective to low-level EFL learners' writing performance.

A total of 46 freshmen volunteers from two universities in Macao took part in this 3-year study. All participants' writing proficiency belonged to the lowest level, scoring 10 or below out of 20 in their first writing task before inviting to participate in the study. Following the process of DBR study (Dolmans & Tigelaar, 2012), four iterations were conducted in four separate periods to test and refine the model. A pre-and post-test were carried out in the 3rd iteration whereas participants in the final iteration were randomly put to a control group and experimental group to evaluate the effectiveness of the proposed CW model. To ensure triangulation of data, semi-structure interviews, transcripts and field notes were collected for analysis.

3. Findings

3.1. RQ1

Subsequent to a comprehensive analysis of theories for collaborative writing as well four cycles of testing, a prescriptive CW model for low-level EFL learners was established. Table 2 showed the summarized findings and refinement of the four cycles. A L2 writing class employing the model would appear like this: before task, the teacher randomly paired up the students and gave out the CW guideline. The guideline was an essential visual aid to reduce the anxiety level of the low-achievers. Next the teacher led the brainstorming and provided language uses as "scaffolds". Moving on to stage 2, the teacher attended to each pair to check learners' understanding of the task and on top of it, to guarantee they "practiced" planning and organizing. Teacher-pair scaffolding is vital for low-level learners yet should be understood as "passive assistance" (offered help when asked). Stage 3 was the period when learners put effort to co-finish the written task, and teacher kept "silent" and "some distance" from them. Finally, teacher offered feedback on language and on interactional pattern to facilitate a collaborative learning environment and motivate learners to learn through this guided interaction.

3.2. RQ2

The prescriptive CW model has significant contribution to the English writing performance of low-level EFL learners. The post-test results from two batches of participants involved in the 3rd iteration and the final iteration respectively were averagely higher than the pre-tests; the participants in the experimental group outperformed the control group in terms of the total score, organization of text as well the use of vocabulary. As seen in Table 3, the mean score of the post-test (M=61.08) was higher than the pre-test (M=58.67), showing a significant difference in the participants' L2 writing performance after weeks of CW task (p<0.01). As a matter of fact, 83% (10 out of 12) of the participants had a raise in the total score with a positive difference ranged from 1-6 points.

Table 2. The summarized findings and refinements of the 4 iterations.

	No. of participants/Duration		abstract of results and findings	abstract of implications and refinement
1st iteration	12/8 weeks	overall:	58% expressed positive perception towards CW; 42% were skeptical	*Working in pair might be more preferable than group for the low-level EFL learners in a CW task;* *Teacher-pair talk should be of flexibility and purpose;* *Teacher-class brainstorming should be lengthened to allow participants to contribute their ideas in L1 as well teacher to provide corresponding output in L2*
		on designed strategies:	More than 50% welcomed the strategies and regarded them as necessities in their co-writing tasks	
2nd iteration	10/10 weeks	overall:	70% favored the idea of writing in pairs and all expressed positively towards CW	*Included a peer feedback session to enhance writing skills and language awareness from an outsider perspective*
		on designed strategies:	Designed strategies A, B and C worked effectively and were perceived positively among all participants; Designed strategies D (feedback on interaction pattern) was deemed helpful in the aspects of "fostering confidence", "getting along in teamwork" and "self-understanding"	
3rd iteration	12/14 weeks	overall:	83% favored writing in pairs and all agreed that the CW practice would be helpful to their English writing	*No refinement on the 4 strategies for no negative feedback or critical suggestions were received from the participants;* *Peer feedback would be better done individually rather than collaboratively*
		on designed strategies	All participants offered positive comments on the model and the 4 strategies	
		pre-test and post-test	83% had an increase in the total score with a positive difference ranging from 1-6 points; Participants improved significantly in the writing component-- organization	
Final iteration	20/8 weeks	overall:	All in the experimental group believed that CW model was conducive and beneficial to their English writing	
		on designed strategies	All in the experimental group affirmed the necessity and function of the 4 strategies	
		pre-test and post-test	The experimental group showed significant improvement in the post-test The experimental group demonstrated a significantly positive difference on both organization and vocabulary The control group showed no significant difference in neither the total score nor the writing components	

Table 3. Mean total on the pre-and post-test.

	M (pre-test)	SD (pre-test)	M (post-test)	SD (post-test)	Sig.
Total	58.67	3.473	61.08	4.055	0.001**

**P<0.01*

4. Discussion and conclusion

The CW model is pillared by the four requisite activities (planning, generating, reviewing, teacher feedback) and composed of four strategies—the CW guideline, teacher-class brainstorming, teacher-pair talk and feedback on language use and interaction pattern. The strategies do not function independently but instead, work among themselves in a reciprocal fashion. Their interrelation and the interplay amongst allow guided interaction and effective collaboration to take place and eventually offer effect to the learner's performance. The CW guideline is likened to a map in the writing journey, instructing the learners how to start and navigating along. Teacher-class brainstorm and teacher-pair should not be regarded as a step backwards to teacher-centered approach, but rather, they are purposefully-designed scaffolds to enable "guided interaction" and could be reduced or removed when students are psychologically ready and (or) intellectually equipped. Teacher's feedback on students' interaction pattern presents itself as an effective means of addressing the relational factors that are frequently discussed in recent second language studies.

Moreover, the CW model could weaken the much observed low-low effect – a frequently mentioned problem by the participants. The less proficient showed "difficulty in accepting that collaborative learning with peers is real learning" (MacGregor, 1992, p.54) for they may be so used to a "teacher-is-source-of knowledge" (p.54) learning routine. Within the four iterations, participants who are aware of the low-low effect are unsure of their capabilities and at the same time question their partners' abilities. It is through a supportive CW environment as well as teacher's deliberate engagement that low-levels become more assured of themselves and their partners, and that the low-low effect gradually relapses. Finally, the CW model (Fig 1) coheres with the values of collaborative learning, attending to low-level EFL learners' needs and promoting their social, cognitive and relational qualities. The two big outer circles could be understood as the learning environment contributed by the CW model yet critical to collaborative learning tasks of all kinds. At the early stage of co-writing, learners are forced to mingle and aware of the presence of socialization. As they proceed to the mid-stage, cognitive gains are expected as learners are scaffolded to interact and conduct peer-learning. Towards the final stage of the collaboration, teacher feedback not only presents students with their language limitations but also draws their attention to relational effects.

To conclude, the finalized CW model conforms to the principles of collaborative learning, integrates the key features of L2 writing process and comprises of repeatedly proved strategies that cater to and fix the needs of the low-level EFL learners in collaborative writing.

Figure 1. The CW model.
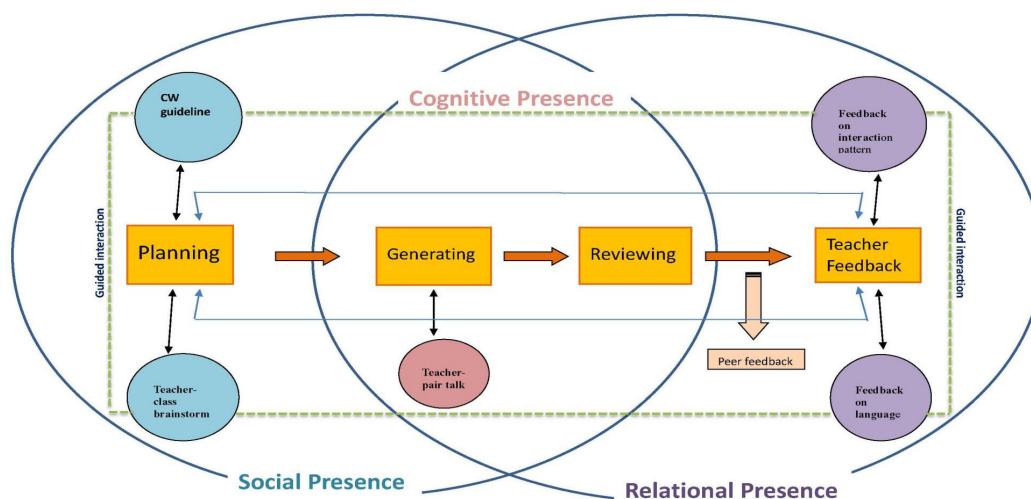
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NURTURING FUTURE EDUCATORS: EXPLORING NEW FRONTIERS OF COLLABORATIVE TEACHER TRAINING MODEL

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Abstract

In 2021, the Israeli Council for Higher Education introduced the Vadmani-Inbar framework, marking a pivotal shift in teacher training. This framework, which replaced the Ariav framework, prioritizes clinical training to bridge the inherent gap between theory and practice in teacher training. As academic coordinator of clinical training in the teacher certificate school of Bar-Ilan University's faculty of education, the author has been actively involved, over the last six years, in developing and assimilation of a clinical model for teacher's training that allows optimal implementation of the clinical core component of the new framework. Over the course of this period two fundamental processes were developed: the creation of a non-disciplinary mandatory course conducted within schools, promoting theory-practice alignment through observations, reflective discourse, and workshops; and the establishment of a specialized disciplinary clinical training track that ensures close coordination between the academia and the field. This clinical training model encompasses a diverse range of learning modalities, including face-to-face and individual instruction, as well as online learning facilitated by learning management system (LMS), and artificial intelligence (AI) tools. Through these academic routs, students are actively engaged in disciplinary and pedagogical content, working extensively within and outside the classroom. They are expected to generate new relevant knowledge and engage in continuous reflective dialogues in order to contribute to the development of a knowledge base that is continuously evolving. Formative and summative evaluations of each student are conducted collaboratively by teachers and academic coordinators, considering various Knowledge, Skills, and Abilities parameters (KSA). Collaboration with schools across diverse sectors in Israel offers students the opportunity to integrate into different educational settings, fostering discourse and cross-sector acquaintances. This study focuses on a research of this clinical training track, that won 2023's Council for Higher Education of Israel call for proposals under the category "experience-integrated academy". Analyzing qualitative interviews and a quantitative questionnaire allows us to examine how this process, led by academic leaders and mentoring teachers, contributes to fostering continuous collaborations of learning communities among students, educators, school personnel, and education professionals. The study provides insights into clinical training, both in terms of the transformative potential of Vadmani-Inbar's framework, as well as its potential to improve teacher education, thereby improving education quality.

Keywords: Clinical teacher training, teachers training in Israel, theory and practice, Vadmani Inbar framework.

1. Introduction: Paradigm's Winds of change

In the dynamically evolving educational milieu of the 21st century, defined by unprecedented global shifts, rapid technological advancements, and the increasingly pivotal role of individual agency, the realm of pedagogy has encountered complexities and challenges of a new magnitude. The Vadmani-Inbar Framework, inaugurated in Israel in 2021, represents a strategic response to these paradigmatic shifts. It highlights the crucial role of clinical training in guiding students through a multifaceted and sometimes enigmatic educational landscape, emphasizing the need to address ethical, social, and moral dimensions within the teaching profession. This approach fosters the holistic well-being of both individuals and groups, thereby enriching the educational experience (Vadmani-Inbar, 2020, p. 4).

The framework spans a spectrum of critical areas, including the establishment of robust linguistic foundations, the development of adaptable, dynamic curricula and assessment methodologies, and the integration of educational experiences with real-world contexts. This necessitates a nuanced comprehension of information as an evolving, interdisciplinary entity, cultivated through interactive processes and tailored strategies.

In response to these imperatives, five guiding principles for training educators in Israel are defined (Ibid, pp. 4-6):

1. Institutional flexibility within a comprehensive framework.
2. Progressively intensive and continuous training geared towards a master's degree.
3. Adaptable teacher training programs for diverse age groups and specializations.
4. Designing cohesive teaching and training curricula that integrate core elements of academic disciplines, pedagogical theories, and clinical training.
5. Emphasis on practical, experiential learning in teacher education.

This article examines the application of these principles, focusing particularly on the fifth, a cornerstone of the new framework that stresses the experiential dimensions of learning and teaching. This principle advocates for clinical training, aiming to bridge the gap between theoretical knowledge and practical application in teacher education, marking a significant shift from traditional pedagogical models towards methodologies akin to those in fields such as law and medicine. This paradigm shift not only redefines the trajectory of teacher education but also has potential implications for enhancing teacher efficacy, improving student learning outcomes, and contributing to the evolution of the educational paradigm at large. Note that the development and implementation efforts described below began earlier, in 2018, as part of preparations for the upcoming framework. Therefore, the study includes data from 2020 graduates onwards.

To gain a full understanding of the meanings of this new paradigm, we should first compare it with the prior Ariav Framework, which established the foundational principles for teacher training in Israel between 2008 and 2021. While acknowledging the importance of practical training, the Ariav framework primarily focused on academic-disciplinary knowledge of students. For instance, its first principle: 'The professional teacher operates based on disciplinary and pedagogic-didactic knowledge in a systematic and evidence-based manner regarding their own teaching and their students' learning' (Ariav, 2008, p. 2). Similar sentiments are woven throughout all other principles, such as: 'Teaching is an activity rooted in theoretical-research knowledge and the wisdom of reflective-practical action, and it is not a marginal profession based on implementation recipes' (Foundational Principle 4, ibid.) or 'The committee views the field of teacher training as an academic field in every respect' (Foundational Principle 7, ibid.).

This spirit, which permeates the document, does not necessarily diminish the value of practical experiences and their integration with academic and disciplinary content. However, for the enhancement of such integration, the Ariav framework primarily focuses on induction programs, i.e., the first year of a teacher's work after completing their teaching certificate, rather than on the training phase, as can be inferred from Foundational Principle 3: 'Teaching is a complex profession (contrary to its simplistic public image), and therefore the acquisition of knowledge and the ability to be a teacher is a complex and gradual process. **It is impossible to impart all the knowledge base required for a future teacher during the initial teacher training** (emphasis in original, N.T). Therefore, training programs should be focused and basic, with additional layers of knowledge and skills learned during the teacher's induction period and throughout their working years (Lifelong Learning). Within its mandate, the committee dealt only with issues pertaining to the initial training stage' (ibid.). Ultimately, the Ariav framework required a minimum of 9 annual practical training hours for an elementary education certificate and 6 hours for a secondary education certificate (ibid., p. 7). In contrast, the Vadmani-Inbar framework increased the number of hours by 50% for an elementary education certificate and by 100% for secondary education. This shift in approach heralds a significant paradigm change from conventional pedagogical models, aligning teacher training more closely with methodologies found in fields such as law and medicine. Such a transformation not only redefines the trajectory of teacher education but also holds potential implications for enhancing teacher efficacy, improving student learning outcomes, and contributing to the evolution of the educational paradigm at large.

Effectively bridging and reducing the gap between theoretical knowledge and practical application is widely recognized in the field of teacher education. Many researchers consider this alignment crucial for enhancing the quality of teacher training programs. Flores, Santos, Fernandez and Pereira for example, highlights pre-service teachers' perspectives on this issue as a key element in maintaining the quality of teacher education. The researchers emphasize the need for a curriculum that is both integrated and responsive, effectively merging theory with practice. Such an approach not only addresses the immediate training needs of future teachers but also prepares them to respond to real-world educational challenges more effectively (Flores, Santos, Fernandes & Pereira, 2014).

In a recent study made in Israel, the researchers examine the roles of mentor-teachers in the practicum phase of student-teachers' education. Utilizing a constructivist field-grounded theory approach, they analyze multiple cases to develop a comprehensive taxonomy. The study identifies six mentoring practices: Adjusting the Challenge, Engaging in Cooperative Activity, Providing Behavioral Guidance, Remaining Involved, Welcoming Change, and Sense-making. These practices are detailed and exemplified through various specific actions observed in mentor-teachers. Upon the aspect of student-teachers' sense of self efficacy this study finds that the mentor-teachers' practices, as categorized in the taxonomy, play a significant role in enhancing student-teachers' feelings of capability and

confidence in their teaching abilities. This is reflected in the way mentor-teachers guide, support, and provide feedback to the student-teachers, ultimately contributing to their professional growth and self-efficacy in the classroom (Carmi & Tamir, 2023)

In the ensuing section, we will outline the innovative approach taken in our clinical training model of teacher education, specifically its goal of bridging the gap between theoretical knowledge and practical implementation. By implementing this model, teacher training can be adapted to meet the evolving needs of 21st century education in accordance with Vadmani-Inbar Framework principles. A primary objective of this program is to produce educators who are both knowledgeable about their particular fields of expertise and capable of applying this knowledge in dynamic classroom environments. In conclusion, we will discuss how the specific components and methodologies of this program directly affect the students' pedagogical skills and self-efficacy as indicated by our research.

2. Clinical training model: Description and ecosystem

The clinical training model is intricately designed to intertwine theoretical learning with practical application, providing an educational experience that is comprehensive and holistic. Two components make up the program, each with a different volume. The minor is a three-credit, non-disciplinary course that includes foundational theories directly relate to classroom instruction. Although the academic content continuously updates, it always emphasizes essential teaching knowledge such as educational objectives, guidelines for understanding and implementing curricula and study materials, the use of taxonomies in learning and assessment processes, the development of lesson plans through thinking routines, and the familiarization of students with contemporary teaching practices.

It is not just about theoretical learning; these theories are also applied in a variety of practical contexts. Faculty members use a trimodal approach to impart this knowledge, reading academic papers, participating in workshops, and reflectively observing professional teachers in heterogeneous groups.

The major portion of the training program consists of nine credit points. The program lasts for the entire school year, rather than just the academic, and emphasizes the practical application of each student's discipline. This part of the program provides students with opportunities for hands-on experiences and direct exposure to practical applications of theoretical concepts through a mentoring process led by teachers and academic leaders in schools. This approach intends to foster an enriched learning experience, deepen understanding of disciplinary, technological, pedagogical and content knowledge (TPCK) and provide close and unmediated encounters with school life. The curriculum is further complemented by ongoing reflective dialogue, focusing on the application of theories and critical thinking about their various interpretations and practical outcomes.

Throughout the program, learning processes are active, constructive and involve regular interactions between all participants. Observation of lessons, exchanging feedback, teaching in classrooms, delivering individual lessons, utilizing LMS platforms for digital asynchronous and synchronous teaching and learning, completing unique personal projects, participating in peer-learning meetings and actively contributing to School' day-to-day life are among the activities the students participate in. In addition, they also have simulations with actors in Bar Ilan's Center of Simulation in Education, "Halev". These activities aim to nurture a wide range of pedagogical skills, from knowledge acquisition to the creation and application of new knowledge, peer learning, receiving and giving feedback, time management and responsibility, using digital platforms, adapting content and pedagogy to these platforms and comprehensive assessment processes. But most importantly, it is intended to instill the students with a sense of professional pride and self-efficacy that will assist them in their future careers. Students' final grade is based on a portfolio containing a wide variety of assignments and other elements like regular attendance, involvement level, personal initiative, and active peer learning. Ongoing feedback from the menting teachers and academic leaders, coupled with formative assessments, ensures continuous reflection and improvement.

As the key to the success of such an array, it is important to establish and maintain a diverse and inclusive ecosystem. A designated academic coordinator ensures effective collaboration with teachers from a wide range of schools, encompassing state secular, state religious, ultra-Orthodox, Arab education, and a variety of educational networks. This variety provides students with a wide exposure to diverse teaching environments and practices. Inclusion is an essential principle, with students with disabilities actively participating and sometimes finding employment in the schools where they are trained. In addition to regular interactions with mentoring teachers and students, the program includes interactions with school principals and occasional engagements with external content experts, including Ministry of Education professionals and school officials. Establishing this ecosystem is essential for the program's success. It is an ongoing, year-round process that necessitates regular maintenance. The operational model we developed is based on four continuously evolving and refining Discourse circles, which operate in a repetitive cycle.

In the innermost circle, faculty members collaborate to formulate the core content. They collectively select and target academic content, structure the syllabus, and determine evaluation

indicators. While the program's core is consistent for all, each group and individual engages differently, as lecturers have the freedom to choose their methods of material explanation, depth of exploration, and workshop conduct. Additionally, due to the collaborative nature, involving faculty, students, teachers, pupils and schools, activities may be modified based on initial discussions and changes throughout the school year.

The academic coordinator is situated in the center of the second circle. It is a major mediating role between the university, the school's principals, appointed activity coordinators, and mentoring teachers. The academic coordinator must re-establish parts of the ecosystem annually, maintain constant communication with schools and addresses any issues that arises.

The third circle consists of each school's appointed coordinator which is responsible for guiding the teachers, real-time coordination, and keeping in touch with lecturers and academic coordinator to manage activities and resolve issues.

Finally, the fourth circle are the students, teachers and pupils, regularly meeting and engaging school's activities. They conduct an ongoing continues dialogues with the schools and faculty, reflect and share their experiences, contributing to their practical learning and development.

3. Research method

We adopted a mixed-methods approach for our research, which included both quantitative and qualitative analysis. The qualitative component is based on in-depth interviews with graduates of the clinical program, aiming to delve into their experiences, levels of satisfaction, and perceptions of self-efficacy. The quantitative component is based on a questionnaire designed by Tal Carmi, Eran Tamir, and Rinat Arviv-Elyashiv, which is partly founded on their previous research (Carmi & Tamir, 2023). Specifically, our study employs segment of their questionnaire aimed at assessing self-efficacy among students who have participated in various training programs (Arviv-Elyashiv & Rosenberg, 2022). Based on Cronbach's alpha, we found a reliability of 0.94 for the questionnaire used in our study.

Two groups of students who graduated between 2020 and 2023 were examined. The experimental group is composed of 44 graduates of the clinical training program described above. The control group consists of 33 graduates of other different programs. In the experimental group, 68.2% of students are females, and 31.8% are males, with an average age of 36.86 (SD=13.70). Similarly, 66.7% of the students in the control group are females, 33.3% are males and their average age is 35.18 (SD=11.58). Based on chi square tests, it was determined that there were no differences in any of the background variables examined between the two groups.

4. Findings and conclusions

The qualitative analysis reveals that students who participated in the clinical training program express high satisfaction with the process, a strong sense of self-efficacy, and a deep commitment to the teaching profession. The interviews explores the extent to which students felt the clinical training process contributed to their readiness to work as teachers, their confidence at the beginning of their careers, and whether they see themselves continuing in the teaching profession. Here are some examples of the responses:

"This training significantly boosted my readiness and confidence to teach. Starting to teach, I had some apprehensions, but my training facilitated a smooth transition into teaching. I plan to continue teaching, aiming to specialize and continually learn" (Ariel Izaks, graduated in 2020).

"This process equipped me with numerous practical tools for my current teaching job, from lesson planning and classroom delivery tips to discipline management. Observing real-time classroom dynamics allowed me to leverage an experienced teacher's insights, avoiding common beginner mistakes. Despite my initial apprehensions, my confidence has grown over time, most likely due to the clinical training which eased my insecurities" (Reut Idan, graduated in 2021).

"This experience with my educational mentor significantly increased my confidence in handling both routine and challenging situations, especially as a class teacher but also in my subject area. I always felt relatively confident about teaching, but this experience undoubtedly enhanced my confidence. I envision continuing in the educational field, whether in a formal school setting or in informal education" (Shoval Riani, graduated in 2022).

"This practical experience significantly prepared me for my teaching role, instilling confidence and a thorough understanding of the curriculum, and fostering my growth and potential for taking on expanded roles in the future. I find my work as a teacher highly meaningful and see myself continuing to develop in teaching and possibly taking on additional roles" (Anat Rotem, graduated in 2023).

"This intensive training approach significantly prepared me for teaching, allowing me to focus on essentials. At my current school, I felt confident to start teaching, thanks to the knowledge and self-assurance gained during training. I certainly see myself continuing in education" (Tal Putterman, graduated in 2023).

All respondents emphasized the importance of the interpersonal relationship they developed over time with their mentor teachers, which they viewed as a critical component of the training process' success. Furthermore, many students indicated that their mentor teachers continued to support and advise them long after the training had ended.

Quantitative analysis indicates distinct differences between the two groups, which supports qualitative questionnaire findings. 90.7% of the research group respondents are employed as teachers compared to 66.7% of the control group. Furthermore, 62.79% of the research group participants indicated that they intend to remain in the teaching profession for more than five years, compared to 42.42 % of the control group.

For self-efficacy, similar results were found. An independent sample T test indicated that there was a significant difference between the groups. Therefore, the average self-efficacy level of students who participated in the program (M=3.98, SD=0.54) was significantly higher than the average self-efficacy level of the students in the control group (M=3.61, SD=0.79). The Cohen's D finds that belonging to various groups contributes approximately 65% to the variance in general ability. A simple logistic regression was performed to predict affiliation to each group, based on the overall sense of self-efficacy. The regression was found significant (p<.05), showing that overall affiliation to one of the groups could be accurately estimated at a rate of 62.3%. Specifically, affiliation to the experimental group could be predicted with an accuracy of 84.1%, and affiliation to the control group at an accuracy rate of 33.3%.

Based on separate T-analyses conducted for each item, the source of the distinctive differences between the two groups lies in an increased sense of self-efficacy among the graduates of the clinical program in promoting school initiatives and projects, arousing their pupil's curiosity, promoting their achievement, developing lesson plans and study units, evaluating pupils, and developing various assessment tools.

The most striking differences were found in clauses related to cooperation with colleagues, and managing classroom learning processes. However, students' perceptions of their ability to influence school decisions and conduct showed the smallest differences. This may be a common experience for newly hired employees in any organization. Nonetheless, it appears beneficial for students to have more opportunities to engage activities that enhance their sense of organizational affiliation and develop their leadership skills.

The results of this short study indicate that the experimental group has distinct advantages in terms of integration into the profession, commitment to it, and sense of self-efficacy. The clinical training modle can be further improved by expanding the research and deepening the analysis of the results.

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ADOPTING CHATGPT TECHNOLOGY APPROACHES IN PROFESSIONAL MUSIC TRAINING – THE TUT EXPERIENCE

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Abstract

The Ministry of Education, Taiwan, is interested in knowing about the impact of ChatGPT on the higher education curricula of music education, how technology applications can serve as learning tools, and the implications of using such tools. What follows are some observations and reflections from the Tainan University of Technology (TUT), Taiwan, and its educators' experiences of teaching music, such as thesis writing. Notable benefits include research support, grading, and enhanced human-computer interaction. The idea put forward is that technology applications require an emergent sensibility in the educational sector, and this represents an opportunity for music educators to reconfigure and strengthen their pedagogical approaches. By recognizing the accessibility of new and varied forms of musicianship and acknowledging how course curricula continue to grow in their range of practices and necessary literacies with AI technologies, strategies can be developed to support teaching enhancements, aid research, increase student retention, and serve as useful experiences for music students.

Keywords: ChatGPT, musician, online learning approaches.

1. Introduction

ChatGPT is the acronym for Chat Generative Pretrained Transformer. It was created by OpenAI and released in November 2022 (Frith, 2023). Marche (2022) suggests that ChatGPT is a disruptive technology that will change scientific and educational processes. Education, including music courses, has seen consistent growth in the use of digital technologies, but integrating ChatGPT also feels like the beginning of a revolution. ChatGPT's emergence has disrupted music education and changed how specific subjects are written about, affecting interactions among learning styles and learning patterns in language that can be recreated with machine learning (Rosalsky & Peaslae, 2023).

A key challenge exposing music's limitation for shifting to online learning is the traditionally focused face-to-face teacher-apprenticeship teaching models. The background to adopting online music courses provides fascinating insights into the higher education scene where technology and the internet supplement face-to-face learning with respect to understanding engagement in practical hands-on activities such as learning how to play a musical instrument, singing, performing solo or in groups, and improvising and composing music. One of the benefits of AI systems is that they can facilitate online learning and make education accessible to students in remote areas, leading to more equitable and inclusive education.

This research aims to explore the relationship between ChatGPT's large language models and musicians/audiences and show how teaching students to write and understand program notes can be facilitated by an artificial intelligence robot that can author essays when given a prompt. The case of the TUT Music Department was examined to achieve this aim. The main reason for focusing on the TUT is that the study of the TUT's Music Department and its curriculum and integration of innovations has been ongoing since 2020. The TUT offers a seven-year program from high school directly to a bachelor's degree in vocational education, and qualifying as a music artist first requires mastery of the general concert audience. This assumption has ensured TUT as a leader in professional music training as music artists shift from amateur to professional status.

2. Background

Like other educational programs, professional music training programs are challenged by major changes in the socio-cultural and educational landscape and addressing pedagogical changes to ensure continued excellence in music teaching is both complex and stratified (Johnson, 2020). In response to

Taiwan's societal challenges, such as current issues regarding music education policy, the Ministry of Education in Taiwan amended the Arts Education Act (AEA) of 1997, which outlined the curriculum for study in the performing arts. The AEA of 1997 was related directly to Taiwan's art education reform (Lau & Li, 2013). This new milestone provided a solid foundation in music education in Taiwan for all students (Ministry of Education, Taiwan, 1997). The TUT Music Department's seven-year program from high school directly to a bachelor's degree in vocational education has served as an example of incorporating educational innovations and interventions based on Teachout's (1997) three categories of skills/knowledge components, namely, teaching skills, personal skills, and music skills and behaviors as core competencies. Handbooks published for 2023 present the benefits and limitations of AI in TUT classrooms, for example, time-saving solutions and ethical issues, and provide concrete examples of how AI can be used to improve student outcomes. In particular, incorporating AI is noted as helpful if the experimentation with technological innovation is not only a task for the teacher but also involves the active participation of the learning community, including school organizations and parents.

How can ChatGPT help teams improve communication and collaboration? "The GPT models are a series of large language models trained to generate human-like text. The first version, GPT, was released in 2018 and was followed by several updated versions, including GPT-2 in 2019 and GPT-3 in 2020" (Leadership Institute, 2023). Launched in November 2020, Chat GPT is an innovative and user-friendly communication platform and tool that helps people stay connected and improves collaboration among team members (Roverba Marketing, 2023). ChatGPT highlights the significance of adaptation for AI systems and the individuals and organizations that use them (Piglet, 2023). ChatGPT can help businesses develop innovative products and services more quickly and adapt easily to technological changes and customer needs.

ChatGPT is the latest innovation to be integrated into teaching music at the TUT. This paper is focused on how ChatGPT can help maintain conversation flow and provide relevant responses, therefore helping to improve communication and collaboration between instructors and students. In the context of ChatGPT and the associated variety of industries and applications, further adaptations proved necessary to achieve the formal educational goals for the Music Department at TUT.

3. Literature review

The world has been stunned by the sophisticated ability of the generative AI tool ChatGPT to complete remarkably complex tasks since its launch (RoboticsBiz, 2023). Today, ChatGPT and chatbots are used in a wide range of industries, including customer service, healthcare, finance, and education, among others. Chatbots' development is the result of advancements in AI and NLP technologies and the increasing demand for more efficient and convenient ways to interact with technology (Kooli, 2023).

The introduction of the technology has not been without controversy, however, especially in the educational field. Incorporating ChatGPT into education has turned into a divisive issue among educators. For example, Fowler (2022) noted, "There is some concern among educators about the potential impacts of chatbots like ChatGPT on education. Some people are worried that chatbots could replace human educators or be used to automate certain teaching tasks, potentially leading to job losses" (p. 1). ChatGPT's capabilities can be roughly divided into three categories: (a) You can ask a question, and ChatGPT answers it. (b) You can ask ChatGPT to generate text, for example, an outline or a reflection on a particular topic. (c) You can enter pieces of text and ask the ChatGPT to summarise, paraphrase, translate, remove spelling mistakes, give feedback about the writing, etc. Also, suppose the author is a professor of pedagogy: One of the most significant advantages of using ChatGPT in the classroom is that it encourages active learning. Students can interact with GPT chatbots in real time, allowing them to ask questions and obtain immediate answers and enabling them to learn. ChatGPT is efficient and produces a written answer. The disadvantage is that verifying whether the answer is true and what the answer is based upon is not easy.

While some see ChatGPT as the future of education, others are more pessimistic and see it as a threat to most forms of learning and a way to make teachers and students lazy with weak or nonexistent analytical skills (RoboticsBiz, 2023). In an article in *The Atlantic*, "The College Essay is Dead," Stephen Marche states, "Nobody is prepared for how AI will transform academia." Possible drawbacks of ChatGPT in education are that research is not focused on matching the level of human interaction a real teacher or tutor provides. For example, Kooli (2023) noted that ChatGPT can only work on one task and respond to one query at a time.

At the TUT, students can receive individualized tutoring and feedback from ChatGPT based on their learning requirements and development. Students can receive individualized research support tutoring from a conversational agent built on a generative model (ChatGPT), which enhances learning outcomes. The conversational agent can adjust explanations to students' comprehension levels and misconceptions.

In the following section, Schumann's Piano Piece Papillons, Op. 2 is used as an example to evaluate the merits of using ChatGPT as a research assistant, like accessing relevant information and data, with students writing academic papers using ChatGPT for writing assistance and suggestions for phrasing, tone, and style.

4. Schumann's Piano piece *Papillons*, Op. 2 program notes for a classical Western concert

As an aspect of the Research Methods and Thesis Writing class at the graduate student level, student performers are expected to write program notes about their performances for a general concert audience, an audience of non-musicians who are interested in music and fairly knowledgeable. The goal of teaching students to write program notes is to increase the audience's understanding and enjoyment of the music performed (Blom et al., 2020).

As a knowledgeable musician, I still enjoy reading program notes and continue to learn through them because no one can know everything about a musician with a vast musical repertoire. It is assumed that program notes are naturally associated with knowing how to listen and think about the music performed at the strategic level and initiate a relationship between performers and their audiences. Therefore, students presenting recitals are encouraged to write notes for themselves and their audiences, and graduate students are often asked to relate interesting facts about the composer they are studying. Knowing the historical context of a piece makes for better interpretations and a better listening experience.

Before COVID-19, the teacher might have taken time in class to explain Schumann's Piano piece *Papillons*, Op. 2, as students rehearsed the piece. For example, the teacher might have alerted students to what was going on in inventive and descriptive titles from Schumann's piano music when he composed the piece and discussed how it is similar or different to anything audiences had heard. Much like college music lecture recitals, the teacher might have discussed with the students and raised awareness about how Schumann uses titles for his movements to reflect the tempo or speed at which he wants the music to be played. The teacher might also have focused on literature and reflected on including program notes to notify the audience about what was written before the piece. For example, it is the scene of the masked ball at the end of Richter's novel *Flegeljahre* (1804, as cited in Perahia, 2014) that provides the dramatic "setting" for the cycle, a scene in which two brothers in love with the same woman vie to win her heart amid the gaiety and varied musical offerings of a social evening with a dance orchestra. Program notes inform the audience and facilitate a better listening experience by including what is interesting and relevant about the composer.

Therefore, the purpose of learning this musical piece goes beyond just playing good music well. It incorporates an intentional introduction to new musical discourses and tools for students to add to their cognitive understanding of how music works by helping the student (and audience) understand that music is located within time and culture. With the growth of artificial intelligence (AI) and natural language processing (NLP) technologies, chatbots have evolved significantly, becoming more capable of handling complex tasks and undertaking more human-like interactions. So, how did my teaching of writing program notes change with the introduction of ChatGPT in the online educational context?

In brief, during and post-COVID, I transitioned into connecting with my program notes' classroom community using these intelligent systems as research assistants and learned to create an engaging learning experience. The advantage of teaching the writing of program notes online is that a teacher has the means to access and foster interaction; for example, both the teacher and the student writing his or her program notes can produce, edit, and enrich videos of performances to create a better learning experience online. For students, ChatGPT facilitates learning through collaborative study groups, individual test preparation assistance, and feedback for improving assigned work. Aligning tool usage with principles of academic integrity ensures proper enhancement rather than substitution of independent scholarship. Academic writing is an essential part of research. ChatGPT can aid the writing process in multiple ways, from outlining to drafting and revising (Essex, 2023). Once a detailed outline is ready, the writing process can be moved forward by having ChatGPT generate initial drafts of sections based on notes and outlines. These drafts can then be reviewed, modified, and improved at the writer's discretion to polish the complete paper. The disadvantage of teaching program notes online is how AI and chatbots could impact the education field negatively with respect to the integrity of assessments. For example, based on the author's teaching practice with MA (Master of Arts degree) music students at the TUT, two student-centred classroom strategies include the critical response process (CRP) and practice as research.

The new online learning experience changed the state of teaching and learning from "mono" and "teacher-centred" to "interactive" and "student-centred," thus making it necessary to create a hybrid model where information technology and online activities became an integral component of the education process (Li, 2022). The author, therefore, used those technologies to teach musical appreciation through program notes. Tech brands such as Chatbot, which can understand and respond to human inputs in natural language, can handle complex tasks and undertake more human-like interactions. In addition, with the internet, it is

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so much easier for students to obtain information about a composer as compared to what was the case in the past, and it was exciting to see students think about music in new ways and begin to comprehend different musical styles as a result of their increased access to various musical genres. Many student musicians also discovered that online platforms such as Bandlab, Charanga, and Soundtrap (owned by Spotify USA) and their online cloud-based Digital Audio Workstations (DAWs) could enhance their reach to interested audiences. Chatbots in education can personalize learning pathways (Hsu et al., 2023). Kuhail et al. (2022) found that chatbots can provide students with instant feedback, support, and personalized learning experiences.

ChatGPT is the emergence of the latest powerful AI-based chatbot. ChatGPT was trained on a massive dataset of text from the internet, allowing it to generate human-like responses to a wide range of questions and prompts (Kooli, 2023). Assessing students through case studies is an example of an effective student assessment strategy. Using case studies that require students to analyze real-world scenarios and apply their knowledge to solve complex problems could help mitigate the effects of the excessive use of AI (Kooli, 2023).

However, while chatbots can provide students with immediate answers to questions, using chatbots in the educational field also raises ethical challenges that must be addressed: Their use can also lead to academic dishonesty and a lack of learning. In addition, using chatbots can create an uneven playing field because some rich students may have access to better or more advanced chatbots than poor students. These are two different issues—one is directed at ensuring all students, regardless of their economic status, have access to the same quality of assistance (the same chatbot), and the other idea supports institutional efficiency.

5. Conclusion

Various AI tools and techniques can be used in education to help researchers, educators, students and even the institution. These methods are constantly evolving as AI technologies advance. One ethical challenge associated with using chatbots in education is the potential for the technology to replace human interaction and expertise. Another ethical challenge is the potential for bias in chatbots. One benefit for education could be that because AI takes care of the drudgery of gathering information, students can focus on evaluating the worth of that information. This paper has reviewed the utility of AI technologies and the ethical challenges that might emerge from their use. The shift to online learning has encouraged a more interactive and student-centred approach to learning. Students' learning is enhanced using digital technologies, for example, their performances are more accessible to wider audiences by making videos showcasing their musical performance skills. This study acknowledges that the potential benefits of AI systems and chatbots in the academic field are substantial including personalized learning, increased accessibility, and improved efficiency; consequently, their use is likely to increase in the coming years.

However, the AI tool ChatGPT is limited in providing the same quality of critique for performances as would be the case in face-to-face instruction, in the same way as watching a televised concert performance is an inferior experience compared to watching a live performance. Moreover, online distance learning courses in music mean that teaching music online requires knowledge and skills in online design, assessment, and communication. At the same time, regardless of what research reveals about chatbots and their place in education, teachers will be asked to use remote teaching methods in music education to ensure the sustainability and scalability of music education or attract and retain students. Arguments for adopting and adapting to online learning approaches for teaching music and musical appreciation should not be ignored.

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FUTURE TEACHERS' KNOWLEDGE, ATTITUDES
AND PRACTICE REGARDING SUSTAINABLE DEVELOPMENT GOALS

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Abstract

Through their activities, future teachers demonstrate the values that children and young people should adopt to become active citizens who influence the ecological, economic, and social dimensions of sustainable development. Therefore, future teachers should exhibit pro-environmental behaviors and attitudes to effectively integrate education for sustainable development into their teaching. They should also have a high level of knowledge about the sustainable development goals to ensure the effective realization of learning outcomes in this field. Sustainable development was defined by the World Commission on Environment and Development in 1987 as development that "enables us to meet the needs of the present without compromising the ability of future generations to meet their needs as well". This idea is directly related to the *Sustainable Development Goals* (2016–2030). In accordance with these principles sustainable development competencies are based on knowledge, positive attitudes, and practical action toward sustainable development goals. The aim of this study is to investigate prospective teachers' knowledge, attitudes, and practices related to the sustainable development goals. The research was conducted on a sample of 275 students, future preschool and primary school teachers, from teacher education programs at universities in Rijeka, Pula and Zagreb. Data processing employed descriptive and inferential statistics (t-test and correlation analysis). A knowledge, attitudes, and practice questionnaire using a 5-point Likert scale was adapted from Afroz and Ilham (2020). The main research variables included future teachers' knowledge, attitudes, and practices related to the sustainable development goals. The results were compared in the context of study location, year of study, and study program (early and preschool education and teacher study). The results indicate that the respondents have a moderate level of knowledge and positive attitudes towards the sustainable development goals, but they showed a slightly lower performance in the practical application of these goals. Spearman's rho coefficient correlation revealed a positive correlation between students' knowledge and practices, and between their attitudes and practices related to the sustainable development goals. In terms of study location, study years, and study program, there were no statistically significant differences in the students' knowledge, attitudes and practices. Based on the obtained results, recommendations were provided for enhancing the initial education of future teachers in the field of sustainable development, as well as suggestions for improving professional training in this area.

Keywords: *Environmental sustainability, future teachers' knowledge, attitudes and practices, initial teacher education, sustainable behavior, sustainable development goals.*

1. Introduction

In 1987 the *World Commission on Environment and Development* defined sustainable development as something that "enables us to meet the needs of the present without compromising the ability of future generations to meet their needs as well" (WCED, 1987). The definition presented several years later described sustainable development as progress which includes forms of economic and social development which protect and enhance the natural environment and social equity (Jeronen, 2020). Principles of inclusiveness in sustainable development are based on an "inherent ambiguity that seeks to finesse the real conflicts between economy and environment and between the present and the future" (Parris & Kates, 2003, 560) and there is a growing acknowledgement that there is a variety of purposes in characterizing and measuring sustainable development: from decision making and management to participation and research (Sachs, 2012; Afroz & Ilham, 2020; Funa, Gabay, Ibardaloza, & Limjap, 2022). The *Sustainable Development Goals* (2016–2030) include 17 goals, 169 marks and 303 indicators (UN, 2014). Parris and Kates (2003, 582) emphasized that each individual, as well as children and young

people "must both improve the integration of sustainable development theory with the practice of characterization and measurement and recognize that the process is as important as product". We are invited to act simultaneously on the international, national and local levels (Carley & Christie, 2017). Though sustainability is the core value of university strategies in Zagreb[1], Pula[2] and Rijeka[3], the purpose of this research is connected to the *Sustainable Development Goals* (2016–2030), like numerous authors in their recent research investigated pro-environmental behaviors and attitudes to effectively integrate education for sustainable development into their university education (Al-Naqbi & Alshannag, 2018; Afroz & Ilham, 2020; Braßler & Sprenger, 2021). It is very important to conduct research in this field on students – prospective preschool and primary school teachers (for example Borges, 2019; Nousheen, Zai, Waseem, & Khan, 2020; Sakin, 2020; Miralles-Cardona, Chiner, & Cardona-Moltó, 2022). They are role models for children and could help them to develop a high level of attitudes and practices about sustainable development goals to ensure the effective realization of learning outcomes in this field.

2. Method

2.1. Research aim and research questions

The aim of this study is to investigate prospective preschool and primary school teachers' knowledge, attitudes, and practices related to the sustainable development goals. The research questions were formulated based on the research aim as follows: (RQ1) What is the extent of students' knowledge regarding sustainable development? (RQ2) How do students articulate their attitudes towards sustainable development? (RQ3) To what degree do students' practical engagements align with the objectives of sustainable development? (RQ4) Is there a correlation between the knowledge, attitudes, and practical involvements of students within the realm of sustainable development? (RQ5) Is there a statistically significant difference in the knowledge, attitudes, and practical actions of students related to sustainable development regarding: a) study location; b) year of study; c) study program.

2.2. Research sample

The study involved a sample of 275 students enrolled in teacher education programs at universities in Zagreb, Pula and Rijeka in the Republic of Croatia. In the participant sample, female respondents were predominantly represented (98.5 %). The sample distribution included 52.7 % of participants from the Faculty of Teacher Education of the University of Zagreb, 35.6 % from the Faculty of Educational Sciences of the Juraj Dobrila University of Pula, and 11.6 % from the Faculty of Teacher Education of the University of Rijeka. Among the participants, 52.4 % were students of the teacher study, and 47.6 % were students of the early and preschool education, with 43.3% of first-year, 16% of second-year, 15.3% of third-year, 17.5% of fourth-year, and 8% of fifth-year students.

2.3. Research procedure and instruments

The survey was conducted electronically using the Google Forms platform. Participation in the research was approved by the Research Ethics Committee of the Juraj Dobrila University of Pula, it was voluntary and anonymous. A knowledge, attitudes and practice questionnaire, adapted from Afroz and Ilham (2020), comprised four sections. The first section collected demographic data about the participants (gender, study location, study program, and academic year). The second section of the questionnaire consisted of a list of 10 concepts related to goals of sustainable development, and students assessed their familiarity with these concepts. The third section of the questionnaire included 14 statements examining students' opinions on sustainable development. Students expressed their agreement with the statements on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). In the fourth section of the questionnaire, students evaluated the alignment of their practical actions with the goals of sustainable development across 14 statements using a 5-point scale from 1 (never) to 5 (always).

2.4. Research methods

Statistical analysis of the data was conducted using the SPSS software. Descriptive parameters, such as M and SD, were employed to establish descriptive indicators for individual items and scales. Spearman's correlation coefficient was calculated to determine the intercorrelation of different variables, while one-way analysis of variance (ANOVA) was applied to ascertain the statistical significance of differences in knowledge, opinions, and practical actions of students in alignment with sustainable

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[1]https://www.unizg.hr/fileadmin/rektorat/O_Sveucilistu/Dokumenti_javnost/Dokumenti/Strateski_dokumenti/Izvjesca/Istrazivacka_strategija_verzija.pdf (23.12.2023)
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development goals, considering the year of study and study location. The statistical significance of differences in respondents' answers, based on the study program in which they were enrolled, was evaluated using the t-test. The reliability of the utilized scales of internal consistency type reached satisfactory or high levels for all scales (Cronbach's $\alpha = 0.71 - 0.86$).

2.5. Results

One of the research questions (RQ1) was to assess students' knowledge of sustainable development. Thus, the study analyzed students' self-assessment of their familiarity with specific concepts related to the goals of sustainable development, presented through 10 statements. The results indicate a moderate level of knowledge among students regarding sustainable development. While students positively assessed their familiarity with most of the statements related to sustainable development, the determined percentages are not satisfactory. A significant portion of students acknowledged to have heard about the *goals of sustainable development* (83.6 %), but only a smaller number (18.5 %) were aware that these goals are to be achieved by 2030. Only 50.9 % of students believed that the *excessive use of natural resources affects the well-being of future generations*, which is a fundamental aspect of sustainable development goals. Students also demonstrated a moderate level of knowledge about the concept of sustainability, with only 41.1 % recognizing its definition. The majority of students (73.5 %) agreed with the statements that *maintaining good relations with different countries is crucial for world peace*, that *healthy oceans and seas are crucial for our existence* (72.4 %), and that *environmental protection, economic growth, and social justice are fundamental elements of a nation* (66.2 %). Although most students affirmatively assessed the statement that *achieving sustainable development requires all people worldwide to have access to quality education* (56.4 %), it is concerning that as many as 43.6 % of students in teacher study negatively evaluated their familiarity with this statement, considering that respondents in this study are future contributors to education for sustainable development. Additionally, 45.1 % of students negatively assessed the statement that *income inequality is a global problem requiring global solutions*, and only 53.8 % of students positively evaluated the idea that *increased use of renewable resources can reduce greenhouse gas emissions*. The second part of the questionnaire explored students' attitudes towards sustainable development (RQ2). The values of the overall M and SD of respondents' answers on the provided scale indicate a positive perception of sustainable development among students ($M_{total} = 4.20$; $SD_{total} = 0.50$). The mean values of respondents' answers fall within a high range (from M = 3.76 to M = 4.79). Participants fully agreed with statements expressing the *need to provide society with the best and free basic health services* (M = 4.79; SD = 0.51) and that *individuals from different cultures must be treated with equal respect* (M = 4.79; SD = 0.52). They generally agreed with all other statements (from M = 4.39 to M = 3.76). The least agreement is observed for statements expressing that *courses on the environment and sustainable development should be part of our university curriculum* (M = 3.76; SD = 0.96) and the statement aimed at determining their *interest in issues related to environmental protection and conservation* (M = 3.83; SD = 0.96). Although these statements fall within the range of positive attitudes, it is concerning that respondents, who will be educating future generations about sustainable development within the education system, have shown less interest in topics related to environmental conservation and the implementation of courses addressing these issues in university curricula. Descriptive indicators of respondents' self-assessment regarding the frequency of practical actions in line with sustainable development goals show that students only occasionally engage in activities aligned with these goals ($M_{total} = 3.41$; $SD_{total} = 0.55$). The mean values of respondents' answers span a wide range (from M = 1.46 to 4.81), and a noticeable range of standard deviation in respondents' answers is also observed. Participants assessed that they always *treat people of all different religions equally* (M = 4.81; SD = 0.51), and this is the only statement evaluated by respondents with such a high value. Furthermore, respondents assessed that they *often separate recyclable waste in their homes* (M = 4.24; SD = 0.99) and are *willing to use renewable energy* (M = 4.24; SD = 0.86). They also frequently *turn off unused electrical appliances in their homes* (M = 3.97; SD = 1.19), *avoid using products made of animal leather* (M = 3.92; SD = 1.25), *conserve water usage in their homes* (M = 3.88; SD = 0.98), and *use reusable shopping bags for groceries* (M = 3.82; SD = 1.12). However, respondents assessed that they rarely *attend courses related to sustainable development* (M = 1.46; SD = 0.94) or *participate in events related to sustainable development* (M = 1.85; SD = 1.14), and infrequently *discuss sustainable development with their friends and family* (M = 2.45; SD = 1.19). This indicates an insufficient development of the proactive role of future preschool and primary school teachers in this field. Furthermore, it was found that respondents assessed that they only occasionally *prioritize public transportation over personal* (M = 3.04; SD = 1.33), are occasionally *willing to pay more for environmentally friendly products* (M = 3.19; SD = 1.13), and only occasionally *avoid using plastic straws in restaurants and cafes* (M = 3.34; SD = 1.29) (RQ3). Furthermore, there is a statistically significant correlation between knowledge and attitudes (r = .332) and practice (r = .217) as well as

between attitudes and practice (r = .479). Correlations among the specified variables are statistically significant at the level of p < 0.01. The highest correlation is between attitudes and practical actions, but correlations have been identified among other variables as well. So, students with a higher level of knowledge simultaneously hold more positive attitudes towards sustainable development and engage more frequently in practical actions aligned with sustainable development goals. Additionally, students who exhibited more positive attitudes in the context of sustainable development estimated that they also behave more frequently in line with sustainable development goals (RQ4). Concerning the academic institution or study location, a univariate analysis of variance (ANOVA) disclosed a statistically significant distinction in students' knowledge of sustainable development (F=4.07, df=274, p=0.02). Subsequent Tukey post hoc examinations revealed that students from Rijeka exhibited a significantly higher average knowledge of the specified objectives compared to students of the other two universities. It is presumed that the increased prevalence is attributed to a higher abundance of courses within the domain of sustainable development available at that academic institution. However, there were no notable differences in other variables among students from diverse universities (attitudes F=0.06, df=274, p=0.95; practice F=2.35, df=274, p=0.09). Moreover, a univariate analysis of variance (ANOVA) elucidated a statistically significant difference in both knowledge and practical actions across distinct years of study among the student sample. Specifically, marked divergences in sustainable development knowledge materialized exclusively between fourth and fifth-year students (F=2.71, df=274, p=0.03), with those entrenched in more advanced academic years exhibiting a superior grasp of the subject matter. Regarding practical actions in the context of sustainable development, second-year students evaluated their practical actions with the lowest values (M = 3.13; SD = 0.46), followed by fourth-year students (M = 3.35; SD = 0.48) and first-year students (M = 3.44; SD = 0.55). Third-year students (M = 3.50; SD = 0.59) and fifth-year students (M = 3.70; SD = 0.56) assessed their engagement with the highest values. One-way ANOVA detected significant difference in evaluating the frequency of practical actions among first and second-year, second and third-year, and second and fifth-year students (F=5.35, df=274, p=0.00). First-, third- and fifth-year students expressed a higher level of assessment in engagement compared to second-year students. No differences were discerned in attitudes across different study years (F=1.69, df=274, p=0.15). Further analysis using the t-test revealed no statistically significant differences in knowledge (t = -0.70; df=273; p=0.27), attitudes (t = -0.36; df=273; p=0.52), and practical actions (t = -0.33; df=273; p=0.82) among students based on their study program given that students from both study programs need to be equally equipped for the implementation of education for sustainable development (RQ5).

2.6. Discussion

Proficiency in knowledge, attitudes, and practical involvement within the realm of sustainable development is imperative for the maturation of prospective teachers in their capacity within the framework of education for sustainable development (similar to Borges, 2019; Nousheen et al., 2020; Sakin, 2020; Miralles-Cardona et al., 2022). The outcomes derived from this study underscore a deficiency in the development of sustainable development knowledge among students enrolled in teacher education programs, accentuating the exigency for concerted efforts to fortify this facet of their competencies. Specifically, as concluded by Nousheen et al. (2020), the confluence of elevated knowledge levels concerning sustainable development, conjoined with adept generic and specific pedagogical and methodical competencies facilitating the transmutation of knowledge into efficacious learning experiences for students, is deemed indispensable for the efficacious orchestration of pedagogical endeavours oriented toward sustainable development. As such, a recommendation is proffered advocating for the incorporation of courses addressing sustainable development, emphasizing the attainment of an advanced level of student knowledge in this domain within the formal education curricula for future teachers (Barth, Godemann, Rieckmann, & Stoltenberg, 2007). Despite students' positive expressions of attitudes toward sustainable development, the ascertained level of practical engagement within the ambit of sustainable goals is deemed suboptimal, similar to results of Borges (2019), Nousheen et al. (2020), and Sakin (2020). Of particular concern is the observation that students exhibit passivity in their involvement in workshops and events germane to sustainable development, signifying a lack of active advocacy for this field. Instead, their participatory actions predominantly encompass sporadic adherence to sustainable development goals within their domestic spheres (Borg, Winberg, & Vinterek, 2017; Bautista, Moreno-Núñez, Ng, & Bull, 2018). Hence, it is suggested that courses focusing on sustainable development, embedded in the curricula for future teachers, not only disseminate theoretical knowledge, but also integrate learning outcomes necessitating active involvement in contemporaneous events and the promotion of sustainable development. This pedagogical approach aspires to nurture proactive agents and proponents of the inherent values of sustainable development. In contrast to the findings of Afroz and Ilham (2020), whose research indicated a negative correlation

between students' knowledge levels and their practical engagements, the present study identifies a positive correlation between these variables. This observation supports the proposition that education and knowledge levels may exhibit a substantive nexus with individual practical endeavours. Consistent with Afroz and Ilham (2020), a discernible disjunction between students' professed attitudes towards sustainable development and their enacted practices within that milieu is apparent in this investigation.

3. Conclusions

Based on this research we can conclude that the study programs conducted at all three universities could be compared and the extent to which they contain learning outcomes in the context of achieving practical skills in the field of sustainable development could be checked. The results obtained in this research promote the necessity of education, especially practice and behaviour, for sustainable development in academic programs of the prospective preschool and primary school teachers to enhance students' proactive approach towards sustainable development. Thus, knowledge would be raised and practice developed to act in this field.

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IMAGING FUTURE SEXUALITY EDUCATORS: ATTITUDES AND OPINIONS OF STUDENT TEACHERS AT SAPIENZA TOWARDS SEXUALITY EDUCATION

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Abstract

Italy has no specific initial teacher training curriculum on Sexuality Education. In undergraduate programs for early childhood and primary school education, topics related to sexuality and its development within the framework of Comprehensive Sexuality Education (CSE) are rarely addressed. The Standards for Sexuality Education in Europe assert the need to address such issues within the 0-4 age group. It is considered crucial to provide young people with accurate, age-appropriate, and scientifically accurate information about sexuality and sexual health. This education should be comprehensive, covering various aspects of sexuality, such as families and relationships, respect, consent, bodily autonomy, anatomy, puberty, menstruation, contraception, pregnancy, sexually transmitted infections, social influences, sexual identity, gender equality, and human rights. In Italy, such training is provided through specific courses that individuals can voluntarily undertake outside university curricula. The main challenge is that these courses come with high costs, making them inaccessible to everyone. And still, to design adequate training, it is necessary to understand the needs of the future recipients. The research, therefore, arose from the question: What were the attitudes and opinions of future educators and teachers in early childhood and primary schools regarding Sexuality Education, both in general and in terms of practical and methodological application within the Italian educational and school system? The objective was to investigate the participants' perspectives and identify training needs. Existing literature highlights numerous weaknesses in training educational personnel on Sexuality Education. Among the reasons for this lack is the educational responsibility being primarily entrusted to experts external to the school or family context and a still heterogeneous and resistant attitude towards these issues, mainly when addressed with children. In the considered undergraduate programs, there are young adults who, according to research and literature, still rely heavily on internet-based and self-directed learning. The research was an exploratory case study at the Sapienza University of Rome. The sample, expected to consist of at least 300 participants, was drawn from the reference population: 851 students enrolled in undergraduate education and training programs for early childhood and primary education. It involved administering a questionnaire based on international scientific literature concerning the educational needs of the student community and the training needs of teaching and academic staff. The questionnaire had close and open questions and aimed to understand pre-service educators' and teachers' perspectives toward Sexuality Education.

Keywords: Sexuality education, student teachers, early childhood education, primary school education, attitudes.

1. Introduction

The World Health Organization established Standards for Sexuality Education in Europe, providing the first clear international definition (WHO, 2010). Sexuality Education (SE) is a lifelong learning process that begins in early childhood and follows an individual's development. While teaching sensitive and challenging topics, many must develop skills necessary for daily life. Addressing issues such as sexual rights, gender identity, gender pedagogy, education on emotions, respect, and consent is fundamental. SE aims to increase and improve knowledge by imparting information and skills, enabling recipients to apply their knowledge and attitudes, and helping develop a positive and respectful self-view and view of others.

Over the years, additional international documents have shared this comprehensive vision (UNESCO, 2018; Plan International, 2020). SE has long been considered an integral part of an

individual's sexual rights (WAS, 2014), thus a right for everyone to have access to information and education on sexuality-related issues in their various components. The need for SE is further evidenced by its presence in Goals 3, 4, and 5 of the 2030 Agenda (UN, 2015; UNESCO, 2023).

Italy has consistently ranked poorly compared to other European countries in terms of enacting supportive laws and implementing SE into the school system (Stettini, 2004). However, the current Italian context is characterized by a wide range of projects proposed by experts, albeit heterogeneous in terms of geography, content, themes, and methods. Italy only offers 29% of activities and projects aligned with international declarations and definitions, i.e., within the Comprehensive SE (CSE) (Chinelli et al., 2022). The results of the National Fertility Study Project (Pizzi, Spinelli, Andreozzi, & Battilomo, 2019) partly reflect the young Italian people's desires for CSE. Specifically, young adults enrolled in university have an average age of 22 years. Over 90% of participants claim to receive and learn online information. Additionally, about half of participants identify the school system as the primary location to receive CSE, with approximately 30% mentioning specific educational-informative meetings.

The need for teacher and educator staff training stems from the perceived necessity by adolescent and university students and experts who advocate for the introduction of CSE (Astle et al., 2021; Bauer, Hämmerli, & Leeners, 2020; Dbouba & Shannon, 2018; Lahoz-García, Jimenez, Castro, & Parejo, 2024), scientifically, age-appropriately, positively, without judgment, and consciously, in a safe, healthy, and protected environment like school. Global comparisons published by UNESCO (2021; 2023), in which Italy is not present, emphasize the need for training, stating the importance of initiating investments, increasing pedagogical knowledge and skills in offering CSE in schools, and investing in research on teacher and educator training models. However, before aspiring to understand how to train educators and teachers potentially, it is necessary to investigate their perceptions and thoughts to avoid designing a top-down training distance from the recipients' needs and context. On the other hand, it is challenging to ascertain what educators and teachers would need. Research in this field (Ang & Lee, 2017; Balter, van Rhijn, & Davies, 2018; Klein, 2021) shows some results regarding the perspectives of educators and practicing teachers: the perceived lack of knowledge and competence, leading to a need for training; the importance given to issues and the sense of adequacy and comfort in addressing CSE; and finally, the willingness and motivation to be trained and teach CSE in the future.

Scientific evidence affirms that addressing CSE topics in early childhood education and primary school contributes to achieving CSE goals, healthy sexual development, both individual's and society's wellness and to prevent child sexual abuse (Kenny et al., 2008; Putri, 2022; Schneider & Hirsch, 2020; Tirtawinata, 2016; Walsh, Zwi, Woolfenden, & Shlonsky, 2018). Evidence contradicts the notion that aspects of sexuality cannot be discussed in the early years of life. In fact, the earlier CSE starts, the better (Smyle, Maticka-Tyndale, & Boyd, 2008); awareness and competencies regarding gender identities and sexual orientations (Hermann-Wilmarth, Lannen, & Ryan, 2017; Ryan, Patraw, & Bednar, 2013), self-esteem, and body image (Halliwell et al., 2016) increase, while the development of stereotypes and harmful biases decrease (Goldfarb & Lieberman, 2021).

The literature shows that student educators and teachers already perceive a lack of knowledge to address CSE in their future educational practices (Brouskeli & Sapountzis, 2017; Jiménez-Ríos, González-Gijón, Martínez-Heredia, & Amaro Agudo, 2023). Hence, this research aims to understand the participants' perspectives for a broader purpose: to design a CSE training that is more concrete and coherent with the needs of all and with the Italian context. As the research is in a preliminary phase, the methodological aspects and hypotheses of the study are presented below.

2. Design

The research project is structured as a multiple exploratory case study with quantitative methodology. Through the administration of a questionnaire, the research aims to explore the perspectives of students currently enrolled in the Degree programs in Educational Sciences and Training (L-19), Pedagogy and Educational Sciences (LM-85), and Primary Education Sciences (LM-85 bis) at the Sapienza University of Rome regarding CSE, both in general and in terms of its practical and methodological aspects within the Italian educational and school system. The hypothesis is that pre-service educators and teachers generally have a positive attitude towards CSE and show a need for training in this regard, but with differences based on age, gender, and sexual orientation, as well as the influence of religion, political orientation, sexual myths, personal beliefs and level of sexism. The Ethics Committee has approved the research for Transdisciplinary Research of Sapienza University of Rome.

2.1. Objectives
The research aims to investigate attitudes, opinions, and educational needs regarding CSE of pre-service educators and teachers enrolled in the Degree programs in the educational and training field of

Sapienza University of Rome. The objective stems from the following research questions: How do educators and teachers in training perceive CSE in schools? How do they perceive CSE in their professional development? Four specific objectives have been determined: (1) to identify the participants' attitudes towards CSE; (2) to identify the participants' opinions on teaching CSE; (3) to investigate the self-perceived sense of competence and comfort in hypothetically teaching CSE; (4) and to explore the potential demand for specific training within the unit of analysis.

2.2. Methods

The study will be conducted on a sample of at least 300 participants. The sample size was calculated based on the statistical analyses that were performed. This number of participants is deemed optimal for the exploratory factor analysis anticipated in the project. All current students enrolled in the Degree programs in Educational Sciences and Training (L-19), Pedagogy and Educational Sciences (LM-85), and Primary Education Sciences (LM-85 bis) at the Sapienza University of Rome constitute the target population of the research. According to the currently enrolled students (academic year 2023/2024), there are 851 students across these programs (L-19 = 370; LM-85 = 76; LM-85 bis = 405). Those currently enrolled in these programs and consented to be contacted for research purposes will be included in the desired population. The number of 300 participants will be selected from the desired population through simple random sampling. A self-report online questionnaire using the Qualtrics platform is planned to achieve the research's objectives. The instrument has both closed and open-ended questions, and it has been constructed based on insights from international literature and the current Italian context regarding CSE (Gradellini et al., 2022; Lunde, Blaalid, Gerbild, & Areskoug Josefsson, 2022; Pássaro, Regra, Serrão, & Marques 2019; Yao & Lee, 2023), as well as the attitudes, opinions, and educational needs of teachers regarding these topics. The questionnaire includes explicitly a section with questions on demographic variables and past experiences with education or training on CSE.

Again, questions were included to investigate participants' attitudes and opinions on methodological aspects, themes, and stakeholders of CSE. The third section of the questionnaire aims to identify the need for training and comfort regarding CSE topics, as well as motivation and willingness to undergo training and then integrate CSE into future educational practices. The last section includes the scale on ambivalent sexism (Glick & Fiske, 1996) to investigate the presence of gender prejudice by administering subscales on hostile and benevolent sexism. Statistical analyses will be conducted using SPSS software. A factor analysis will be performed to assess the reliability and validity of the scales included in the questionnaire using Cronbach's alpha. First, descriptive analyses will be conducted to test the hypothesis of a generally positive attitude among students. A univariate analysis of variance will be performed. In this analysis, the dependent variable will be the attitude towards CSE, while the independent variable will be the group membership (i.e., type of Degree: L-19, LM-85, LM-85 bis). Additionally, the effects of sexual myths, beliefs, and training needs on the dependent variable (attitude) will be considered. Finally, a categorical analysis (Batini et al., 2020) of the questionnaire responses to open-ended questions will be conducted using a bottom-up reflexive thematic analysis approach (Braun & Clarke, 2021). Responses will be categorized to provide aggregated results, and descriptive analyses will be performed on these categorizations.

3. Conclusions

In Italy, Comprehensive Sexuality Education (CSE) training is often left to the individual's discretion; teachers and educators choose whether to include and address CSE topics in their educational activities and whether to seek training through external professional courses or academic studies. An analysis of needs and context is necessary to understand the perspectives and needs of the participants. The potential of this study lies in the lack of similar research in the Italian context. This research aims to contribute to highlighting the training needs of future educators and teachers regarding CSE topics during childhood. Through an exploratory multiple case study in the educational and training Degree programs at Sapienza University of Rome, the research aims to investigate the participants' attitudes, opinions, and training needs. This will be accomplished by administering a designed questionnaire to explore these aspects. The importance of collecting this data lies in identifying the lacking areas in training to understand how to enhance their preparation to increase educational and school activities on these topics. Therefore, future educators and teachers will be able to provide educational continuity on CSE that is aligned with the needs of all individuals. As evidenced in the literature, this is an essential factor in ensuring people's well-being.

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THE TRAINING OF THE SOCIO-PEDAGOGICAL PROFESSIONAL EDUCATOR: AN OVERVIEW OF THE EUROPEAN CONTEXT

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Abstract

In the European context, the training of socio-pedagogical professional educator is influenced by a holistic approach aiming to integrate social, cultural, and economic dimensions. The adoption of common standards at the European level contributes to ensuring coherence in skill acquisition. Training paths for professional educators in Europe are characterized by diversity, reflecting the variety of pedagogical, cultural, and social approaches present in different countries (Eurydice, 2019, 2023). The competencies to be trained are integrated into national or supranational educational frameworks, such as the European Qualifications Framework (EQF, 2017), which not only emphasizes efforts towards European harmonization but also facilitates professional mobility within the European Union. Despite variations in the regulation of education professionals and the structure of training and specialization courses across countries, some common features underscore the importance of training these professionals. Specifically, there is a strong emphasis in Europe on social and pedagogical education, preparing educators to promote social inclusion, individual empowerment, and the adoption of effective pedagogical methodologies. The promotion of interculturality and the management of diversity are cross-cutting themes reflecting a strong commitment to building inclusive and pluralistic societies. In terms of curriculum design and development, learning outcomes are at the forefront of educational change (EQF, 2017). Ensuring the quality of university education shared among European countries also means supporting educators in training to achieve the expected competencies at the end of their higher education journey. The training of socio-pedagogical professional educators in Europe is a dynamic process that adapts to contemporary challenges and the evolving needs of society, contributing to shaping professionals capable of addressing complex challenges related to the promotion of well-being and the harmonious development of individuals (ONU, 2015; ISTAT, 2018). Its significance in creating an inclusive, innovative, and future-oriented educational environment is fundamental to social and cultural progress in Europe. Socio-pedagogical educators represent essential pillars in the construction of educated, resilient, and socially responsible communities. The objective of this contribution is to present a reflection on the profile of the socio-pedagogical professional educator in Italy and within the European framework, with a specific focus on the required competencies.

Keywords: Socio-pedagogical professional educator, training paths, competencies, Italy and Europe.

1. Introduction

The needs of contemporary society in the European context are becoming increasingly complex, and the actions taken by the European community reflect the construction of a network of professionals, especially in the field of education, working to provide targeted and higher-quality interventions (WHO, 2016). In this European policy context, the use of educational work becomes a natural and much-needed consequence. The social educator, in this sense, becomes the response to all the needs of societies that, although economically and culturally different, pursue the common goal: the construction of inclusive and just societies that value the individual and their development throughout the entire lifespan (ONU, 2015; ISTAT, 2018).

European interest in this role emerges precisely when the Community is concerned with the complexity of humanity and addresses the issue of the quality of life. The educator is the social operator who works with individuals and the entire social network around them, dealing with their growth and overcoming isolation and marginalization. The training of professional socio-pedagogical educators in Europe is a dynamic process that adapts to contemporary challenges and the changing needs of society, contributing to shaping professionals capable of addressing complex challenges related to the promotion of

well-being and harmonious development of individuals (Euridyce, 2019, 2023). Their importance in creating an inclusive, innovative, and future-oriented educational environment is fundamental to social and cultural progress in Europe. Socio-pedagogical educators represent essential pillars in the construction of educated, resilient, and socially responsible communities. Despite this fundamental agreement, the issues surrounding the recognition of the professional figure of the educator, the regulatory situation, intervention areas, and the type of training expected from these professionals reflect a highly diversified reality in Europe (Euridyce, 2019, 2023). This is why the role of the professional educator is constantly under discussion.

2. Socio-pedagogical professional educator in European context

Education professionals are a necessary component for building just and inclusive societies. Quality education is, consequently, the foundation for developing competent educators who, fortified by their specific knowledge of the education sector and practice-oriented competencies, address educational issues. Educational and training institutions have the task of training educators prepared to provide high-quality educational and training performances in order to meet the standards of their respective countries (WHO, 2016). Educational work is situated in contexts that present different and constantly evolving forms and problems. Competent educators must possess the tools to understand educational needs and use all information to design effective educational interventions with improvement in mind. In the Framework of Qualifications and Titles (2008), competence is defined as the proven ability to use knowledge, skills and personal, social, and methodological abilities to address work and study situations in the course of professional and personal development. Competence, therefore, becomes a tool for mobilizing resources, knowledge and competencies necessary to optimally respond to the demands that arise from the context and the individuals with whom the professional educator works.

Working in educational contexts means mobilizing an increasingly broad and complex set of competencies that must necessarily adapt to the flexible and dynamic contexts of educational work. But what are these competencies, and what is the qualification level for the professional educator in the European context? The necessary premise to make at this point is that these competencies are often integrated into national or supranational educational frameworks, such as the European Qualifications Framework (EQF) or other specific documents in the educational sector, which vary depending on the region or country considered. This emphasizes how important it is to situate the competencies of education professionals and adapt them to the specific needs of each context or country.

In Europe, the EQF (2017) establishes a series of criteria based on the achievement of certain levels of learning with the aim of organizing and integrating qualifications and improving the levels of transparency, accessibility and quality of the education and training system in relation to the labor market. In this sense, learning outcomes highlight the coherence and objectives of the qualification and become the indicator to be considered for: designing curricula in formal learning contexts and creating non-formal learning pathways in the workplace. In terms of the European architecture of professions (EQF), the qualification of the socio-pedagogical professional educator ranks within level 6, which requires the professional to have an advanced degree of knowledge in the field of intervention, competencies in solving complex work problems, as well as a high degree of responsibility and autonomy in managing activities and projects, even in teams. The underlying principle of these directives is to ensure that every country in Europe can develop the most appropriate type of training for its cultural and social specificities, while ensuring a training and regulatory standard for professional accreditation that allows various European countries to recognize a competent and ethically defined professionalism.

How does all this translate in terms of required competencies for educators? Starting from the premise that social education is a profession based on the combination of theoretical knowledge, practical skills, and personal commitment to collaborate in creating an inclusive society, the professional educator must necessarily continuously build and enhance a repertoire of fundamental and central competencies (AIEJI, 2005). From the Common Platform for Social Educators in Europe, fundamental competencies for addressing educational practice involve the ability to intervene and evaluate the educational situation and, in particular, the ability to reflect on educational issues aimed at guiding educational practice more effectively. Among the central competencies there are relational, communicative, organizational, systemic, and methodological skills. Therefore, educational work translates into a series of actions that require adequate and targeted professional competencies to achieve all the objectives of an educational intervention within a specific social and cultural context. It is precisely because of the characteristic of situated educational work that the training of educators is complex, as is the definition and recognition of their professionalism.

3. The case of Italy

In Italy, Law 205 of 2017 regulates the professional figure of the educator who operates in all socio-educational, socio-assistance, family support services, and minority group contexts, as well as in educational and school settings. The "Iori" law is effectively the regulatory recognition that governs education professions. Professional educators in Italy owe their qualification to the attainment of a degree in Educational Sciences and Training (L-19). It is for this reason that the recognition of the professional educator increases interest and attention to the training proposal and the definition of specific coherent initial training paths, aimed at favoring trajectories of professional development with a view to continuous improvement and enhancement of skills. The training offer must be organized to facilitate the translation of disciplinary content into usable knowledge in the professional world, respecting the educational pact, which is comprehensive, transparent, and shared (Boffo, 2021; Tammaro, Ferrantino & Iannotta, 2020).

The best way to promote the enhancement of skills is to conceive training experiences in theoretical-practical paths during which students can engage in reflective inquiry to enhance competencies and gain greater role awareness in educational practice (Chello et al., 2020). The professional identity of educators is built within training paths oriented towards the development and acquisition of indispensable competencies and knowledge to act within educational and training contexts (Cornacchia, Madriz, & Chianese, 2021). Training represents the cornerstone around which the professionalism of educators (Frison, 2020) and quality educational work (Rigamonti and Formenti, 2020) is defined. From these theoretical premises, the first study of the doctoral research project develops, which aims to investigate which competencies Italian Universities declare to train for professional educators in the initial training contexts of degree courses in Educational Sciences L-19.

To investigate the learning outcomes and competencies to be acquired at the end of the study path in Educational Sciences (L-19), the Annual Single Form (SUA) of 42 study courses were read and analyzed, excluding those with courses in distance learning mode. The SUA forms were downloaded in February 2023 from the portal of the Ministry of Universities and Research. Each SUA forms is structured according to tables containing management measures for the design, implementation, and self-assessment of degree courses. To examine the learning outcomes and competencies that universities intend to train for social educators, the tables referring to the training objectives of the courses were read. For the analysis of the final training objectives of the Annual Single Form, a qualitative approach with a bottom-up process was used (Braun & Clarke, 2006; Gale et al., 2013). From reading of all the SUA forms, 4 main categories of knowledge and specific competencies for the profession were identified. The categories and subcategories were designed following a conservative principle whereby each category is unique, comprehensive, and based on specific criteria and descriptions (Batini et al., 2020). This initial process led to the construction of a model of categories, necessary for analyzing the SUA forms and providing final descriptive statistics on the occurrences of each category, and therefore of each identified competence, mentioned within the SUA forms. Below is the categorical model of the 4 groups of specific competencies and knowledge identified with detailed description.

Table 1. Model of competencies and knowledge categories identified in SUA form.

Categories	Description
Knowledge and competences related to the educational area	Educators must acquire theoretical knowledge concerning the regulatory frameworks and the functioning of educational and training institutions, as well as psychopedagogical and related subjects, useful to guide educational practice and understand educational phenomena.
Organizational, methodological and didactic knowledge and competences	Educators must acquire methodological and didactic skills to be adapted to the educational and training needs and to the possible intervention strategies identified. In order to organize and manage the delivery of content, they must have adequate application skills of new digital instruments. The ability to design and evaluate an educational intervention cannot be separated from the acquisition of skills such as paying attention and observation, with the aim of identifying the educational problem and designing an intervention with adequate objectives. Practical skills relate to the ability to use educational research tools to empirically analyze educational situations, including through experimental surveys.

Communication competences	Communication skills for educators are essential to manage the organization and educational and formative activities using an appropriate and specialized language for communications with institutions and within teams. Communication skills are also indispensable for establishing interpersonal relationships that are functional to educational practice.
Competences of relationship and reflection	Educators work in contexts and situations of relationship, for this reason they must be able to read the affective-relational dynamics of individuals and groups to establish effective care relationships and intergroup ties, as well as being able to collaborate in multidisciplinary and interprofessional teams. Educators must be able to make a continuous reflective analysis of their work to improve educational practice and learn new skills. Specifically, it is required that they know how to manage independently and flexibly the problems and educational situations and to direct their training with the aim of developing professionalism.

The final analysis work allows us to understand how often the groups of specific competencies and knowledge identified are present in the SUA forms. In this way, a detailed overview of all the final learning objectives of the study courses in Educational Sciences (L-19) is produced for professional educators.

4. Final discussion

In Italy, there is a focus on providing an identity-forming education that trains competent and aware professional educators, while in the European context, there is an aim for greater recognition of the profession and optimization of competencies in terms of training objectives. This work must be attributed the importance it deserves, even just for the valuable roles and objectives it holds for the development of just and egalitarian societies. The training of socio-pedagogical educators' competencies in the European context should aim to meet current needs, but also to prepare education professionals to lead change and contribute to the construction of inclusive societies, respectful of diversity and oriented towards the well-being of all citizens. Reflecting on the skills necessary for educational practice is indicative to understand how to structure initial training paths and, above all, to provide useful guidance to orient the process of developing their own professionalism for educators in training and in service. Observing practices, noting the results achieved, reflecting on the strategies used, engaging with colleagues and other professionals, redesigning one's own action... these are all necessary actions to increase awareness, responsibility, and professional autonomy.

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TRAINING THE MEDIA-EDUCATIONAL HABITUS: 21ST CENTURY SKILLS IN DIGITAL DIDACTIC SETTINGS IN TEACHER EDUCATION

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Abstract

The educational policy demand for a reorientation of competencies towards more communication, future orientation, critical thinking, and collaboration - labeled "21st Century Skills" (Trilling & Fadel, 2012) – must have consequences for designing school and university teaching/learning situations. Previous university teacher education relied on individual work, individual examinations, the comprehension of existing positions, knowledge of tradition, and recognition and dominance of imparted content knowledge by teaching authorities. The central media of university teaching was printed matter. The pessimistic verdict of Clinton, Jenkins, and McWilliams from 2013 that we are training future teachers at universities "for an outdated world" has lost none of its relevance in Germany concerning media education and digital literacy. The media skepticism in teacher training and practical teaching in schools in Germany will be reflected in the first part of the talk. Therefore, in addition to subject-specific and curricular foundations and didactic design options, teachers need a peer-supported culture of meta-cognitive reflection that includes their expectations and beliefs in media. The second part of the talk presents a practice-relevant implementation in a cross-university, cross-state, and cross-subject didactic setting. It challenges and encourages students concerning their future didactic demands as teachers in producing a digital-online editable MOOC (Massive Open Online Course) as a peer-to-peer study offer.

Keywords: Media-educational habitus, 21st Century Skills, digital didactic setting, teacher education, media skepticism.

1. Introduction

Today, reading is embedded in digital media offerings and devices. International performance studies for pupils not only show manifest gender-specific differences in the same age cohort. Above all, the socially determined educational gap is widening. Whether for socially responsible action in the pandemic, diversity and serious source selection when searching for information or reflected political opinion-forming: reading and media skills are cross-sectional or critical skills. Convergent media development (Jenkins, 2009), in particular, requires a broader, interdisciplinary promotion of digital use - in terms of technology and the use and evaluation of content. That applies to schools and universities.

The educational policy demands more communication, future orientation, critical thinking, and cooperation, which should have consequences for school and university teaching design. Universities are key players in improving the media skills of prospective teachers. However, the pessimistic assessment by Clinton, Jenkins, and McWilliams (2013, p. 9) has lost none of its relevance, especially in Germany and about media education and digital literacy - the education system is still "designed for an outdated world."

2. Media skepticism among German teachers

This complaint is rooted in the convictions of prospective student teachers (Petko, 2012; Admiraal et al., 2017). Studies conducted over several years have shown that prospective teachers at universities have already brought a profound media skepticism with them from their school biography (Schmid, Goertz, Radomski, Thom, & Behrens, 2017; Marci-Boehncke & Delere, 2018; Rath & Delere, 2020). This media skepticism is often reinforced in the humanities (Gretter & Yadav, 2018). The result is a rather anti-digital "media pedagogical habitus" (Friedrichs, 2015), which has been identified in

international studies on media education in Germany (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014; Fraillon, Ainley, Schulz, Friedman, & Duckworth, 2019). Despite the digital challenges of the coronavirus years, this finding has remained the same in the current PISA survey 2022 (cf. OECD, 2023a, 2023b). Although the coronavirus pandemic has forced digital teaching in the classroom, this practice has not been sustainable. With regard to other OECD countries, the willingness of German teachers to use digital media in the classroom is still well below the OECD average in 2022 (cf. Lewalter, Kastorff, & Moser, 2023, 268). Technical usage skills, the ability to see through economic interdependencies, and the ethical and political evaluation of media offerings overtax prospective teachers. Here, it becomes clear that only interdisciplinary, networked thinking and reflection can create security. These are to be conveyed didactically in the curriculum via an orientation toward 21st-century skills.

3. Shaping digital spaces together: MOOC

Here, we present a didactic setting that specifically incorporates media education, curricular frameworks, inclusion, and future orientation into teacher training and challenges learners' metacognitive skills. The concept of our event was cross-university and cross-state. In addition, two subjects cooperated with a common theme: philosophy/ethics and the national language subject, here: German. Both subjects are curricularly responsible for teaching (digital) media skills, with different emphases. Therefore, student teachers at both universities should acquire digital media skills during their studies and learn how to pass them on to their future pupils. Students expect their training to have a connection to schools. In Germany, this teacher training takes place at universities and teacher training colleges, which offer subject-specific and subject-didactic as well as educational science and psychology-oriented courses. The seminar concept presented here is based, among other things, on the "21st Century Skills" (Trilling & Fadel, 2012), which demand overarching digital skills. Teachers should learn that subject-specific skills and life-world, social, and future-relevant skills must be promoted and didactically planned.

In addition, the joint work in the seminar can also be understood as at least a short-term Professional Learning Community (PLC) (Vescio & Adams, 2015), as teachers from the universities cooperate across university and subject boundaries "at eye level" with M.A. students from both locations to jointly create a platform for future student cohorts in the B.A. program. To this end, students at the Dortmund and Ludwigsburg universities developed digital learning units on school-relevant media education topics in cooperative PLCs. These are then available to other students in younger semesters as digital online MOOCs (Massive Open Online Courses) as peer-to-peer learning opportunities. In this way, both academic and media didactic skills are realized through content-related and methodological work and reflection requirements.

In the first round of seminars (developmental course I, summer term 2021), the students from both universities and we, as lecturers, met weekly in a digital room on the Moodle learning platform via Zoom access. The first step was to clarify relevant focal points from a student's perspective. Twelve core topics were profiled in joint work. The M.A. students then worked on the thematic units of the course digitally in groups (breakout sessions). With explicit reference to "21st Century Skills," the students identified relevant specialist literature, reported on the current state of research, and began with the digital production of the MOOC. The first product of the new MOOC learning units to be created was a self-produced introductory video with a motivational and abstract character. There were also information units, application and transfer tasks. At the end of the seminar, all students presented their unit in digital presentations in the digital plenum. One semester later (developmental course II, winter term 2021/2022), the units were developed further - this time by a new cohort of M.A. students. However, they developed the topics in comparison with the preliminary work of their fellow students. After these two creation phases, the units were standardized in layout for use as a self-study unit in a B.A. study phase and implemented in Moodle platforms with the help of the I.T. Media Centers at both university locations. From summer term 2022, B.A. students will now work on these subject units with digital tutorial support.

4. Didactic concept

This teaching and learning setting is aimed not only at the peer-supported development of teaching content and learning processes within the university but also at the professionalization of pre-service teachers in their future professional field, the school. The thematic and practical orientation towards the "mediatization" (Krotz, 2007) and digitalization of our modern societies (Marci-Boehncke, Rath, and Tkotzyk, 2023) is intended to realize the professional digital literacy (Marci-Boehncke & Vogel, 2018) of teachers. Teaching digital literacy is a cross-cutting task for teachers of all school subjects. Therefore, the multi-stage, process-oriented, and media-educational peer-to-peer concept we present here is also a future-oriented professionalization of future teachers.

We conceptualize our planning as a didactic tetrahedron (cf. Tall, 1886; Prediger, Roesken-Winter, & Leuders, 2019), systematically including learners, teachers, subject content, and media resources. It will be further developed as a thematically persistent moment in the process of developing our setting over three steps (see figure 1): (1) development and production of the digital self-study offer (development courses I and II), (2) use of the digital study offer by B.A. students (MOOC) and finally (3) the initiation of digital media education in later lessons (prospective school classes). The concept of integrated digitality in the tetrahedron as an implementation of the theory of mediatization (Krotz, 2007) is not located in one of the tetrahedron nodes but on the line between the learning content and the media resources. This digitalization of the development and teaching process is carried into the tetrahedron of the next stage via the peer-to-peer learning setting. Gaining skills through developing, producing, and using a digitalized setting ensures these skills are adopted in future school lessons.

Figure 1. Didactical tetrahedron model (own graphic).
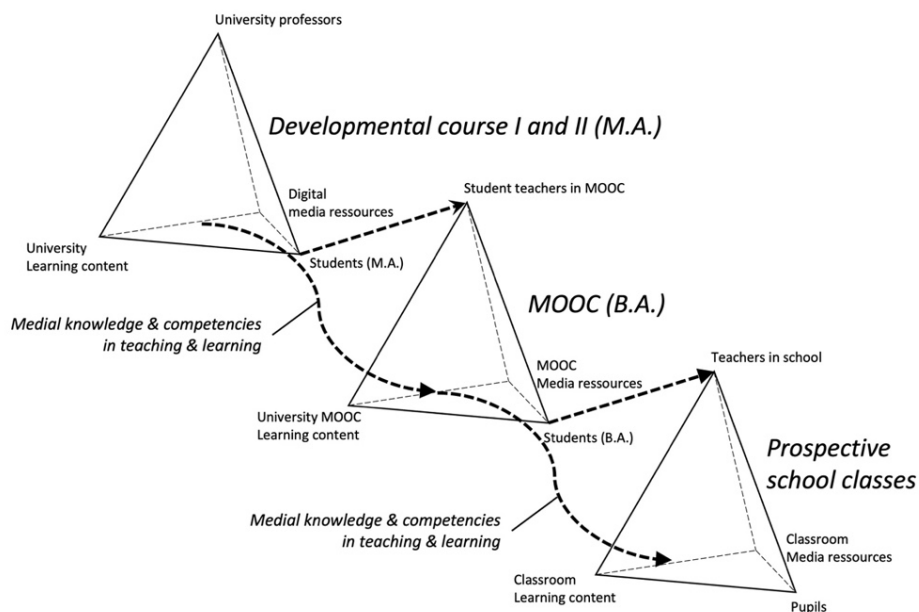
Fundamental here is the process of anticipated role assumption in step 1 (developmental courses I and II) with regard to step 2. The M.A. students, who are in the position of the learners in the logic of the didactic tetrahedron, actively create the MOOC for their peers, the future B.A. students, in two consecutive semesters. In doing so, however, they anticipate the role of the student teacher in relation to these peers, who indirectly address and guide their learners in the MOOC via media offerings (auditory, animated, or written addressing) (cf. Borko et al., 2021).

In the same way, a process of anticipated role assumption is also initiated for B.A. students in step 2 (MOOC B.A.) with regard to step 3 (prospective school classes): they are instructed to anticipate their role as future teachers. In addition, the concept of digitalization of the development and teaching process is taken into the tetrahedron of the next step via the peer-to-peer learning setting. Gaining skills through developing, producing, and using a digitalized setting ensures that these skills are adopted in future school lessons. In addition, after a few semesters of use (cf. step 2), a further revision (cf. step 1) takes place, which then leads to renewed use and implementation (cf. step 3). We can describe the entire procedure as an iterative process of sustainable updating of the teaching offer.

5. Digital skills and school relevance: The evaluation

The "21st Century Skills" from Trilling and Fadel (2012) are particularly relevant in our model. The 21st Century Skills describe fundamental skills indispensable for a digitalized society's future. In this respect, it is the professional task of schools to prepare the next generation for this - and this means that future teachers must have already acquired and reflected on these skills. As in the didactic tetrahedron model, media are not only a tool and a topic but also a context for action.

The evaluations now available (cf. Marci-Boehncke, Rath, Greiff, Hueser, & Akdeniz, 2023) since summer term 2022 at both universities show the high level of acceptance and efficiency of the course. In brief evaluations after each unit, the B.A. students (total n=192) were asked to rate on a four-point Likert scale (1 = very relevant, 4 = not relevant) how relevant they consider the respective topic to be for the school. The students rate the content orientation as highly relevant (average 1.57). On a further Likert scale (1 = very high, 4 = low), they were asked to indicate what learning gains they assumed for themselves. They explicitly recognize their own practical educational needs and growth (digital literacy and media literacy), although there are more significant standard deviations and a slightly higher mean value (1.97) due to differences in previous education. Overall, the results show a very high appreciation of this learning offer compared to other seminar evaluations. This didactic implementation of mediatization and digitalization has reached the students' practices. That could be a "disruption" as a "gestalt shift" in the students' media pedagogical habitus, which will have an impact on their professional media activities in the medium term (cf. Flavin, 2012).

6. Conclusions

The interweaving of the various facets that are evoked in the seminars with the term "media" (work equipment, topic, and context of action) enables the students to have different individual approaches to the joint work. As part of youth culture, all students use digital devices, which are also part of their habitus. However, the confidence level in using them - technically and in terms of content and political reflection - differs significantly. However, as a sub-competence of the subjects German and Ethics, comprehensive digital sovereignty is part of the necessary educational content.

The work in cross-university teams was severe and motivated, and the results show a committed and highly appreciative approach to the topics and work on offer. The brief evaluation by the students in the MOOC-supported courses of the B.A. cohort shows an increasing acceptance of the course after two semesters. The topics are rated as very relevant, as is the level of understanding when working through them, and thus, the students' competence gains. The differences in assessment between the units are only slight. The topics concerning students in their own peer group - such as internet security and social media use - are particularly valued. Students are also very grateful for information on inclusion and the role of digital media in this.

On the other hand, aspects of teaching justification – such as curricular frameworks – seem not quite as attractive. It is also apparent that the cohort is already divided among students regarding their future orientation. For example, the relevance of algorithms and A.I. is considered less important, especially among students in German. The importance of the future conveyed in the unit and the connection of this topic to linguistic structures (A.I. and ICT as a semiotic system) needs to be understood. Nevertheless, the values on the scales are close to each other, so there is a very high level of interest in this learning opportunity.

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THE ASSOCIATION BETWEEN PERCEIVED DISCRIMINATION PROFILES AND CAREER ASPIRATIONS AND EXPECTATIONS OF HIGH SCHOOL STUDENTS

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Abstract

Career development literature suggests that perceived discrimination may influence the career choices of individuals from diverse backgrounds (e.g., racial minorities) (Swanson & Fouad, 2020). More specifically, perceptions of both overt and covert discrimination could lead to the elimination of career options (Poon, 2014; Schneider & Dimito, 2010), limiting perceptions regarding career opportunities (Conkel-Ziebell et al., 2019) and attenuated career expectations (Abrahamsen & Drange, 2015). However, perceptions of discrimination are rarely systematically measured in these studies and their association with individuals from diverse backgrounds' career choices seems to be overlooked. Therefore, the study aims to 1) identify profiles of perceptions of discrimination and 2) examine how profile membership relates to key sociodemographic characteristics as well as limiting perceptions regarding career plans, educational aspirations and expectations. Thus, a sample of 756 Canadian high school students (M = 16.3 years old; SD = 0.9) completed an online survey from May 2022 to February 2023. Among them, 52% identified as female, 46% identified as male and 2% identified differently. It is also important to note that the sample is made up of a majority of racialized students (72%) and over a third of immigrant students (38%). Latent profile analyses revealed three distinct perceived discrimination profiles, across which proportions of females, racial minorities and Indigenous people, as well as mean levels of limiting perceptions regarding career plans varied. The conclusion highlights appropriate courses of action to counter the potential adverse effects of perceived discrimination on career aspirations and expectations.

Keywords: High school students, perceived discrimination, latent profiles, career aspirations, career expectations.

1. Introduction

Career development literature suggests that perceived discrimination may influence the career choices of individuals from diverse backgrounds (e.g., racial minorities, LGBTQ2A+) (Schneider & Dimito, 2010; Swanson & Fouad, 2020). More specifically, perceptions of both overt and covert discrimination (i.e., microaggressions) could lead to the elimination of career options (Poon, 2014; Schneider & Dimito, 2010), limiting perceptions regarding career opportunities (Conkel-Ziebell et al., 2019) and attenuated career expectations (Abrahamsen & Drange, 2015). However, perceptions of discrimination are rarely systematically measured in these studies and their association with individuals from diverse backgrounds' career choices seems to be overlooked in Canada and elsewhere.

2. Objectives

Therefore, the current study proposes a quantitative approach to systematically and thoroughly measure perceptions of discrimination and their association to career choices. More specifically, the study aims to identify profiles of perceptions of discrimination based on the frequency of overt (e.g., threat and aggression, exclusion) and covert dimensions (e.g., environmental invalidations, assumptions of inferiority) of discrimination. Another objective is to examine how profile membership relates to key sociodemographic characteristics (e.g., racial minority, immigrant, and LGBTQ2A+ status, gender) as well as limiting perceptions regarding career plans, educational aspirations and expectations.

3. Methods

3.1. Participants and procedure

The sample included 1056 Quebec (Canada) high school students, among which 756 of them (M = 16.3 years old; SD = 0.9) completed an online survey. Among them, 52% identified as female, 46% identified as male and 2% identified differently. The sample is made up of 72% of racialized students and 38% of immigrant students. From May 2022 to February 2023, students from selected high schools were invited to complete the survey on a voluntary basis in class or at home via an email sent by their school. In order to obtain free and informed consent from participants, a consent form preceded the online questionnaire. The study has been approved by the ethics committee of the researcher's university.

3.2. Measures

3.2.1. Perceived discrimination. Items (16) measuring overt dimensions of perceived discrimination were selected and adapted from the *Lifetime Brief Perceived Ethnic Discrimination Questionnaire-Community Version* (Brondolo et al., 2005). Items (18) measuring covert dimensions of perceived discrimination were selected and adapted from two existing scales: the *Racial Microaggressions Scale* (Torres-Harding et al., 2012) and the *Revised 28-item Racial and Ethnic Microaggressions Scale* (Forrest et al., 2015). Participants indicated how often each of the described situations occurred because of their distinctive characteristics using a five-point Likert scale (0 = never, 4 = very often).

3.2.2. Limiting perceptions regarding career plans. Participants were asked to indicate their degree of agreement towards seven statements regarding their perceptions of accessible career options, barriers (e.g., anticipation of discrimination) and potential for professional achievement in relation to their distinctive characteristics using a five-point Likert scale (0 = strongly disagree, 4 = strongly agree). An average score of limiting perceptions regarding career plans was generated for the analyses.

3.2.3. Educational aspirations and expectations. Educational aspirations were measured in terms of the highest level of diploma sought given ideal conditions (1) High school diploma, vocational diploma or less; 2) College degree; 3) Bachelor's degree; 3) Master's degree; 4) Doctorate degree). Educational expectations were identified in terms of the highest level of diploma likely to be attained.

3.2.4. Sociodemographic information. Participants answered questions pertaining to their age, gender, sexual orientation, Indigenous status, racial minority status, disability status and country of birth.

3.3. Statistical analyses

All analyses were conducted using Mplus 8.10. Factor scores for perceived discrimination were generated using exploratory structural equation modeling (ESEM) (Marsh et al., 2014). Estimations of covert discrimination frequency were based on a bifactor ESEM model that included a global factor (global microaggressions) and four specific factors (assumptions of inferiority, environmental invalidations, assumptions of criminality, invisibility). Estimations of overt discrimination frequency were based on a ESEM model that included four specific factors (threat and aggression, exclusion and injustice, threat and stigmatization, and stigmatization at work). Using factor scores obtained from measurement models, latent profile analyses (LPA) were conducted in order to identify the optimal profile solution based on theoretical implications and fit indices (Morin et al., 2016). Based on the retained solution, the BCH procedure was used to compare means of limiting perceptions regarding career plans across profiles. The DCAT procedure was also used to compare the distribution of gender, racial minority status, immigrant status, sexual orientation, disability status, Indigenous status, as well as educational aspirations and expectations across profiles.

4. Results

LPA with one-to-five-profile models were tested, for which fit indices are presented in Table 1. The three-profile solution was retained revealing three distinct perceived discrimination profiles (see Figure 1). Profile 1 (low frequency; 21% of the sample) includes participants reporting relatively low frequency for global microaggressions, threat and aggression, exclusion and injustice, as well as stigmatization at work. Profile 2 (moderate frequency; 43% of the sample) characterizes participants reporting moderately low frequency for global microaggressions and the four factors of overt discrimination. Profile 3 (high frequency; 36% of the sample) includes participants reporting relatively high frequency for global microaggressions and the four factors of overt discrimination. Profiles were then contrasted on six sociodemographic characteristics as well as limiting perceptions regarding career plans, educational aspirations and expectations (see Tables 2 and 3). Results showed that Indigenous people were more likely to belong to the Moderate profile. Both Moderate and High profiles included the

highest proportions of racial minorities. In addition, both Low and High profiles included the highest proportions of females. The effect size for these differences was small. Results also showed that participants belonging to the Moderate and High profiles reported higher levels of limiting perceptions than participants from the Low profile. The effect size of these differences varies from moderate to large. Finally, no differences were observed across profiles for educational aspirations and expectations.

Table 1. Results from latent profiles analyses (N = 832).

Model	LL	#fp	Scaling	AIC	BIC	ABIC	Entropy	aLMR	BLRT
1 profile	-9447.37	18	1.44	18930.73	19015.76	18958.60	N/A	N/A	N/A
2 profiles	-7014.63	37	1.64	14103.26	14278.04	14160.54	.93	<.001	<.001
3 profiles	-6134.01	56	1.45	12374.03	12636.56	12460.72	.93	<.001	<.001
4 profiles	-5603.22	75	1.48	11356.45	11710.73	11472.56	.93	.010	<.001
5 profiles				Did not converge					

Note. LL: Model LogLikelihood; #fp: Number of free parameters; Scaling: Scaling factor associated with MLR loglikelihood estimates; AIC: Akaïke Information Criteria; BIC: Bayesian Information Criteria; ABIC: Sample-Size Adjusted BIC; aLMR: Adjusted Lo, Mendell, and Rubin's Likelihood Test; BLRT: Bootstrap Likelihood Ratio Test.

Figure 1. Final latent profile solution (N = 832).
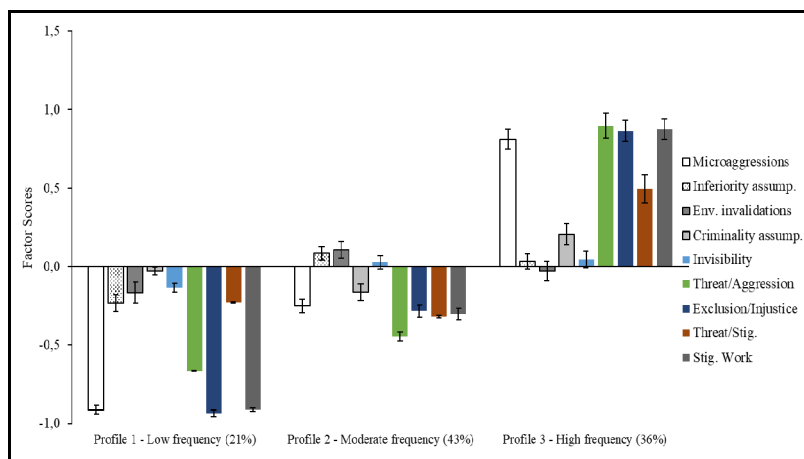
Table 2. Standardized profile means/proportions and standard error of covariates (N = 832).

	Standardized means and proportions (standard error)		
	Profile 1 Low frequency	Profile 2 Moderate frequency	Profile 3 High frequency
Gender (Female)	52,2% (0.04)	46,8% (0.04)	59,0% (0.03)
Racial minority status	63,6% (0.04)	73,5% (0.04)	75,0% (0.03)
Immigrant status	35,3% (0.04)	33,2% (0.03)	41,5% (0.03)
Sexual orientation			
(Homosexuality)	8,0% (0.02)	9,0% (0.02)	9,2% (0.02)
(Other)	5,9% (0.02)	8,8% (0.02)	6,4% (0.01)
Disability	2,2% (0.01)	5,1% (0.01)	3,6% (0.01)
Indigenous status	1,2% (0.01)	4,5% (0.01)	0,0% (0.00)
Limiting perceptions regarding career plans	0.95 (0.06)	1.64 (0.05)	1.26 (0.04)
Educational aspirations			
(High school diploma, vocational diploma or less)	7,1% (0.02)	6,6% (0.02)	9,6% (0.02)
(Doctorate degree)	39,9% (0.04)	40,6% (0.03)	42,0% (0.03)
Educational expectations			
(High school diploma, vocational diploma or less)	12,1% (0.03)	7,8% (0.02)	12,7% (0.02)
(Doctorate degree)	35,2% (0.04)	29,3% (0.03)	26,6% (0.03)

Table 3. Comparing profiles on demographic variables and educational aspirations and expectations.

	Effect sizes values for profile comparisons		
	1 vs 2	1 vs 3	2 vs 3
Gender	.13*	.07	.14**
Racial minority status	.10*	.11*	.02
Immigrant status	.02	.05	.07
Sexual orientation	.05	.02	.04
Disability	.08	.04	.04
Indigenous status	.10*	.04	.13**
Limiting perceptions regarding career plans	.87***	.41***	.47***
Educational aspirations	.03	.06	.07
Educational expectations	.11	.08	.09

Note. Size of differences between profiles are measured by Cohen's *d* (Limiting perceptions regarding career plans) and Cramer's *V* (gender, racial minority status, immigrant status, sexual orientation, disability, Indigenous status, educational aspirations and expectations) effect size. Cohen's *d* effect size = .2 (small), .5 (moderate), .8 (large). Cramer's *V* effect size = .1 (small), moderate (.3), and large (.5). *$p < .05$, ** $p < .01$, ***$p < .001$

5. Discussion

The research results first showed that the perceived discrimination profiles stood out not so much in terms of the frequency of specific forms of microaggressions, but the addition of these microaggressions. It is important to highlight this observation as it is hypothesized that repeated microaggressions experiences may lead to cumulative harm (Evans & Mallon, 2020). The results also shed some light on specific groups at risk of perceiving discrimination. Consistent with the observation that racial minorities generally perceive more discrimination than their peers (e.g., Boulet, 2022), racial minority students were more likely to perceive different forms of discrimination than non-racialized youth. It is also important to note that the High profile included a higher proportion of female and racial minority students, which raises the relevance of adopting an intersectional perspective in the study of discrimination (Harnois, 2014). As expected, higher frequency of perceived discrimination was associated with a higher level of limiting perceptions regarding career plans, which includes the perceptions of limited accessible career options and the anticipation of discrimination on the labour market. Career development literature suggests that these limiting perceptions could lead to the elimination of career options deemed as inaccessible (e.g., Poon, 2014) and attenuated career expectations (Abrahamsen & Drange, 2015). However, the absence of differences in terms of educational expectations across profiles is notable in the present study. It is likely that educational expectations vary more according to specific overt and covert dimensions of perceived discrimination rather than profile membership.

6. Conclusions

A majority of the participating high schools implements an intercultural policy, which could potentially explain the relatively low frequency of perceived discrimination in the sample. Among other things, this intercultural policy aims to 1) promote the academic and social integration of students from immigrant backgrounds and 2) ensure staff development on interculturalism (Commission scolaire de la Pointe-de-l'Île, 2009). It would be relevant to first assess the impact of such a policy on inclusion, and then consider its implementation in other high schools if deemed appropriate. As for educational practice, avenues of intervention with youth from immigrant backgrounds should focus on assessing barriers to career choices, examining experiences and anticipation of discrimination, re-examining eliminated career options on the basis of perceived barriers and examining potentially attenuated career expectations (Fouad & Kantemnni, 2020). In light of the social cognitive career theory, it would also be relevant to assess and modify the unfavourable self-efficacy beliefs of students from immigrant backgrounds regarding career domains that they deem inaccessible, notably by identifying role models in these domains (Sheu & Wang, 2021). Some limitations of this study should be noted. First, in light of the participating high schools composition, racialized and immigrant students are overrepresented in the sample. It is reasonable to assume that the results would vary with a more representative sample. Second, it is also possible that the measure of a general form of discrimination as opposed to a specific form of discrimination may have influenced the frequency of perceived discrimination among the participating students. Finally, seeing as both career aspirations and expectations are relatively high among the participating students and that they are mostly congruent, one wonders to what extent students were able to distinguish between them. We may also wonder how this influences the association with the perceived discrimination profiles. Future research should focus on gathering data using a more representative sample, enhancing the measure of career aspirations and expectations and measuring a specific form of discrimination.

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DRAWING AND WRITING ABOUT FRIENDSHIP AS A WAY TO SUPPORT SOCIAL INCLUSION IN PRIMARY GRADES

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Abstract

When talking about inclusive education in our country, the focus is primarily on learners with lower abilities, but a person's social development is also of decisive importance for academic development, social inclusion and a successful transition to adulthood. Therefore, in addition to learning and teaching, the school must take care of the students' well-being and create a friendly, safe and bullying-free school environment where all students have an equal opportunity to participate in school life and have and express their opinion. Our school participated in the European Commission's project "Social inclusion through student participation" (SIPP). Within the project, in cooperation with partners from Italy, Denmark, Sweden and Switzerland, a friendship survey was conducted in the first grade of school in each country, where students had to draw a picture of friendship at school and write briefly what they think about it. This report presents the results of the survey conducted with the students of the partner school in our country. The sample included 26 girls and 22 boys. The article analyzes children's use of pictures and words and its connection with social inclusion in the school environment. The "draw and write" method was used, because young children can express their emotions most effectively in this way. The pictures drawn about friendship were divided into six thematic areas, which were defined in cooperation with international project partners: situations (16), emotions (10), symbols (10), classrooms (5), houses and homes (4) and mathematical visualization (3). The easiest way for children to handle the concept of friendship was through situational approach, as well as describing emotions and symbolism.

Keywords: Social inclusion, student participation, inclusive education in the 1st grade, friendliness, drawing analysis.

1. Introduction

All students should feel accepted and valued, regardless of their intellectual, social, physical, cultural, or other features (Hastings & Oakford, 2010), because research has shown that a key factor for academic development, social inclusion and for successful transition to adulthood is a person's social development (Vlachou et al., 2016). The goal of social inclusion in school is for guaranteeing the welfare of the students, namely that everyone would feel safe and well, despite their special needs or idiosyncrasies (Ikwumelu, Oyibe, & Oketa, 2015).

Before the age of ten, children have an easier time expressing their feelings through drawing rather than verbal communication (Grosse, Streubel, Gunzenhauser & Saalbach, 2021). At the same time, student's comments help us understand the subject matter of the relevant art. Many previous studies have focused on children's drawings, looking at them from behavioral and emotional viewpoints and analysing use of color and featured objects, along with their size, placement, and level of detail (Degura & Nutbrown, 2017; Mandrapa, 2015).

2. Social inclusion

The results from the research of Schwab, Zurbriggen and Venetz (2020) point out that inclusion should not only focus on academic success but that one should also look at the student's social-emotional development. In a school environment it is important to support sutdent's welfare, make their voice heard and to strengthen self-regulation. One must observe student's social inclusion in the classroom because inclusion in a non-formal activity may not translate into inclusion in a classroom in a formal activity. Norwegian pedagogy scientists Nordahl, Jahnsen, Støen, & Tinnesand (2016) confirm the fact that students do well in school when they experience good relations with both teachers and their peers, and when they feel valued.

2.1. Friendship

Friendly relationships are not only important for individual development, they are also necessary for successful community life (Bradburn, 1960).

The focus of friendship changes as age changes and intimacy and loyalty become important. Marcone, Caputo, and della Monica (2015) found that preschoolers clearly have difficulty defining the term friend. At school age, this difficulty disappears, although the reasoning remains self-centered: A friend is someone who helps us achieve our goals and do what we want.

2.2. Drawing as creating a visual text

Drawings are the reflectors and highlighters of the child's inner world (Bastrup-Madsen, 2001).

Before the age of ten, emotions play an important role in vocabulary acquisition, so it is often easier for primary school students to draw abstract and emotion-related feelings than verbal speech. Their thoughts and feelings are conveyed by colors, shapes, the presence, or absence of objects in the picture and the location of the object on the paper (Grosse, Streubel, Gunzenhauser, & Saalbach, 2021).

Children's drawings can be studied schematically from different angles such as action (dynamic aspect), symbolic representation, functional dependence and thought (Athey, 1990). The pictures often show a cause-and-effect relationship (Deguara & Nutbrown, 2017). The pictures are places where something actually happens, and the creation of schematic scenes is based on the child's own experiences. Thus, pictures are an objective source for understanding the child's experiences with still abstract words. Since the child likes to use many symbolic elements, the best way to interpret the pictures would be to let the child come up with the meanings of the symbols themselves (Coates & Coates, 2006).

Degura and Nutbrown (2017) point out that the colors convey the emotions that the situation caused, also the colors describe the children's nature, for example, purple and black suggest a dominant child who constantly needs something.

In pictures, the rule is that the most important figures are brought out larger. Impulsive children are tall, neckless, and have asymmetrical body parts. Concern is signaled by clouds, rain, people with no or closed eyes, and images of flying birds. When the child is angry, he draws people with big long arms and teeth, and when he is insecure, he draws crooked armless monsters with tiny heads (Mandrapa, 2015).

The researchers believe that the first glance at the drawing and the general impression left by it are the most important. Attention should be paid to whether the picture is ready, what colors have been used, how things are located and how big they are (Uzunboylu & Evram, 2017) and repeated motifs (Farokhi & Hashemi, 2011).

3. Objectives

The team of the School of Educational Sciences of Tallinn University participated in an international project, and this study was carried out in school(s) in Estonia, Italy, Denmark, Sweden and Switzerland within the framework of one of the activities of the European Commission's project "Social inclusion through student participation". This article deals with data from an Estonian school, but the subject areas defined jointly with the project partners have been used in the analysis of the drawings.

The aim of this study is to find out how first grade students draw friendliness and with which expressions they characterize it. The following research questions were posed: How do first grade students express friendliness by drawing? What words and sentences do primary school students use to characterize friendliness? How does drawing and expressing friendship change as the student grows older?

We assume that understanding the concept of friendship is related to the child's age and becomes more detailed, deeper and multi-layered as the age increases.

4. Methods

A small private school from Estonia participated in the study, whose development plan aims to support the potential development of each individual according to the environment. 12 students from the first grade (8 girls and 4 boys), 12 from the second grade (5 girls, 7 boys), 12 from the third grade (5 girls, 7 boys) and 12 from the fourth grade (8 girls and 4 boys). boys) participated in the study. The whole sample (N = 48) consisted of 1.-4. 26 girls and 22 boys study in the class.

Since children's drawings can be treated as visual texts transmitted as pictures (Albers, 2007), we chose the term drawing as one of the data collection methods because of its abstractness, in order to simplify the description of friendliness for students. The children were not asked to talk about their picture, although there were some who wrote explanatory sentences for their drawings. The activity was conducted once with each class by a researcher whom the students had not met before. As an introductory

activity, a theme matching game was organized where they thought of adjectives for a teddy bear and then the children could say whether they thought it was friendly or not.

To collect data, students were given an A4 paper and asked to draw a picture of friendship on one side of the page and write 3-10 sentences about friendship on the other side of the page. No further instructions were given, the first class was helped to write sentences if necessary. The children had 45 minutes to complete the task. There were colored pencils on the tables, which the children could use as they wished.

Compositional interpretation was used as a data analysis method in the analysis of children's drawings, during which one tries to understand the meaning of the picture and looks at the content, color range, spatial arrangement and expressiveness (Rose, 2001). Qualitative content analysis was used to analyze the words and sentences written by the students, which allows the researcher to analyze the respondents' experiences and understand their assessments and interpretations of different situations (Laherand, 2008; Õunapuu, 2014).

5. Results and discussion

The pictures drawn about friendship were divided into six topics: situations (16), emotions (10), symbols (10), classrooms (5), houses and homes (4) and mathematical visualization (3). Thus, it can be argued that the easiest way for children to handle the concept of friendship was through situational approach, as well as describing emotions and symbolism.

Most of the **situation drawings** (N = 16) depict some kind of situation, and all pictures were dominated by friendly and positive solutions. When drawing situations, it is like small stories that the child conveys (Bastrup-Madsen, 2001). Four children have located their activity by the sea, although the zig-zag line used for the sea can be considered as an imitation of writing (Worthington, 2009).

Emotions were depicted ten times in the pictures. One emotion image consists of two neatly drawn children holding their pets side by side. The children's faces are satisfied. A study by Missaghi-Lakshman and Whissell (1991) shows that it is easiest for children to depict happy and sad emotions, while other emotions are more difficult to express in a drawing. In many cases, happiness is conveyed only by the line of the mouth, including the position of the mouth is not important in terms of emotion (Cannoni, Pinto & Bombi, 2021). The teacher rarely appears in the pictures.

In the images of the symbols, four had rainbows, which (Fogarty, 2018) refer to bright children with positive thoughts and experiences. One picture shows a head with big eyes and a big mouth, from which it can be concluded that the child is a good communicator and once again feels positively watched by an adult. In addition, there is a sun in the picture, which, as already described, indicates a bright world picture.

Classrooms were shown in five pictures, but three of them do not have students and are drawn as empty rooms. In one picture, the classroom has a barred doorway and the way out of the door is green, which may indicate that the child feels safe and comfortable only outside the classroom, while in the classroom he is rather shy (Albers, 2007).

Children can give different meanings to **houses and homes** (Fogarty, 2018), but in general they reflect the surrounding situation. Although the task was to draw friendliness in a school context, we got drawings of four houses, two of which were nice and tidy, surrounded by friendly activities. One of the houses drawn was sloppy and in some places the shape of the bars appeared. Houses are symbols of stability and structure and give us a description of the life we experience, bars suggest that the child experiences the depicted place as a prison (Fogarty, 2018).

Pictures expressing **mathematical thinking** were the least of the given sample (N = 3). These pictures represented scales for rating different behaviors and communicated through facial expressions and graded representation what is positive behavior and what is not. Such repeated use of faces as images testifies to students' need to emphasize certain aspects and their understanding (Farokhi & Hashemi, 2011).

Adding **verbal explanations** to the concept of friendliness was quite difficult in the **first grade**. Children wrote down words related to friendship. The most common words were friend and good friend (N = 9). Activities that can be done with a friend or a friendly person were described: I can play with him (N = 7), I can play football (N = 2), I can visit him (N = 2). An activity that the friend does not do was also mentioned: the friend does not hit (N = 2), but the children can sing, ride a bike and talk about things with him. Friends should be kind and share things.

Second grad students began to write about things that two people have in common, such as the sentence: A friend is someone you want to do things with all the time and he enjoys being with you. The ability to generalize was born - friendliness is when people are like brothers, love the same things. It was also considered important that the friend was smart enough. When describing friendliness, the word

friendly (N = 4), playing together (N = 3) was mentioned. In contrast to the first class, belonging was highlighted: It is important for a friend to recognize you in front of others, saying hello was highlighted (N = 3) and being a support to a friend (N = 4).

The difference for the **third graders** was that when the children wrote about what a friend should do and what they do, the good things were in the form of an action, and the things the friend should not do were in the form of a command. Writing about friendliness, the emphasis had also shifted to the use of words, friendliness is expressed in politeness (N = 2), nice language (N = 4), not cursing (N = 3), in addition to saying hello and acting like a friend cannot be arrogant. Not gossiping and being honest were mentioned twice. Being friendly also meant not being ignored (N = 2). Sharing things, worksheets, and pens is still an important feature of friendliness (N = 8).

In the case of **fourth-grade** students, due to their greater linguistic ability, unlike the above-mentioned classes, they answered with proper full sentences that contained both analysis elements and students' emotions. One boy wrote: I think a friend is a person who shares things, helps and doesn't hitFor girls, the verbal part is more important: I like it when someone listens to me and answers my questions. Invites me to play and explains how to do it.

Again, not hitting (N = 6) and being helpful (N = 5) were mentioned the most. Yelling not being loved is mentioned twice in relation to friendliness in this age group as a new thing. And in the words of one girl: A friendly person will not hurt you physically or emotionally.

6. Conclusions

Most of the drawings depicted situations, and all of them had an overwhelming positive emotion or supportive behavior. An earlier theory also points out that when drawing situations, it is like small stories that the child conveys (Bastrup-Madsen, 2001). Images describing situations are dominated by images describing sharing, standing up for the other, consoling and playing together. Families are also involved in friendship.

There were ten times each of emotions and symbols in the drawings, emotions are conveyed mainly by facial expressions and body positions, and in the case of symbols, a rainbow and the sun are depicted several times, which indicate bright emotions. Most of the emotions were positive, but there were also some that indicated anger or insecurity. The teacher rarely appeared in the pictures. Earlier studies (Missaghi-Lakshman & Whissell, 1991; Cannoni et al., 2021) have also shown that it is easiest for children to imagine joy and sadness, so for example happiness is conveyed in many cases only with the line of the mouth.

In this study, the children themselves were not asked for verbal explanations about the drawings.

Based on children's written texts, it can be pointed out that for students, friendliness means an emotionally warm personality, with whom it is easy to communicate and relate, without negative emotions. The criterion of friendliness is also respect for others (respects people's feelings, ideas and beliefs) and public acknowledgment of one's friends in front of others. Friendliness also includes the ability to show patience and care and take enough time for people. Friendliness is considered more of a character trait than a skill, but it is also something that can be learned and improved.

Social involvement and friendliness are key words in the development of a complete person, despite the abstract nature of the concept, it turned out that, both verbally and in drawings, children understand friendship as sharing things, acting together, caring for each other, helping, respecting, standing up for the protection of others, as well as safety and reliability. While the word usage was slightly different by age level with different emphases and also by gender, the age characteristics did not differ when drawing.

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TEACHING SCIENCE THROUGH HUMANISING PEDAGOGIES:
THE SOUTH AFRICAN PERSPECTIVE

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Abstract

This inquiry involved 60 Grade 11 biology students, and 3 teachers from different schools. The students were of Xhosa and Zulu origin in South Africa. After teaching the topic of carbohydrate fermentation to Grade 11 students over the years, two problematic issues recurred year in and year out. The different cohorts of students found this topic abstract as evidenced by their poor scores in given unit tests. The teachers also struggled to teach this topic in ways that are student engaging as they would just narrate the details of the topic and the students would take notes. In a quest to resolve this dilemmatic classroom scenario, two main research questions guided this inquiry: What is the impact of engaging humanising pedagogies in the teaching and learning of science content? How could science content be integrated with South African indigenous knowledge system for enhanced student understanding? A quasi-controlled experiment was used. The control group was taught through the broadcast method and the experimental group was taught through humanising pedagogies. It emerged that teaching and learning that entailed contextualising the content for teaching in the students' everyday knowledge, is a powerful tool for operationalising 'humanising pedagogies.' Engaging humanising pedagogies during teaching and learning decolonised the content for teaching by giving it a 'human face' and 'indigenous smile'. This did not only enhance student comprehension, but it also enhanced the teaching of abstract science concepts that are difficult content to teach. Recommendations are made.

Keywords: Fermentation, humanising pedagogies, intervention, Indigenous games, home brew beer.

1. Introduction and background

The world over, the teaching and learning of science ideas have been hailed as a challenging enterprise (Çimer, 2012). Many reasons have been put forward to explain this. These range from the perceived complex nature of science itself and its associated teaching methods (Lazarowitz & Penso, 1992), the science topic in question and the teacher's teaching style (Anderman & Anderman, 2009), the availability of teaching resources and the student's attitudes towards the science discipline (Çimer, 2012). The varied explanations are indicative of the complexities around the teaching and learning of science. This probably further explains why some scholars have viewed this process of teaching and learning from a theoretical and relatively abstract perspectives, e.g. the idea of border crossing (Cobern & Aikenhead, 1998). Furthermore, for biology in particular, many students have been noted to face difficulties with most biology topics (e.g., Özcan, 2003). This has stimulated researchers to investigate why students experience such difficulties and possible ways to overcome such difficulties (Zeidan, 2010). The different and complex biological levels of organization and the abstract nature of most concepts have been found to make learning biology particularly difficult (Zeidan, 2010). In addition to this, the abstract and interdisciplinary nature associated with biological concepts make the teaching and learning of most biology topics difficulty. The challenges students face with particular topics have led to a thrust towards specific research on the challenges associated with the teaching and learning of specific science topics, which in turn has shed insights that leads to the development of topic specific PCK (Mavhunga & Rollnick, 2017). Thus, issues around the teaching and learning of biology topics has been of concern to researchers because, for instance, experiencing difficulties in many biological topics has been found to be negatively affecting students' motivation and performance in this discipline (Özcan, 2003). This inquiry embraces this type of research trajectory.

After teaching the topic of carbohydrate fermentation to Grade 11 students of Xhosa and Zulu origin in South Africa over the years, two problematic issues recurred year in and year out. The different cohorts of students found this topic abstract because they struggled to grasp the content of this topic as

evidenced by their poor scores in unit tests given. Most teachers also struggled to teach this topic in ways that are student-engaging as those investigated in this inquiry would just narrate the details of the topic and the students taking down notes. The concepts which were emerging particularly difficult to teach and also for the student to grasp was the issue of fermentation at physical, chemical and molecular level, especially coming up with the chemical symbols of the reactants and the associated products and then balancing the associated chemical equations. In a quest to provide insights for understanding this dilemmatic classroom scenario, the following research questions guided this inquiry: What is the impact of engaging humanising pedagogies in the teaching and learning of science content? How could science content be integrated with South African indigenous knowledge system for enhanced student understanding?

2. Reviewed literature and the conceptual framework

2.1. Conceptual/Theoretical framework

Each typical social sciences research is seemingly associated with complexity and uniqueness because it involves human subjects whose behaviours in any given context cannot be predicted. Thus, I could not locate a single existing theory to use as a theoretical framework for this inquiry. A framework that is *'home-grown' or a* conceptual framework *(personal integration of concepts)* instead of one that is already there*, i.e. 'off-the-shelf'* (Antonenko, 2014) *was used* to overcome this complexity in this research (see Figure 1 below). The main constructs are discussed below the diagram.

Figure 1. A conceptual framework for the inquiry.
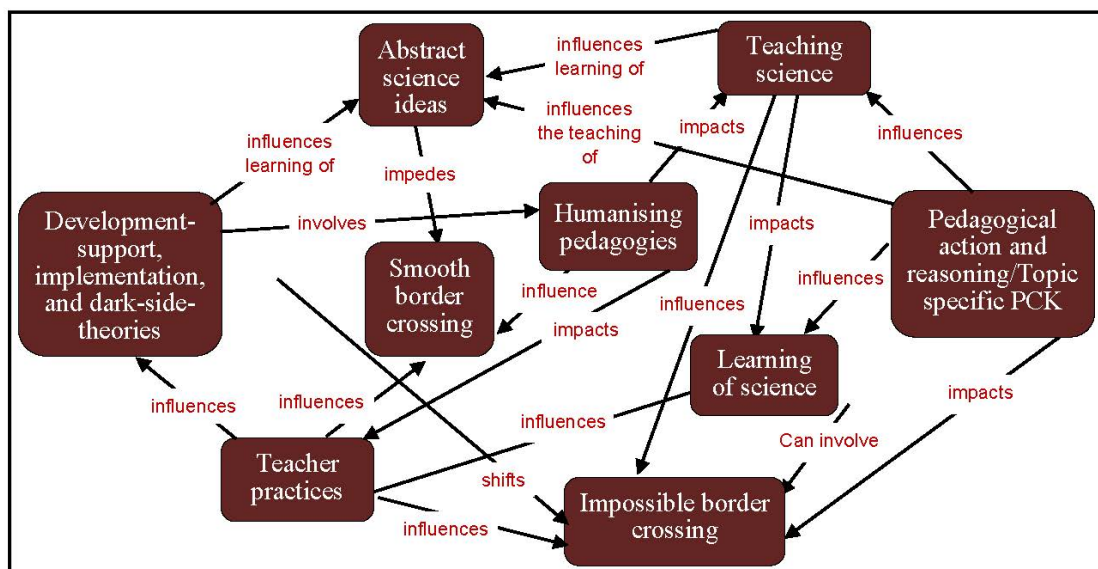
2.1.1. Humanising pedagogy. In this inquiry, pedagogy is seen as a philosophy of education that puts in the spotlight '*the content of what is being taught and the methods of how it is taught*'. It also highlights who is being taught and who is teaching, and the purpose (Geduld & Sathorar, 2016. p. 43). In terms of addressing specific learning needs of students (e.g. challenges with grasping abstract content), the quest of this inquiry was to give the textbook content for teaching and learning a human face familiar to the students by using teaching and learning approaches that attempt to contextualise the topic of biological fermentation (use of humanising pedagogies).

2.1.2. Border crossing. The theoretical lens of 'border crossing' views the issue of science teaching and learning in the light of induction into the culture of science (Cobern & Aikenhead, 1998). Thus, teaching is viewed as a form of cultural transmission and science learning as a typical cultural acquisition. This is because science is deemed not as an absolute truth, but as a typical culture where enculturation can occur during the phenomenon of teaching and learning. Thus, the notion of border crossing postulates the existence of borders between distinguishable cultures/subcultures that poses obstacles for individuals to cross. Consequently, the science teachers and students' experiences in the classroom have been theorized in terms of the ease with which they both cross cultural borders into the culture of science. Thus, the notion of border crossing has been used in science education to conceptualize difficulties that students encounter when learning science ideas. This crossing of borders has been categorised by scholars such as Cobern and

Aikenhead (1998) using terms such as *smooth*, *manageable*, *hazardous*, or *virtually impossible*. In addition to this, in this inquiry, the 'development-support-, implementation-, and dark-side-theories (Astleitner, 2020) were the main theoretical lens that scaffold this investigation.

3. Methodology

In my quest to answer this research question, intervention measures that entailed a quasi-controlled experiment were engaged during the teaching of the topic of biological fermentation. The control group was taught using the broadcast method of chalk, board, and talk. The experimental group was taught using 'humanising pedagogies' that involved contextualising the topic of fermentation in relation to the students' indigenous and traditional knowledge systems. The issue of indigenous 'home beer brewing', or what is termed '*umqomboti*' amongst the Zulu/Xhosa indigenous people of South Africa and also playing the African 'Hide and Seek' indigenous game (*umacatshelana*) were used to represent content for teaching. The collected data included unit test scores, which were analysed quantitatively. In-depth group interviews were used to find students' learning experiences from the humanising pedagogy approach used. The students' views were thematic analysed for themes (thematic analysis) through the process of coding from a deductive to an inductive approach.

3.1. Representing the balancing of complex chemical equations content using indigenous traditional games

In terms of the traditional knowledge systems, the balancing of chemical equations entailed incorporating the students' childhood traditional game called "*macatshelana*' (disjoin hands, hide seek find and re-join hands) in the teaching and balancing of the generally perceived complex fermentation chemical equations. The idea of writing and balancing chemical equations has always been a nightmare for the investigated students. We had to engage them in social interactions so that they learn from each other. This was also to address the aspect that some students learn better by interaction with the informed others (Vygotsky, 1978).

The students were exposed to all the stages of the home brewing beer experiment with the help of an elderly woman chosen because of her '*umqhombot*i beer brewing skills in her community. During the traditional game, the students were given different colours of coats, red (representing oxygen atom), black (carbon) and white (hydrogen). The game was about first joining hands into a ring structure of a sugar by a total of 24 students (see Figure 2 below). A whistle was then blown and the 'reaction' began to happen. The other few students wearing blue coats (denoting enzymes) had a role of helping the other students in the ring to break the joining of hands (bond breaking). The 'freed' students then mingled with each other and the rest of the group after dis-joining hands (hiding from each other). The whistle was then blown for the second time. This time students did not form a ring structure, but two in black (Carbon) joined hands with five in white (Hydrogen) with one more in red joining with one in white at the end (ethanol). One of the students in black then joined with two in red to denote carbon dioxide. The total number of students with hands joined were then counted and compared with the initial 24 in the earlier ring. For the students to go add up to the earlier total, the students were asked to discuss how the puzzle could be solved. Whilst this was a bit abstract for most students, the students were probed to form other ethanol and carbon dioxide 'molecules' until all the students had other students to join hands with. The groups of the remaining students who joined to form ethanol groups and carbon dioxide groups were then counted to balance the initial total of 24 students in the ring (balancing the equation). At the end when all the students who were in the initial ring shown in Figure 2 below, also had all their hands joined. If the student was not joining to other students using both hands, then one of the hands was shoved inside the pocket as part of the simple rules of the game (denoting hydrogen atoms that can only bond using a single bond.

4. Results and conclusions

It emerged that most of the students in the experimental group (taught through humanising pedagogies) grasped the fermentation content with ease (smooth border crossing), and their prevalence of inaccurate ideas held was far lower when compared with their counterparts as depicted in Figure 3 and Figure 4 below. However, a few students in the control group grasped the fermentation content but with relatively low scores when compared to the experimental group (manageable border crossing). These students were identified as *talented* students whose marks were always far above average even in different other topics (see Figure 3). Furthermore, during the games and the beer brewing, the students were excited as they played like kindergarten kids and also like real adults during their beer brewing traditional experiment.

Figure 2. The initial single group of 24 students with hands joined.
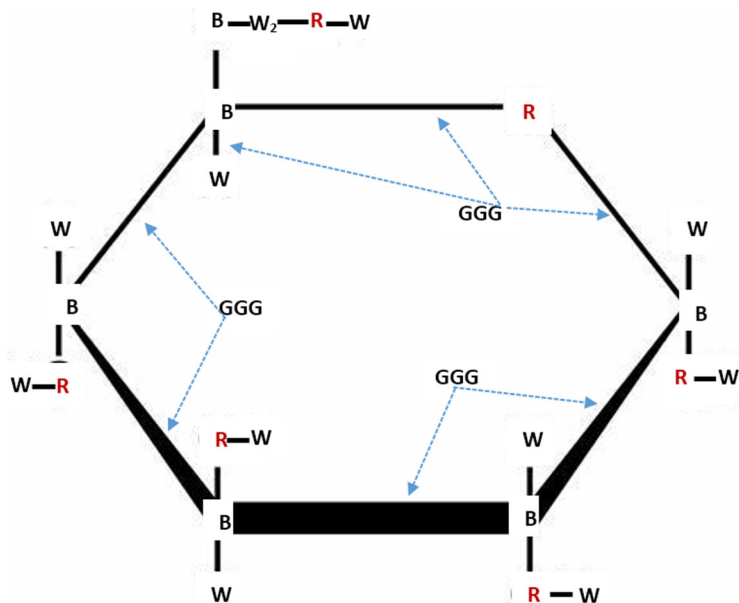
Figure 3. The notion of border crossing as used in this inquiry, based in the ideas by Cobern & Aikenhead (1998).
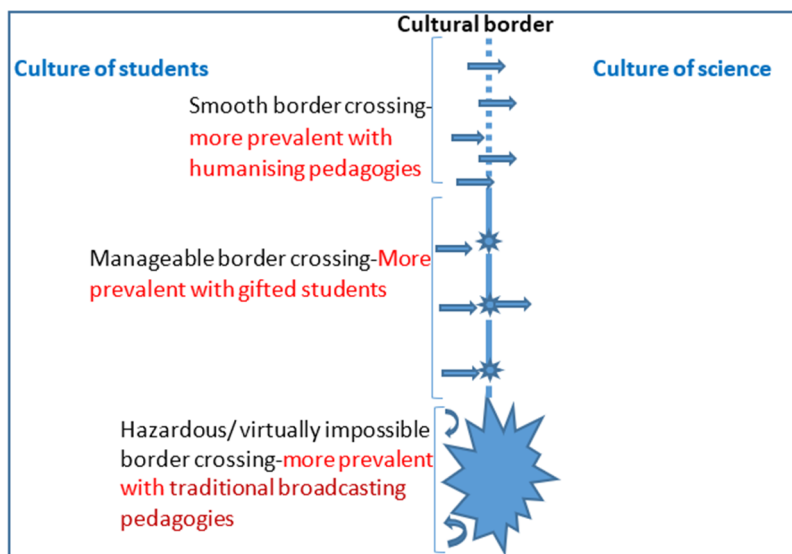
For instance, when asked about what they liked about the learning activities for this topic, the response by Jack (pseudonym): *I like being outdoors and playing as I learn is pretty awesome. I am excited I now know how to make beer.* This statement is evident that the change from the traditional way of teacher standing in front and the students behind their desks is a welcome development which the student wish to have quite often. Furthermore, the playful hands-on activities in real life and authentic situations empowers the students to learn from what they are doing. This is because there is a kindergarten in every adult (Resnick, 2017), and when that child in us is awakened, then our learning is maximised due to deep childhood innocence concentration that goes with everything.

Figure 4. Students' conceptions of fermentation ideas after teaching.
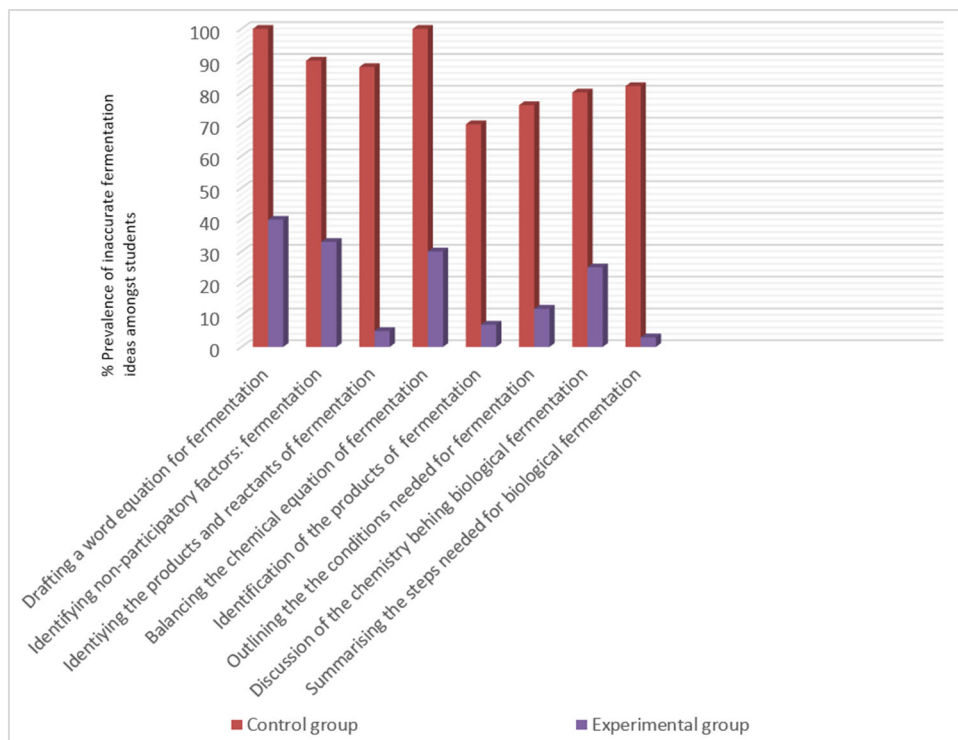
Thus, from this inquiry, it emerged that teaching and learning which entailed contextualising the content for teaching in the students' playful everyday knowledge, is a powerful tool for operationalising 'humanising pedagogies.' Engaging humanising pedagogies during teaching and learning transformed the content for teaching by giving it a 'human face' and 'indigenous smile'. This not only enhances student comprehension but also enhances the teaching of abstract science concepts through dramatic play. As educators at any level or from whatever part of the globe, it is imperative to contextualise the content for teaching in the relevant everyday life knowledge of the students we teach. Such pedagogical approaches that use dramatic play in our teaching, awakens the child in students, which is crucial for maximum concentration, a powerful precursor for effective learning.

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QUALITATIVE FRAMEWORK: AN APPROACH TO THE EVALUATION OF STUDENT'S WRITTEN OUTPUTS

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Abstract

This paper sought to apply a qualitative framework using a directed approach to content analysis in the evaluation of learning. It addresses the need to establish standard indicators in evaluating students' written outputs such as assignments and exams. The written outputs of students in an online course on educational philosophy were analyzed to determine the manifestations of recalled knowledge, construction of knowledge and understanding, and levels of cognition with reference to Bloom's taxonomy of educational outcomes. The analysis includes a multi-step process. Initially, it involved the examination of words, phrases and sentences that were used to express key ideas and concepts related to the theories covered in class, as a way of determining the initial coding categories. Identified were statements that reveal the students' understanding of the course content as well as their interpretations. Marked or noted were reactions, insights, opinions, realizations and new learning, whether implicit and explicitly expressed. At this point, the analysis revealed the levels of cognition where construction of knowledge and understanding occurs, whether lower or higher order thinking. The next step involved a new set of codes that took cognizance of the process of relating newly acquired learning to existing knowledge that manifest students' point of view and active construction of knowledge. The inquiry revealed how students demonstrate levels of cognitive presence, meaning making, linking and associating, higher order thinking, use of principles, reflective learning, as well as change in individual perspectives. Formed were the standard features of the qualitative framework for evaluating student's written outputs in order to determine active construction of knowledge.

Keywords: Qualitative framework, evaluation of written output, content analysis, knowledge construction.

1. Introduction

In the conceptual map of teaching and learning, the function of evaluation is engraved, presumably, as a continuous process, the purpose of which is to measure what has been learned during the term or course. Learning manifested by change in behavior is relatively easy to judge, but change in mental structures or thinking is difficult to assess. There are issues of ambiguity of standards and bias in the marking and grading written output.

From our experiences in working with a group of tutors, we talk about classroom assessment and evaluation with reference to performance and ratings. Practically, at the end of the semester, summative assessment of learning is done through final exams. Generally, various types of tests are given to students upon which evaluation is usually based. Written outputs such as reflection papers and essays are expected to reveal what has been learned or not learned. While evaluation should give value to the learning and achievements of students, we realize that it requires metrics using a set of standards. It is understood that marks or grades should be just and fair, and this presupposes an objective process of generating values. Unfortunately, the process is faced with two primary issues: a lack of exact measures, and bias due to doubt. This is because there are no clearcut answer keys, which leads to subjectivity.

The lack of a defined set of criteria or standards, or specific rules could create an attitude of intuitively knowing what to do which leads to a hit-or-miss practice that produces judgments without evidence. This is definitely a disadvantage on the part of the students. Even if teachers and tutors ascribe to a particular rubric as a scoring guide, often there are well-defined and clear criteria. Interpretation can be arbitrary, depending on the teacher's mood, mindset, and other conditions that influence scoring.

We noted that even in the use of rubrics, the room for interpretation opens to bias. There can be arbitrariness in the understanding of its construction in the mind of the individual who marks, or the teacher who evaluates, and of the students as well. According to Malouff (2008) bias in grading can be conscious or unconscious. It is influenced by prior experience or beliefs and strong personal opinion about particular topics. In the qualitative tradition of evaluation subjectivity in grading or marking written outputs like essays or final exams cannot be avoided. Personal views can creep in the judgment without consciously noting it. Studies of actual grading have produced mixed evidence regarding the existence of bias (Malouff & Thorsteinsson, 2016). The manner in which teachers mark the written outputs of online students is unclear or unexamined. Huot in 2002 noted that there had been limited number of studies verifying the features of written outputs. To date, the search for related studies yielded scarce results.

The desire to manage the felt inadequacies or lack of fundamental basis in marking students' exams became the motivation to construct an approach for evaluating written outputs. We address the following questions to guide the inquiry: What should we expect to read and assess as evidence of learning in the written output? Specifically, what features should we look for in written outputs? What patterns of cognitive learning are manifested in the written outputs?

2. Literature review

Biggs, Telfer, and Moore (1993) gave account of two (2) traditions of evaluation: the quantitative and the qualitative. Both have their own features with specific attributes. The quantitative approach is known to require how much of the facts from the instructional materials had been assimilated and accumulated. The assessment is commonly in the form of objective tests such as multiple choice or item selection, identification, calculation, or tests that considers what is right or wrong. Often times, learning is rote or belonging to lower order thinking.

On the other hand, the qualitative tradition shows not only what has been accumulated and assimilated, rather it is directed on the content, how it is understood and interpreted (Biggs, Telfer, & Moore, 2003). Assessment delved into the abilities of the students to construct knowledge and levels of cognitive development. Students learning features higher order thinking. Incidentally, inquiries specific on the qualitative approach of evaluating students' outputs are limited. Academic researchers find evaluation as the field to look for when interested to determine the students' development and progress in academic performance. Decades ago, researchers noted that our knowledge of the process of learning and instruction have substantially developed (Sheppard, 1991; Biggs, Telfer, & Moore, 1993). However, this is not manifested in the techniques and the models used for evaluating learning.

Experts in the field provide insight on the use of frameworks for the evaluation of students' written outputs. The framework is a universal and essential part of any scientific endeavor, providing a preparatory measure or schema of beliefs ideas and principles, or a system of rules from which a plan of action or decision making is made. In a review, Partelow (2023) cited Schlager (2007) that in empirical studies, the framework provides a foundation for inquiry. They can guide researchers in designing new empirical research by indicating which core concepts and relationships are of interest to be measured and compared. According to Binder et al. (2013) a framework provides a set of assumptions, concepts, values and practices. It is a means to organize diagnostic, descriptive, and prescriptive inquiry, providing the basic vocabulary of concepts and terms to construct the causal explanations expected of a theory (McGinnis & Ostrom, 2014).

Can there be standard indicators for marking students' assignments and exams and other written outputs? A qualitative framework can be the answer. It can provide a set of criteria from which any teacher can be able to assess with confidence the learner's output particularly the written final exams. This study sought to demonstrate how a qualitative framework can be used in the assessment of student learning

3. Method

This study used a qualitative framework as an unobtrusive approach in assessing student learning. It ventures into the application of a directed content analysis of the written exams of 26 students in an online course in Philosophy of Education. Permission to use the student outputs was acquired at the start of the course. Students raised no objection regarding the use of output materials for research purposes.

The revised Bloom's taxonomy of educational objectives served as theoretical framework as it provides a basis for determining a system of rules to gauge cognitive learning. The framework was positioned as basis for assumptions, concepts, values, and practices in the identification of the cognitive levels, and the preparatory identification of the level of understanding of the subject matter. There are six (6) cognitive processes defined from low to higher order: remembering, understanding, applying, analyzing, evaluating, and creating (Anderson & Krathwohl, 2001).

4. Process of analysis

The written outputs of students in an online course on educational philosophy were analyzed to determine the manifestations of recalled knowledge, construction of knowledge and understanding, and levels of cognition with reference to Bloom's taxonomy of educational outcomes. In preparation for the analysis of the data, the sentences in each exam paper were numbered and analyzed. The written outputs contained a minimum of 13 sentences and a maximum of 84 sentences. Most, a written output contained 35 - 48 sentences.

The analysis involved a multi-step process where each step of the identified a cognitive level.
- The first step was examining and marking of the words and phrases in each sentence that were used in expressing key ideas and concepts related to the theories covered in the course.
- Then, the next step involved the identification/coding of statements that indicate the students' cognitive action:
  - Remembering an understanding of the course content as well as their interpretations (i.e., definition, interpretation, rephrasing).
  - reactions, insights, opinions, realizations, suggestions, and new learning, whether implicit and explicitly expressed.
- These were then matched with the levels of cognitive outcomes in Bloom's taxonomy. This analysis revealed the levels of cognition, as well as whether lower or higher order thinking.

A. Remember or recall	(R)	D. Analyze	(An)
B. Understand	(U)	E. Evaluate	(E)
C. Apply	(Ap)	F. Create	(C)

- The next step involved a new set of codes identifying relationships between previously known and new understanding including change in attitude or point of view.

5. Findings

Several patterns on how the students composed answers to the exams were identified. Among the 26 students' written final exam, ten (10) or 38% of the students had exams that manifested the pattern of Understand-Apply-Analyze-Evaluate-Create or **UApAnEC.** This was the dominant pattern. Another pattern that surfaced among seven (7) or 27% was Recall-Understand-Application-Analysis-Evaluate-Create or **RUApAnEC** pattern. In this pattern, the presence of Recall (R) made a difference. The recall was about work-related experiences in school when they were students. Another pattern that turned up was the **UAnEC** for five (5) or 19.% for the Understand-Analyze-Evaluate-Create pattern; it lacked the application level. Apparent in all the patterns were the presence of Evaluate and Create statements. These cognitive levels are considered as belonging to higher order thinking skills, indicative of quality student learning. The four (4) remaining students manifested varying patterns of four levels of thinking. Altogether, these patterns of thinking reflected in student written outputs provide valuable insights about how learners think about what they have learned. What they have written provide evidences of what they understood, as well as how they processed new knowledge and understanding.

6. Discussion

The process of analysis revealed students' cognitions in answering the exam questions. It demonstrated students' levels of cognitive presence, meaning making, linking and associating, higher order thinking, use of principles, reflective learning, as well as change in individual perspectives. Among the indicators are the use of course terminologies and principles which led to making associations and relationships. As sentences relate to each other, there is the inevitable formation of main ideas and themes (Biggs, Telfer, & Moore, 1993). In their responses, the students used course terminologies to show knowledge about the discipline such as essentialism, existentialism, pragmatism, progressivism, and various related philosophical perspectives that governed teaching and learning. In addition, students expressed inclinations towards progressivism and existentialism or eclectic approach to explain their philosophical orientations. A few mentioned and described specific approaches and strategies like student centeredness which they applied and found helpful in teaching and learning when asked about formulating possible solutions to address educational issues. This is an expression of arriving at a new understanding of the concepts. The familiarity of the jargon of the course enabled the learners to make new associations and relationships.

In understanding the course content, information processing took place as the learners went into the process of retrieving from memory the stored knowledge and experiences considered to be relevant. Those who tended to retrieve ideas and thoughts learned and acquired from instructional materials or other learning resources. They interpreted theories and principles by association or wove knowledge with personal beliefs, events in the work place and experience, validating their understanding of the instructional materials. Such manifested thinking signifies impacts and transformation on the life of the individual. Thus, the transformation of learning materials was evident from lower levels of understanding to higher levels of evaluation, reflection and creativity. As such, the analysis of content indicated the depth and breadth of integration, albeit performance of students in the course. The ultimate demonstration of learning was in the creative application of the knowledge of concepts and principles.

7. Qualitative framework

Inferred from the processes of cognitive analyses of the content of student exams, we were able to extract the framework we found very useful in marking the final exams.

Figure 1. Qualitative Framework- an approach to the evaluation of student's written outputs.

Students' Exams	Bloom' Cognitive Process Dimensions	Qualitative Framework
	➤ Remember ➤ Understand ➤ Apply ➤ Analyze ➤ Evaluate ➤ Create	A. Levels of Cognitive presence B. Transformation of instructional materials involved: ➤ Use of principles, terminologies ➤ Linking, associating, making relationships ➤ Realizations & new interpretations/reflections/meaning making ➤ Construction of knowledge /formation of new ideas / themes ➤ Change in mindset or perspective

Every statement in the students' written final exam was the subject of analysis. Bloom's taxonomy was applied to determine and identify qualitative cognitive levels. In the qualitative framework, the knowledge levels indicated the use of principles and terminologies in the academic discipline. The knowledge acquired from the instructional materials is transformed in the manner students weave ideas and concepts which involve linking or associating of understood principles, realizations and new interpretations, reflections and meaning making to previous learnings and experiences. Moreover, to show abilities on higher order thinking, students expressed judgment and decisions as in "I believe…, I favor…, I am inclined…". This unveils change in mindsets and perspectives. In the receiving feedback, students can learn the quality of what they have written when marks area warded appropriately.

8. Conclusion

The processes of analysis of text were an eye opener for the researcher. It provides a rationalized method for evaluating student written output, as well a clear set of criteria that reduces the risk of ambiguity and bias in marking exam papers. The task of inquiry summons a deep process of understanding the content, reflection, and objectivity. It involved critical reading and reading to cognitively empathize. To be able to do these, repetitive reading of the student's output was necessary.

One of the highlights in the use of qualitative framework are the cognitive patterns in the construction of knowledge and formation of new ideas and themes. The identification of these levels of cognition provide insight into the students' flow of thoughts while expressing their ideas in writing. It also inspires the conscious effort to add another aspect to complement the existing rubrics that are in use. It implanted a new way of doing something in clarifying the felt inadequacies while marking the written output.

We wish to promote and consider the cognitive processing of information as a qualitative approach to the evaluation of what has been learned. This method of evaluating student's written outputs is a qualitative measure that determines the development of understanding about the material and the subject matter taught in the classroom. It becomes important to consider the manifestations of learning in terms of the processes of cognitive levels that takes place in the written outputs. It offers a new guideline for the

practical issues on the arbitrariness that confront the marker and the teacher when evaluating students' written work. The cognitive processes show learning and utilization of materials in the individual context.

As we emphasize the value of a qualitative framework to marking and evaluating written outputs, we are made to realize that we have to continue looking for alternative approaches that are specific and well defined, and bound to keep up with the changing needs and development of our students. This has implication also to the questions designed by the teacher. They should be broken down into smaller chunks to provide guidance and elicit specific answers to posted questions.

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TEACHING FRACTIONS AND THE CONCEPT OF INVERSE OPERATIONS: SCIENTIFIC CONCEPTS IN PRE-SERVICE TEACHERS' LEARNING OF MATHEMATICS FOR TEACHING PURPOSES

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Abstract

The purpose of this project is to analyze how the scientific concept of inverse operations can be used as a "bottom-up" approach for teaching mathematical operations with whole and rational numbers. The primary aim of this analytical review is to provide support for student teachers in their learning of scientific mathematical concepts for the purposes of teaching. The theoretical approaches applied in this project are the theories of mathematical structures, especially the theory of inverse semigroups (Abelian groups), as well as relational thinking in comparison with instrumental thinking. The methodological approach is Vygotsky's Doctrine of Scientific Concepts. The presentation of the analytical findings is intended to illustrate a clear connection to mathematical structures, such as the concepts of inverse, as well as how these structures can support pre-service teachers' learning with regard to teaching mathematical operations in arithmetic and algebra. The development of a theoretical approach based on this study and its analytical findings is ongoing, but it is already being implemented in the teacher education programs for Grades K-3 and 4-6 at Södertörn University in Sweden.

Keywords: Learning for teaching, mathematical structure, scientific concept, rational numbers, inverse operations.

1. Introduction

International research in this field is constantly developing. Researchers agree that the quality of mathematics education received by prospective teachers plays a central role in their subsequent students' ability to acquire math skills. The findings of international empirical and theoretical studies imply that teachers' knowledge of mathematics and the way they teach it do not provide sufficient support for their students' development in the subject (Ball, Hill & Bass, 2005).

Numerous researchers point out that the pre-service preparation of math teachers should involve interning at a school, so they can gain insights into how students learn math and mathematical context. At the same time, pre-service teachers' learning of math and the didactics of mathematics is crucial for their ability to teach, because teachers' mathematical knowledge corresponds to students' development and performance (Hill, Ball, & Schilling, 2008; Mallart, Font, & Diez, 2017). What do pre-service teachers learn about mathematics, and how should they learn mathematical concepts that provide understanding of their own learning and that of their students? How should the content of pre-service teachers' mathematics coursework be structured to ensure that student teachers understand core mathematical concepts and are able to see and use patterns and relationships within these concepts as a basis for breaking down their meaning into essential parts via a process of analysis and integration? Many studies on pre-service mathematics learning have addressed these questions and identified a need for more knowledge about the relationships between fundamental mathematics instruction through mathematical concepts and the content of teaching material for student teachers that gives them the skills to teach math via necessary progression and logic.

According to Vygotsky (1986): "The only good kind of instruction is that which marches ahead of development and leads it" (p. 188). A key to pre-service teachers' acquisition of mathematical knowledge for teaching purposes is that they must learn fundamental mathematics and didactics in well-organized courses with clear, scientifically based contextualization that ensures the development of solid math knowledge specifically geared toward teaching. Researchers agree that teaching basic arithmetic is by no means easy and straightforward; it demands theoretical knowledge about the content.

According to Kieran (2004), structure sense in arithmetic is a conceptual bridge to algebra and other areas of mathematics. Knowledge about numbers and mathematical operations is a key to ensuring the continuity of learning, the development of prerequisites for mathematical thinking, and the ability to re-construct mathematics (Kozulin, Gindis, Ageyev, and Miller, 2003). From this point of view, a teacher or pre-service teacher needs a good overview of (and good insight into) the current content of operations, as well as opportunities to identify multifaceted perceptions of the operations and continuity of thinking. At the same time, it is important to give them opportunities to understand the nature of school mathematics in relation to mathematics as a science. According to Kozulin et al. (2003) conceptual change in learning is the result of students' perception of scientific (mathematical) concepts and ability to ascribe language to their thoughts. This is a central point of view in Vygotsky's approach (1986) to theoretical learning.

The purpose of this theoretical project is to analyze how the mathematical concept of inverse operations tied to rational numbers can be used as a bottom-up approach in how pre-service teachers learn math for the purposes of teaching. The aim is to support student teachers' development of knowledge about mathematical structures in terms of their role as scientific mathematical concepts for teaching.

2. Theoretical perspectives

2.1. Mathematical structure and mathematical thinking

Mathematical structures are crucial to pre-service teachers' knowledge of mathematics and ability to teach the subject. In this context, mathematical structures spur deeper mathematical thinking and help learners to engage in the learning process more effectively (Mason, Stephens, & Watson, 2009). In terms of how we think, the analysis of mathematical structures can also elucidate the connection between "conceptual and procedural approaches to teaching and learning mathematics" (p. 10). In line with this, it is relevant to express ideas about mathematical structures related to pre-service teachers' teaching-related math knowledge and how this knowledge can support their students' learning. According to Mason et al. (2009), a mathematical structure is defined through "the identification of general properties which are instantiated in particular situations as relationships between elements" (p. 10). This underlines two important aspects of the definition of a mathematical structure. The first has to do with the mathematical meaning of general/essential properties, and the second with "association" between elements. These elements are mathematical objects or concepts, e.g., number concepts, algebraic concepts, and their operations. In this context, the operations are related within elements of natural numbers, whole numbers and rational numbers. In a conceptual sense, the relationship between elements is a connection between these number concepts and operations with them, as well as an extension of these operations to algebraic elements/concepts. Understanding mathematical structures as relationships between essential properties within a mathematical structure (mathematical concept), the relationship between different elements, and "mastering procedures" allows for the development of contextual meaning in an individual's mathematical knowledge. The understanding of mathematical structure can result in more effective learning focused on the re-construction of existing mathematical knowledge and the construction of new mathematical knowledge (Mason et al., 2009).

The theoretical issues surrounding mathematical structure clearly indicate which kind of mathematical knowledge makes sense in teaching and learning. In general terms "making sense" means understanding mathematical structures and the relationships between them in an arithmetic and algebraic context (Kieran, Pang, Schifter, & Fong, 2016). A mathematical structure like the Abelian group for addition describes the relationship between general/essential properties within the group and relationships between natural numbers and rules for addition, including the concept of inverse operations. The Abelian group for multiplication is structured the same way, but relates to multiplication (van der Waerden, 1971). One interpretation of the Abelian groups in a conceptual context associated with teaching is described by Karlsson and Kilborn (2024). With regard to teaching algebra, they also highlight the importance of the Abelian groups as a professionally specific form of mathematics knowledge.

Discussions about mathematical structures in instruction bring theoretical considerations about the phenomenon of mathematical thinking and contextual sense to the fore. Mathematical thinking is important for learners' analysis of mathematical structures in order to understand content, as well as for their ability to apply this knowledge to conceptual and procedural learning. Researchers have used a framework for mathematical thinking related to domains such as relational thinking (Skemp, 1976; Empson, Levi, & Carpenter, 2010; Starr, Vendetti, & Bunge, 2018), and instrumental thinking (Mason et al., 2009). Skemp (1976) describes the distinction between two different types of understanding (thinking) as relational understanding and instrumental understanding. He defines the concept of understanding as "knowing both what to do and why" (p. 2). Relational thinking/understanding encompasses such issues as what to do and why. Answering these questions demands the ability to

generalize mathematical structures/concepts according to their essential properties and to make conceptual and procedural connections with other mathematical structures/concepts. Relational thinking includes understanding the properties of numbers, mathematical operations with numbers, and properties for inverse operations, as well as the ability to handle number sentences. In terms of pre-service learning for the purposes of teaching focused on relational thinking, it is important to support the conceptualization of mathematical operations, restructure operations related to transition from one number range to another and give students the skills to generalize mathematical operations from the use of natural numbers and rational numbers to algebraic symbols (Molina & Mason, 2009).

2.2. Scientific knowledge and concepts

Closer investigation of what pre-service teachers should learn demands a connection to classroom instruction and how course content ought to be taught in relation to students' learning. In the context of scientific knowledge and theoretical views about scientific (theoretical) knowledge and its significance for mathematics learning (Karpov, 2003), this study is rooted in socio-constructivism. The application of mathematical perspectives to mathematical structures is important for the development of the mathematical thinking of pre-service teachers themselves, as well as for their understanding of the same process among their students. It is also crucial to emphasize that theoretical-analytical learning effectively maximizes the opportunities for abstract thinking and the generalization of content and concepts. The question of how course content can be broken down into logical sequences learners can adapt and absorb is a key aspect of mathematical knowledge for teaching. Against this background and in terms of the mathematical preparation of pre-service teachers, content knowledge should be theorized in a manner that underscores the clear interplay between theoretical knowledge and its impact on the teaching of mathematics. In the context of socio-constructivism, learning is discussed as the generation of "spontaneous" and "scientific" concepts (Karpov, 2003). Spontaneous concepts result from the generalization of everyday experience and knowledge, and scientific concepts are born of the generalization and systematic collection of human scientific knowledge. It is crucial to understand that spontaneous concepts are necessary conditions for the construction of scientific concepts through the analysis of differences and similarities. The theoretical approach of this study focuses on how scientific knowledge and concepts lead to reflections about why pre-service teachers should learn theoretical concepts as a basis for teaching math (Bakirov & Turgunbaev, 2019). The theoretical outlines for the study are presented in Figure 1.

Figure 1. Systemized theoretical framework: Learning for teaching.
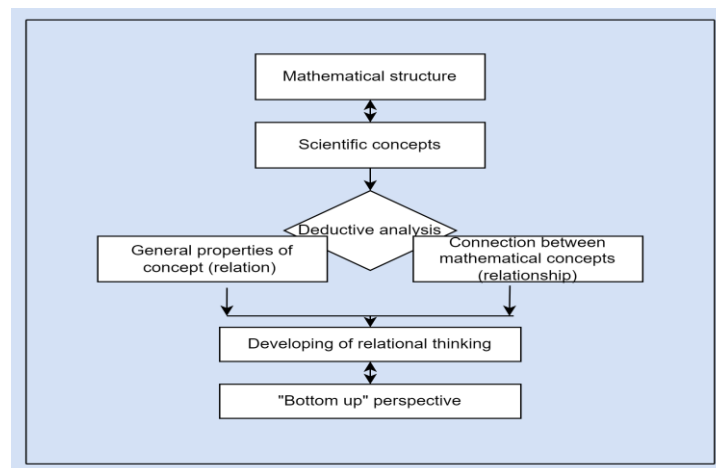
3. Teaching fractions and inverse operations

This study examines the mathematical structure of the Abelian groups for addition and multiplication, with a focus on inverse operations (van der Waerden, 1971). This is crucial content for sequence analysis related to the purpose of the study, namely analysis of how the mathematical structure of inverse operations and rational numbers can be used as a bottom-up approach in how pre-service teachers learn to teach. The analysis follows the system presented in Figure 1. The inverse operations first applied to whole numbers can be extended and applied to rational numbers. This general (essential) property of inverse operations illustrates a conceptual continuity and relationship between mathematical concepts. To illustrate this conceptual continuity, analytical findings related to both whole numbers and rational numbers are presented.

Finding 1. Addition and its inverse subtraction of whole numbers

In the Abelian group for addition, the definition of "inverse" is that for every a there is an element $(-a)$ in the group, such that $a + (-a) = (-a) + a = 0$. Here, $(-a)$ is called the (additive) inverse of a and vice versa (van der Waerden, 1971). For example, the natural number 5 is the additive inverse of (-5), and the sum of the numbers 5 and (-5) is zero. On the number line, this can be expressed as mirroring around the neutral, central element of zero. This illustrates how negative numbers are inverses of their positive, natural counterparts.

On the number line, adding 5 can be expressed as an arrow five units long pointing to the right, and subtracting 5 can be an arrow five units long pointing to the left. The addition $3 + 5 = 8$ and the subtraction $8 - 5 = 3$ are illustrated on the number line in Figure 2.

Figure 2. Addition and inverse operation subtraction.
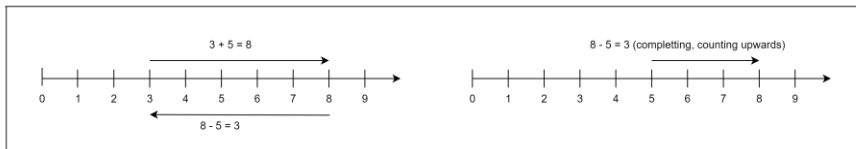
The subtraction $8 - 5 = x$ can also be carried out as the inverse of the open addition $5 + x = 8$ by *completing the number line,* i.e., counting up from 5 to 8 in 3 steps. This is shown on the number line in Figure 2 (counting upwards). If one applies the rule that the sum of two whole numbers, $b + (-b) = 0$, it is easy to understand how to carry out the subtraction $a - (-b)$. We start with the subtraction $a - b$ and then add $(b + (-b))$. By using the commutative law for addition, we find that $a - b = a + (-b)$. This means that $a - b = a +$ (the inverse of b). However, as this is true for all whole numbers, it also means that $a - (-b)$ equals $a +$ (the inverse of $(-b) = a + b$. The relational thinking about the addition of whole numbers and their inverse subtraction can be extended to rational numbers.

Finding 2. Multiplication and its inverse division of whole numbers

To examine what this means by multiplying two whole numbers, we can start with $a \cdot (-b)$, where $a > 0$. When we apply the distributive law, we find that $a \cdot b + a \cdot (-b) = a \cdot (b + (-b)) = 0$. This means that $a \cdot b$ and $a \cdot (-b)$ are inverse numbers and consequently that $a \cdot (-b) = (-a \cdot b)$. In the same way, $(-a) \cdot b = (-a \cdot b)$. How do we interpret the multiplication $(-a) \cdot (-b)$ of two negative numbers? By once again using the distributive law, we find that $(-a) \cdot b + (-a) \cdot (-b) = (-a) \cdot (b + (-b)) = 0$, which means that $(-a) \cdot (-b)$ is the inverse of $(-a) \cdot b$, whose inverse is $a \cdot b$. Consequently, $(-a) \cdot (-b) = a \cdot b$. In sum, the finding is that the product of two negative numbers is a positive number.

Finding 3. Rational numbers and inverse operations
- *Case 1*

In the Abelian group for multiplication, the definition of "inverse" is that for every a in the group (provided that $a \neq 0$), there is an element $\frac{1}{a}$, such that $a \cdot \frac{1}{a} = 1$. In this case, $\frac{1}{a}$ is the (multiplicative) inverse of a and vice versa (van der Waerden, 1971). This means that if writing a as $\frac{a}{1}$, the inverse can be likened, metaphorically speaking, to mirroring $\frac{a}{1}$ vertically along the fractional line. If we stick with this metaphor, it is also easy to find the inverse of $\frac{a}{b}$ as $\frac{b}{a}$ and determine that $\frac{a}{b} \cdot \frac{b}{a} = 1$. In the next step, it is important to define the inverse operation for division in a way that can also be applied to the division of rational numbers. Such a definition is that $a \div b = a \cdot \frac{1}{b}$. This means, e.g., that $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$, and more explicitly that $\frac{2}{5} \div \frac{1}{2} = \frac{2}{5} \cdot 2$ and $\frac{2}{5} \div \frac{3}{7} = \frac{2}{5} \cdot \frac{7}{3}$. Against this background, students with only basic knowledge of algebra can understand the formula for the division of two fractions.

This is an interesting point for relational thinking. $\frac{a}{2} \div \frac{a}{2} = 1$ and $\frac{2}{a} \cdot \frac{a}{2} = 1$ independent of a; it just depends on the conceptual meaning of the division as result of an inverse operation multiplication.
- *Case 2*

Now only the multiplication of two rational numbers remains. To begin with, let us multiply two basic fractions, $\frac{1}{a}$ and $\frac{1}{b}$, and then multiply their product by $(a \cdot b)$. When we then apply the commutative and associative laws, we get $(a \cdot b) \cdot (\frac{1}{a} \cdot \frac{1}{b}) = (a \cdot \frac{1}{a}) \cdot (b \cdot \frac{1}{b}) = 1 \cdot 1$. Since the product $(a \cdot b) \cdot (\frac{1}{a} \cdot \frac{1}{b}) = 1$, we know that the inverse of $(\frac{1}{a} \cdot \frac{1}{b})$ is $(a \cdot b)$. However, the inverse of $a \cdot b$ is $\frac{1}{a \cdot b}$. Consequently, $\frac{1}{a} \cdot \frac{1}{b} = \frac{1}{a \cdot b}$.

After this, it is simple to multiply two arbitrarily chosen fractions: $\frac{a}{b} \cdot \frac{c}{d}$. By first splitting things up as $a \cdot \frac{1}{b} \cdot c \cdot \frac{1}{d}$ and then using the communicative law för multiplication, one finds that $(a \cdot b) \cdot (\frac{1}{b} \cdot \frac{1}{d}) = (a \cdot b) \cdot \frac{1}{b \cdot d} = \frac{a \cdot b}{b \cdot d}$. This illustrates how relational thinking can be used to analyze the multiplication of two rational numbers.

4. Conclusions

This paper shows that mathematical structures and the concept of inverse operations of rational numbers can give pre-service teachers conceptual support as they learn how to teach math. At the same time, this analysis by theoretical framework (Figure 1) can provide a clearer understanding for pre-service teachers about how the methods of working from the bottom up and breaking mathematical concepts down as two different approaches (inductive and deductive) for teaching and learning. The analytical findings are illustrated with a clear connection to the mathematical structures/scientific concepts of inverse operations for addition and multiplication. These concepts can support student teachers' perceptions of mathematical operations and how to learn and teach them. This theoretical approach and the analytical findings of the study are currently being implemented in the teacher education programs for Grades K-3 and 4-6 at Södertörn University in Sweden.

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GENDER AND STUDENTS' MATHEMATICAL LITERACY ABILITIES

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Abstract

Gender is one of the most commonly considered factors in educational research since many years, to explain differences in mathematics achievement. Despite the stereotype that boys are better than girls in mathematics, the most recent results of the Programme for International Student assessment, PISA, showed that in a significant number of countries there was a reduction or even elimination of the gap between boys and girls in terms of their performance in mathematical literacy. More specific for Greece in 2003, according to PISA's data and results, the difference in students' mathematical literacy performance between the boys and girls measured 19 points, with boys outperforming girls, while fifteen years later in PISA 2018, this difference has been reduced to zero points. This current study aims to investigate the abilities of boys and girls in mathematical literacy upon completing their compulsory education, which in more words means to evaluate in terms of the functional use of their mathematical knowledge when solving real-life math problems. Moreover, it aims to answer to the research question, if there is a statistically significant difference in mathematical literacy performance between boys and girls? The research was carried out in 650 students from all over Greece who were completing 9th grade or were at the beginning of the 10th grade and their schools were selected based on the degree of urbanization of the area where the respective school was located (large urban center, small urban center, rural area). The findings of the research showed that there are no significant differences in the average performance in mathematical literacy between boys and girls.

Keywords: Gender, Greece, mathematical literacy, compulsory education.

1. Introduction

Gender should not determine one's abilities. When provided with equal opportunities, both boys and girls stand an equal chance of realizing their potential, as highlighted by the OECD (OECD, 2015). Despite this principle, the underrepresentation of women in STEM fields persists, both in higher education and the professional realm. This enduring discrepancy has spurred increased research interest in comprehending gender differences in math performance (Breda & Napp, 2019; Else-Quest et al., 2010; Ghasemi & Burley, 2019; Régner et al., 2014). Recognizing that gender can significantly impact a country's economic development and social inclusion, it becomes imperative to study and consider gender differences in education when formulating strategies and policies to enhance educational outcomes (EACEA, Eurydice, 2010). Additionally, investigating students with high proficiency in mathematics is crucial, as it directly influences their choices in higher education. This exploration may provide insights into the lower percentage of women opting for studies related to mathematics and science (Lubinski & Benbow, 2006, cited in Eriksson et al., 2020).

In addition to the mentioned points, it is worth noting that recent years have witnessed a transformation in the characteristics expected of individuals, influenced by the digitization of various aspects of our lives. The skills deemed essential for active and thoughtful participation in 21st-century advancements as a creative and analytical citizen have been redefined, particularly in relation to mathematics (OECD, 2018). These revised attributes collectively constitute a mathematically literate individual. Therefore, it is crucial to delve into a more targeted investigation of the mathematical literacy skills of both genders, boys and girls, rather than focusing solely on general mathematical proficiency.

The OECD's Programme for International Student Assessment (PISA) from 2000 till today measures every three years the achievement of 15-years old students on mathematical literacy. In the 2022 PISA survey, statistical analysis revealed that boys outperformed girls in mathematical literacy in 40 out of 81 participating countries, while girls demonstrated a statistically significant advantage over boys in 17 out of 81 countries (OECD, 2023). Over the decade from 2009 to 2018, 43 out of 64 countries partaking in the

PISA survey showed no statistically significant change in the performance difference between boys and girls in mathematical literacy. Throughout this period, boys consistently outscored girls. The OECD recommends looking to countries that have successfully reduced or eliminated achievement gaps between boys and girls as examples, emphasizing that gender-related achievement gaps are neither inherent nor inevitable (OECD, 2019a). The ultimate objective is to establish conditions conducive to enabling both boys and girls to maximize their potential to the fullest extent possible. More specifically concerning Greece, data from the PISA survey reveals that in 2003, there was a 19-point difference in mathematical literacy performance between boys and girls, with boys surpassing girls. According to the OECD, this gap translates to a difference of half a school year[1] between the two genders. However, over the course of fifteen years, by 2018, this disparity has been completely eradicated (Nolka & Sofianopoulou, 2022). It's worth noting, as indicated by the OECD, that Greece falls into the category of countries where the reduction and elimination of this difference are attributed to a decline in the performance of boys rather than an improvement in the performance of girls (OECD, 2019b). In the most recent PISA 2022 survey, this margin expanded to a 6-point advantage in favor of boys but without a statistically significant difference (OECD, 2023).

But apart from the score of boys and girls separately and the differences between them it should be noted that Greece's mean performance in mathematical literacy in general all the years from 2000 till 2022, has been consistently below the OECD average with a statistically significant difference. The observed stability and lower status could be partially attributed to the insufficient alignment among Greek mathematics curricula, junior high school mathematics textbooks, and the PISA mathematics framework. Furthermore, the emphasis on content rather than the intended framework might contribute to this situation. (IEP, 2019; Nolka & Sofianopoulou, 2022; OECD, 2018). To a certain extent, this current study tackles the concern by aligning the specific issues within its research tool with the junior high school mathematics curriculum, contrasting them with both the PISA survey and Greek results.

2. Research

This study involved 650 students from across Greece, either in the final stages of 9th grade or at the outset of 10th grade, who were either completing or had recently completed compulsory education. The schools included in the sample were chosen based on the level of urbanization in their respective regions. 60% of the students enrolled in schools situated in large urban centers, while 25% attended schools in small urban centers. Additionally, 16% of the sample attended schools located in rural areas of Greece. Among the 650 survey respondents, 303 (46.6%) were boys, and 347 (53.4%) were girls.

The research utilized a mathematical test consisting of five authentic, real-world math problems, each comprising individual sub-questions or items. In total, students were required to address and respond to eleven items. These problems were presented in the form of word problems grounded in real-life contexts, always initiated by an introductory text or stimulus. The subject matter ranged from everyday experiences to broader interests and the world of the students, showcasing mathematical abilities relevant to literate individuals. The initial tool comprised eleven items designed to align with the four overarching categories of mathematical content: a) change and relationships, b) quantity, c) space and shape, and d) uncertainty and data, as defined in the PISA international assessment program. Each item was carefully crafted to meet these criteria. Within each of the four categories, questions of varying difficulty levels—specifically, three degrees of difficulty—were incorporated to cater to the diverse needs of both male and female participants in the study. Beyond encompassing mathematical content, these eleven items were intentionally developed to align with one of the three core mathematical processes: formulation, application, and interpretation. Additionally, they were designed to address the process of mathematical reasoning, which students were required or expected to employ during problem-solving activities. Moreover, the mathematical concepts and knowledge that were surfacing within both the overall set of problems and individual items, which students were tasked with recalling and applying, aligned with the curriculum of compulsory education in Greece, encompassing junior high school mathematics. The dependent variable for mathematical literacy achievement was the performance or score on the mathematical test. The score was determined through the coding of students' responses, their categorization into acceptable, partially acceptable, non-acceptable, or no answer, and the calculation of weighting coefficients for each item based on the graded difficulty of the problems.

This study intended to answer to the research question, if there is a statistically significant difference in mathematical literacy performance between boys and girls?

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[1] According to the OECD, approximately 38 or 40 units correspond to one school year.

3. Results

To investigate potential statistically significant differences in mathematical literacy performance between boys and girls in the sample, an independent samples t-test was employed. The analysis revealed no statistically significant distinctions in the average performance in mathematical literacy between boys and girls within the sample (t(648) = .234, p-value = .815 > .05). Boys displayed a slightly higher average performance (M = 16.48) compared to girls (M = 16.29). The scoring scale spans from 0 to 42 points. Among the sampled students as a whole, the mean score for mathematical literacy was 16.38 units, with a standard deviation of 10.02.

Table 1. Mean performance in mathematical literacy categorized by gender.

Gender	M	SD	SE	N	t	df
Boys	16.48	10.53	.61	303	.234	648
Girls	16.29	9.57	.51	347		

To facilitate broader application of the current research findings, we categorized them based on students' proficiency in mathematical literacy. This categorization involves three distinct score levels, determined by the students' performance in mathematical literacy, specifically gauged through successful responses to a set of problems in the administered math test. Concretely, students accumulating up to 14 units fall into the low-level category, those amassing 15 to 30 units are classified as medium-level, and students accumulating more than 30 units are placed in the high-level category of mathematical literacy.

The Chi-square test examining the relationship between gender (two categories) and mathematical literacy levels (three categories: low, medium, high) revealed no significant deviation from independence [$x^2(2)$ = 3.08, p-value = .214>.05]. Both boys and girls demonstrated frequencies across mathematical literacy levels that closely aligned with the expected values (Table 2). Less than half of the girls in the sample and over half of the boys were categorized as having low mathematical literacy skills. Conversely, close to one-tenth of the boys and girls in the sample individually demonstrated a high level of mathematical literacy.

Table 2. Gender and mathematical literacy score level.

Gender/Levels	Low-level	Medium-level	High-level	x^2	df
Boys	162 (53.5%) (156.60)	102 (33.7%) (111.90)	39(12.9%) (34.50)	3.08	2
Girls	174 (50.1%) (179.40)	138 (39.8%) (128.10)	35 (10.1%) (39.50)		
Total	336 (51.7%)	240 (36.9%)	74 (11.4%)		

Expected frequencies are shown in parentheses below the corresponding frequencies

4. Conclusion

This current study examined the abilities of 650 boys and girls in mathematical literacy and examined the gender differences in mathematical literacy performance upon completing the compulsory education in Greece. Analyzing the results from the research tool, it becomes evident that both male and female students, taken as a whole, lack satisfactory levels of mathematical literacy skills. More specifically, concerning the research question posed in this study, it is found that the gender factor does not influence students' performance in mathematical literacy.

When comparing the findings of the current research with existing literature, it is first observed that the gender factor has been found to be statistically insignificant regarding the performance of male and female students in Greece in mathematical literacy. This pattern aligns with the findings from the PISA 2018 survey, which indicated no significant difference and specifically a zero difference in scores between boys and girls. It is also consistent with the results of the most recent PISA 2022 survey, where the gap widened to 6 points in favor of boys, although this difference was not statistically significant.

The current study's significance lies to our discovery that the trend observed in the international PISA study aligns with the national data from Greece upon comparison. These discoveries are crucial for promoting Greek students' gender equality in mathematical literacy. Hence, the poor performance of students in Greece in mathematical literacy does not depend on gender. Therefore, other causes should be sought and suitable conditions should be created to develop the abilities of all Greek students as a whole in mathematical literacy.

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PHONOLOGICAL-ORTHOGRAPHIC STIMULATION PROGRAM FOR SCHOOLCHILDREN WITH LEARNING DIFFICULTIES

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Abstract

Objectives: This study aimed to develop a phonological-orthographic stimulation program for schoolchildren with learning difficulties from the 3rd to 5th year of Elementary School and compare the performance of schoolchildren in a pre- and post-testing situation in the phonological-orthographic stimulation program. This study will be developed in two phases, phase 1 aims to develop the phonological-orthographic stimulation program based on literature review, in order to verify which studies used stimulation programs with the phonological-orthographic stimulation. In this phase 2, 30 schoolchildren with learning difficulties, both sexes, aged between 8 years and 4 months and 12 years and 3 months participated, who attended 3rd to the 5th year of Elementary School. The schoolchildren were divided into two groups: group I (GI): composed of 15 schoolchildren with learning difficulties submitted to application of the Phonological-Orthographic Stimulation Program, group II (GII): composed by 15 schoolchildren with learning difficulties not submitted to application of the Phonological-Orthographic Stimulation Program. All schoolchildren were submitted in the application Pro-Ortography Assessment in pre- and post- testing situation. The program developed was composed of a module with strategies with oral vowel phonemes and a module with strategies with nasal vowel phonemes. The phonological-orthographic stimulation was ro-Ortography (pre-testing), twelve sessions for applying the developed program and the final three sessions being used for apply to Pro-Ortography (pos-testing). Results: It was possible to verify that there was a significant difference in the GI students, submitted to the stimulation program developed in this study, in pre- and post-testing situations. In GII, there was no change in the classification of performance in the Pro-Ortography subtests, nor in the classification of performance according to the semiology of errors, demonstrating the effectiveness of the stimulation program to GI. Conclusion: In phase I, it was possible to develop a Phonological-Orthographic Stimulation Program for students with learning difficulties for students in the 3rd to 5th year of Elementary School. In phase II it was possible to verify the effectiveness and applicability of the program developed in phase I and it was possible to conclude that the strategies selected for the stimulation program are effective and can be applied to students from the 3rd to the 5th year of Elementary School I with learning difficulties both in the clinical context and in the educational context, assisting in the teaching-learning process.

Keywords: Orthographic writing, learning, intervention studies.

1. Introduction

When inserted in the school environment, the child already dominates the linguistic system in its oral mode, so it is considered that the child already has the skills developed to start the learning process of reading and writing. For the learning process of reading and writing to be effective, it is necessary that the student develop other skills, such as the notion of the phonological aspects of the language. For this, the student needs to develop metalinguistic skills that concerns aspects of language at its phonological, morphological, syntactic and semantic levels. Developing these skills will make the students create awareness of phrases, words, syllables and phonemes as smaller units (Fernández et al., 2010; Capellini, 2004; Queiroga, 2006; Correa, 2007).

For spelling to be effective it is necessary for the student to select the meaning of the word he wants to write (semantic system). Soon after this selection the syntactic system will determine what will be the word and the position of each one within the sentence being built, soon after which the phonological route or the lexical route is triggered, which will allow the student to correctly write the desired word.

At the end, with the mental orthographic representation of the words, the grapheme selection and the motor acts necessary for the realization of each grapheme that will compose the word (Sampaio et al., 2017) occur.

Students who have spelling difficulties need more efficient help regarding the spelling errors found and the reason why they are occurring. It is necessary that the student understands the rules established in spelling and also the skills involved, so that he has a more facilitating writing. Intervention activities are needed that make the students reflect at the time of writing, developing orthographic awareness, so that difficulties and errors can decrease (Zorzi & Ciasca, 2008).

2. Objectives

Develop a program of phonological-orthographic stimulation for students with learning difficulties from the 3rd to the 5th year of Elementary School I in the context of a pandemic.

3. Methods

This study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences of the São Paulo State University "Júlio de Mesquita Filho" - FFC/UNESP - Marília-SP, under number 50658521.8.0000.5406.

This study will be developed in two phases, The phase 1 aimed to develop the phonological-orthographic stimulation program based on literature review, in order to verify which studies used stimulation programs with the phonological-orthographic stimulation.

The literature search was performed only in national databases such as Scielo and Google Scholar, using descriptors, intervention studies, handwriting, spelling and keywords, intervention and dysorthography. This criterion was used due to the characteristics of the Portuguese Language Writing System, which is an alphabetic writing system with greater transparency than opacity, making it difficult to use intervention studies with spelling difficulties performed in other countries with more transparent spellings such as Spanish and Italian and profound ones such as English and French.

The Phonological-Orthographic Stimulation Program was designed to be performed in 18 sessions, and the three initial sessions were used for pre-testing, 12 sessions for the application of the program developed and the three final sessions were used for post-testing.

The first seven sessions referring to module 1 and the last five sessions referring to module 2. Module 1 consisted of strategies with oral vowel phonemes, and module 2 was composed of strategies with nasal vowel phonemes. All sessions consisted of the following activities: knowledge of the alphabet, grapheme-phoneme correspondence, mental map of vowels and their graphic representations, naming of figures, reading of words, copying, identification of phonemes and instructed dictation.

In this phase 2, 30 schoolchildren with learning difficulties, both sexes, aged between 8 years and 4 months and 12 years and 3 months participated, who attended 3rd to the 5th year of Elementary School. The schoolchildren were divided into two groups:

- Group I (GI): composed of 15 schoolchildren with learning difficulties submitted to application of the Phonological-Orthographic Stimulation Program, sendo 3 escolares do sexo feminino e 12 do sexo masculino.
- Group II (GII): composed by 15 schoolchildren with learning difficulties not submitted to application of the Phonological-Orthographic Stimulation Program, sendo 5 do sexo feminino e 10 do sexo masculine.

All schoolchildren were submitted in the application Pro-Ortography Assessment (BATISTA et al, 2014) in pre- and post- testing situation. The program developed was composed of a module with strategies with oral vowel phonemes and a module with strategies with nasal vowel phonemes. The phonological-orthographic stimulation was Pro-Ortography (pre-testing), twelve sessions for applying the developed program and the final three sessions being used for apply to Pro-Ortography (pos-testing).

Data analysis was performed using the Statistical *Package for Social Sciences, version* 25.0. The test applied was the McNemar test. *The results were statistically analyzed with a significance level of 5% (0.050) and discriminated in the tables with the asterisk in the presence of statistical significance.*

4. Results

Table 1 shows the comparison of the classification of the performance of the Pro-spelling subtest of the GI and GII students in the pre- and post-testing situations.

Table 1. Distribution of the comparison of the classification of school performance of GI and GII in the Pro-spelling subtests by frequency and p-value.

Subtests	Performance rating	Groups					
		I			II		
		Freq.	Perc.	P-value	Freq.	Perc.	P-value
ELA-PRE	Inferior	4	33,30%		8	66,70%	
	Medium	10	71,40%		4	28,60%	
	Superior	1	25,00%	0,004*	3	75,00%	> 0,999
ELA-POST	Inferior	0	0,00%		8	100,00%	
	Medium	5	55,60%		4	44,40%	
	Superior	10	76,90%		3	23,10%	
DRLA-PRÉ	Inferior	6	75,00%		2	25,00%	
	Medium	7	36,80%		12	63,20%	
	Superior	2	66,70%	0,001*	1	33,30%	> 0,999
DRLA-POST	Inferior	1	33,30%		2	66,70%	
	Medium	6	33,30%		12	66,70%	
	Superior	8	88,90%		1	11,10%	
DP-PRE	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%		0	0,00%	
	Superior	0	0,00%	0,002*	0	0,00%	> 0,999
DP-POST	Inferior	4	21,10%		15	78,90%	
	Medium	9	100,00%		0	0,00%	
	Superior	2	100,00%		0	0,00%	
DPP-PRE	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%		0	0,00%	
	Superior	0	0,00%	0,005*	0	0,00%	> 0,999
DPP-POST	Inferior	7	31,80%		15	68,20%	
	Medium	8	100,00%		0	0,00%	
	Superior	0	0,00%		0	0,00%	
DF-PRÉ	Inferior	12	50,00%		12	50,00%	
	Medium	3	50,00%		3	50,00%	
	Superior	0	0,00%	0,003*	0	0,00%	> 0,999
DF-PÓS	Inferior	5	29,40%		12	70,60%	
	Medium	8	72,70%		3	27,30%	
	Superior	2	100,00%		0	0,00%	
DFR-PRE	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%		0	0,00%	
	Superior	0	0,00%	0,025*	0	0,00%	> 0,999
DFR-POST	Inferior	10	40,00%		15	60,00%	
	Medium	5	100,00%		0	0,00%	
	Superior	0	0,00%		0	0,00%	
EP-PRE	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%		0	0,00%	
	Superior	0	0,00%	> 0,999	0	0,00%	> 0,999
EP-POST	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%		0	0,00%	
	Superior	0	0,00%		0	0,00%	
DS-PRE	Inferior	11	42,30%		15	57,70%	
	Medium	4	100,00%		0	0,00%	
	superior	0	0,00%	0,157	0	0,00%	> 0,999
DS-POST	Inferior	9	37,50%		15	62,50%	
	Medium	6	100,00%		0	0,00%	
	superior	0	0,00%		0	0,00%	
MLO-PRÉ	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%	> 0,999	0	0,00%	> 0,999
	Superior	0	0,00%		0	0,00%	

Subtests	Performance rating	Groups					
		I			II		
		Freq.	Perc.	P-value	Freq.	Perc.	P-value
MLO-POST	Inferior	15	50,00%		15	50,00%	
	Medium	0	0,00%		0	0,00%	
	Superior	0	0,00%		0	0,00%	

Legend: ELA: Writing of the letters of the alphabet; DRLA: Randomized dictation of alphabet letters; DP: Dictation of words; DPP: Dictation of pseudowords; DF: dictation with figures; DFR: Dictation of sentences; EP: Deliberate error; DS: Spelled dictation; MLO: Orthographic lexical memory.

With the application of the McNemar test, it was possible to verify that there was a significant difference in the students of the GI, submitted to the stimulation program elaborated in this study, in pre andtesting, showing that the students of this group changed the classification of performance from lower to middle, from medium to higher in the subtests ELA (Writing of the letters of the alphabet),

DRLA (Randomized dictation of the letters of the alphabet) and DP (Dictation of words). There was also a decrease in the number of students with lower performance in the DPP (Dictation of pseudowords), DF (Dictation with figures) and DFR (Dictation of sentences) tests.

5. Discussion

From the results obtained in this study, we can consider that the strategies developed in the phonological-orthographic stimulation program for students with learning difficulties showed applicability and that is, after the elaboration of the stimulation program and its application in the students with learning difficulties of the pilot study, it can be verified that the elaborated program can be applied in students who present difficulties in the phonological-orthographic relationship. Although the national literature did not reveal a significant number of studies with orthographic stimulation/intervention, the studies analyzed for the elaboration of the program described in this study indicated the lack of studies with emphasis on vowels. It is necessary that the student understands the phonological relationship of vowels with their graphic representation, because all of them have more than one representation, and to prevent errors in the writing of vowels occur, these possibilities need to be stimulated. In addition, vowels in alphabetical spelling are important for syllable formation and differentiation in word meanings (Meireles & Correa, 2005).

6. Conclusion

From the bibliographic survey and the information collected and analyzed in phase 1 of this study, it was possible to elaborate a Phonological Stimulation Program Orthographic for schoolchildren with learning difficulties for schoolchildren from 3rd to 5th year of Elementary School I in a pandemic context.

In phase 2 it was possible to verify the effectiveness and applicability of the programme developed in phase I and, it was possible to conclude that the strategies selected for the stimulation program are effective and can be applied in students from 3. to assisting in the teaching learning process.

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FACILITATING FLEXIBLE LEARNING EXPERIENCES

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Abstract

Digital mediums provide opportunities to create a cohesive environment to support learners' education, by bringing together instructors, learners, and course resources in a way that fosters a sense of community while enabling easy access to course materials. One effective way to achieve this cohesion is to set up the course environment to meaningfully curate and manage resources and interactions, supporting learners' navigation and engagement with the resources, as well as instructors and their peers. We present a digital environment that facilitate such curation by providing a vision that allows instructors to organize and structure their courses comprehensively. We provide an interactive and collaborative learning environment for students with Microsoft Teams to support student communication, collaboration, digital annotation, note-taking, and file sharing. This approach supports personalized knowledge acquisition, learning and study in a structured and moderated environment for learners to attain differentiated educational goals.

Keywords: *Educational quality and standards engagement, cohesive digital learning experiences, automated curated learning, collaborative learning environments, meaningfully curated courses.*

1. Introduction and motivation

The integration of technology into classrooms constitutes a recognized trend in contemporary approaches to higher education, driven by a desire to enhance the learning outcomes and create a learner-focused environment that enables flexibility of learning while meaningfully engaging with the curriculum. Through the deliberate adoption of technology, educators aim to optimize instruction to encourage exploration, differentiation, and ownership of the learning process, focused on high-quality education.

We showcase an agile digital environment using Microsoft Teams in conjunction with OneNote to facilitate instructional communication and collaboration, paired up with digital annotation and note-taking. By using Microsoft Teams, Instructors can integrate like scheduled class meetings with automatically curated recordings, just-in-time office hours, screen sharing that can be used for note annotation, and file sharing to support personalized study and collaborative learning. This ensures that digital resources provide an integrated learning environment that facilitates the strategic use of class time, guided practice, and self-regulated learning. This work is centered around the implementation of an education innovation strategy for meaningful digital learning experiences in physical classrooms, online environments, and hybrid settings. We aim to provide impactful and innovative learning experiences that prioritize intentional learning strategies. We have received positive feedback from graduate students since 2018 on using this method, and we continue to improve these techniques in current courses. Our approach engages students in active learning, exploration, and experimentation to strengthen competencies and confidence as learners.

2. Theoretical grounding

An optimized learning environment is crucial for effective learning, ensuring that learners can process, organize, and connect new information to preexisting knowledge, without feeling overwhelmed by poorly designed learning environment (Bransford et al., 2000). Effective presentation is crucial for a learner's ability to process, store, and encode information, as an overloaded working memory can hinder the transitioning of content to long-term memory (Chang et al., 2012). Technology can support a design that presents learners with the necessary expert and peer feedback, empowering learners to synthesize information from multiple perspectives, asking questions driven by their personal interests, while reducing the strain on the learner to seek new information from multiple content resources. Additionally, this provides learners with critical feedback tailored to their specific challenges, since a well-designed and

dynamic educational environment includes reliable communication & accessible instructional resources to support collaboration (Bower et al., 2014).

Cognitive load theory (CLT) studies the load placed on the brain when a learner is introduced to new information and the limitations of working memory that impact the learning process (Sweller, 2020). All learners have a specific capacity for working memory that impacts the ability to perform complex cognitive tasks (Sepp et al., 2019). If the working memory capacity is overloaded, a student will be unable to process additional information & halting the learning process. As such, CLT emphasizes that both intrinsic and extraneous cognitive load management require proper management of learning materials and classroom design to manage extraneous cognitive overload and foster a learning design promoting learner persistence.

The contribution of our work is to provide a framework and examples of a digital environment that automatically curates content from both learners and instructors, incorporating agile learning tools to provide tailored feedback, thus creating a seamless learning experience with reduced cognitive overload. Our work anchors these concepts to a framework and provides examples of how digital environments can manage cognitive load and optimize knowledge acquisition, retention, and transfer.

3. The dynamic digital environment conducive to flexible student engagements

The strategic setup of this digital environment involves not only deciding what to include in order to facilitate flexible learning experiences but also how to set up the digital environment in order to support the dynamic curation of content both by instructors and learners. We particularly present this setup in the MS Teams environment, driven by the following three instructional goals:

1. Support flexible asynchronous just-in-time discussions, both in groups and one-on-one, by facilitating flexible learning, exploration and differentiation,
2. Support synchronous instruction focused on active learning through conversations, concept mapping, problem-solving, data analysis, and group discussions,
3. Promote co-creation of new content through collaborative projects that need an environment that promotes creativity, collaborative writing, and easy incorporation of immediate feedback.

In this study, we present our pedagogical approach for delivering graduate-level mathematics courses at the Naval Postgraduate School. Our approach involves distinct methods of instruction, which include asynchronous guided learning, classroom instruction, synchronous problem-solving, synchronous data analysis, weekly assessments, as well as creation of new content, such as research projects. As such, we seek a digital environment that supports the functionality identified in the first column of Table 1. The second column identifies how MS Teams supports that functionality for our class (Microsoft, 2024).

Table 1. Summary of desired functionality and solutions for content sharing, collaboration, and communication.

Desired Functionality	MS Teams Features to Meet Functionality
Portal to resources, communication, collaboration	Channels/Tabs/Breakout Rooms
Easy access & integration with existing software	M365 suite
Ability to welcome & orient students, as well as agile access to meetings & resources	Classroom home page with a dynamic display of calendar meetings, assignments, and content
Intuitive posting and curation of content	File sharing & class notebook
Support conversation between students, as well as students and instructor	Curated channels and chats, using the tag notification
Timely feedback mechanism	Focused channel discussions
Assignments and grading capability	Assignments and rubrics
Dynamic access to classroom meetings/recordings	Calendar invites of a dedicated team's channel
Automatically curating classroom recordings	Curated channel for meetings and recordings
Automatic posting of classroom recordings	MS Stream through calendar invites
Ability to run and demo live code	Markdown for live preview and sharing of code
Ability to share editable code in a chat	Code snippets in a message

To exemplify this, Figure 1 showcases an example of this environment, highlighting the MS Teams' default organization channels, and customizable channels designed for topic-focused curation. The home page for MA4027, a graduate-level course at the Naval Postgraduate School, shows students' lightly personalized view with their individual files and deadlines, enabling them to access applicable materials, communicate & collaborate with peers and the instructors effectively. We observed that this dynamic welcome page enables students to identify their immediate priorities quickly, and to easily access relevant digital classroom notes and correlated homework solutions to promote efficiency and effectiveness.

Moreover, during classes, instructors join the prescheduled semester-long classroom's digital meetings whose recordings get automatically saved in the "Meetings and Recordings" channel, allowing topic repeatability. Students have the option to join the same meeting creating a no-front-classroom setting, as each student can view the content on personal devices during face-to-face classes. This enables learners to exercise agency over their learning by choosing engagement modalities and promoting self-organization, planning, and independence attending online in instances when school attendance would otherwise be compromised.

Figure 1. The configuration of the MA4027 depicts two types of channels and the dynamic welcome page.
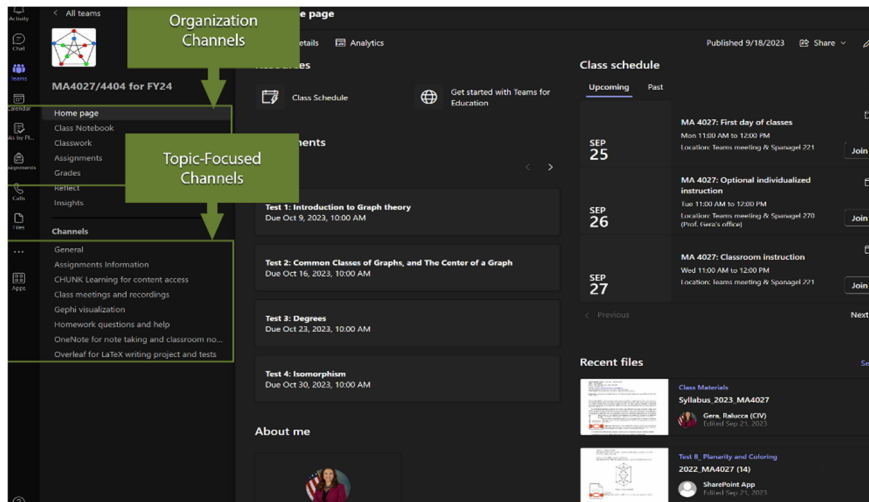
Figure 2 depicts a previous iteration of the MA4027 course, illustrating the channels that support persistent breakout sessions if desired. It also identifies use of topic-focused channels, each used for questions and resources for specific software, so that learners utilize a hassle-free file exchange, perusal of classroom notes, and direct access to external websites (without the need to memorize the respective links, such as the "Overleaf supporting LaTeX" tab). Therefore, learners can exercise greater control over their learning experience and efficiently engage with course materials, fostering a sense of self-assurance and mastery.

Figure 2. The composition of a MA4027 course highlights channels facilitating needed persistent breakout sessions, and a topic-specific channel (depicted in blue) used for classroom notes & direct access to external websites.
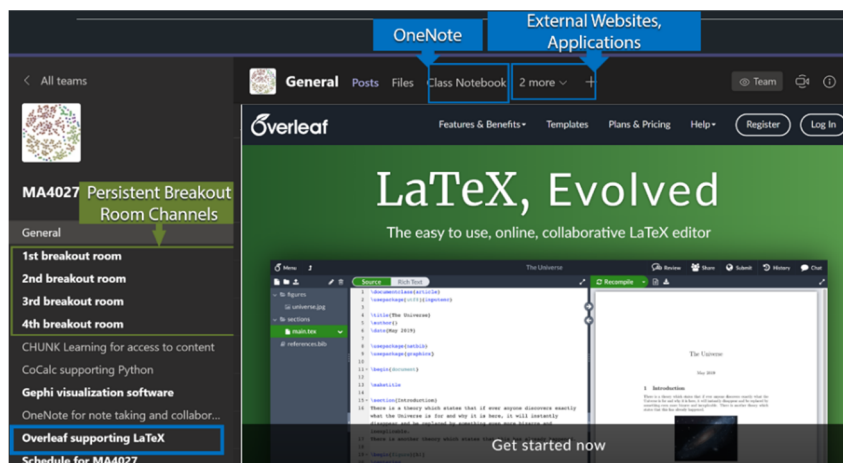
To facilitate social learning, topic-focused channels enable the curation of questions and resources, allowing for autonomous peer-to-peer sharing & collaboration on relevant content. This structured learning approach promotes student self-regulation, autonomous learning, and flexible learning engagement. Our analysis of this curated environment indicates that students share resources with their peers and tag instructors when decisions are needed, leading to deeper understanding of subject matter. It is evident to us that curation of information is a critical component of social learning, promoting collective knowledge construction and providing a framework for students to establish their own organizational standards.

4. The utilization of digital notes and annotation

To encourage safe writing within a digital notebook, it is crucial that a digital notebook have robust organization features and individual permission settings, to differentiate between the instructor's notes accessible by everyone, and the student's individual notes. This ensures that users can easily categorize their notes & ideas, and reference resources in a structured manner, facilitating ease of retrieval to reduce cognitive load, while supporting effective communication with learners and instructors [Soffer, 2020]. Safeguards against unwanted modifications to students' individual work instill confidence in annotating personal insights. Students who demonstrate higher engagement with course materials and utilize technology effectively, including the use of digital notebooks, tend to have higher levels of persistence and better academic achievement than their peers (Morris et al., 2005).

We exemplify this setup in the OneNote environment, consistent with the above-mentioned need for best practices, as well as the pre-identified instructional goals of Section 3. Table 2 summarizes our desired functionality and how OneNote meets that functionality (Microsoft, 2020) and (Microsoft, 2024).

Table 2. Summary of desired functionality and solutions leveraging digital annotation and note-taking tools during instruction, homework, and peer collaborations to streamline the learning experience for students.

Desired Functionality	OneNote Features to Meet Functionality
Digital notetaking accessible across devices	M365 suite
Agile integration of notetaking and annotation	Integrated notebook with the classroom team in MS Teams for digital and handwritten notes
Robust organizational features	Customizable categories, tagging, search, hierarchical notetaking
Clear & customizable permission settings enable safe and collaborative notetaking	Securely share sections or individual pages either 1-1 or groups at various levels of permission.
Facilitate efficiencies during office hours	Student Notebooks & Collaboration Space
Augment and provide updates to classroom notes	Content syncs with instant access
Easy referencing content from multiple sources	Organization of notes using titled sections and pages enables easy referencing of all notes
Private sharing of homework or quizzes for grading	Student Notebooks
Ability to solve & graph math problems	Mathematics solver
Digital Office hours even for face-to-face class	Student Notebooks & Collaboration Space

To exemplify this portion of the digital learning environment and how it supports flexible learning experiences, Figure 3 presents a breakdown of the digital notebook demonstrating streamlined organization of the various elements that reinforce instruction and promote effective learning.

Figure 3. The digital notebook contains four sections, each having specific permissions for editing and viewing content.
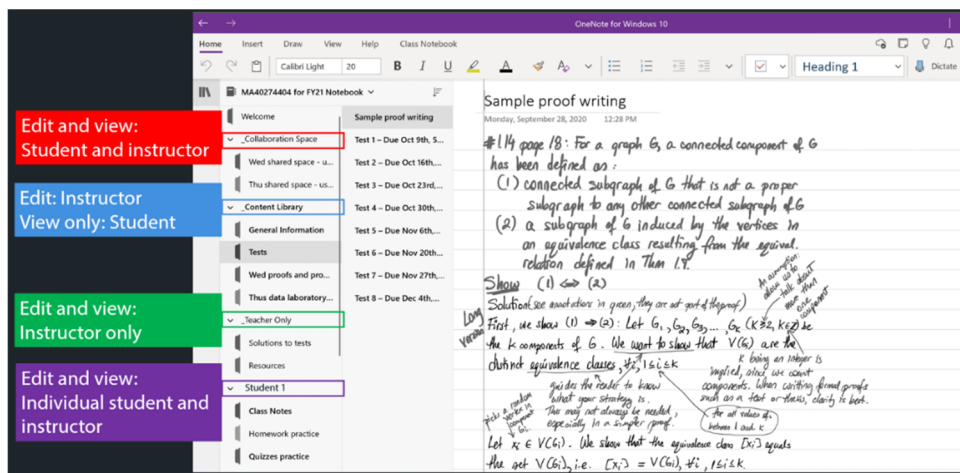
Figure 4 shows an example of organizing content within the "Content Library" using an organized strategy, displaying classroom notes, homework assignments, and practice materials in an orderly fashion.

Particularly, we show three successive chapters in corresponding order integrated with corresponding homework assignments and other relevant practice materials, promoting an organized learning strategy.

Figure 4. An example of organizing content within the "Content Library", displaying classroom notes by chapter.
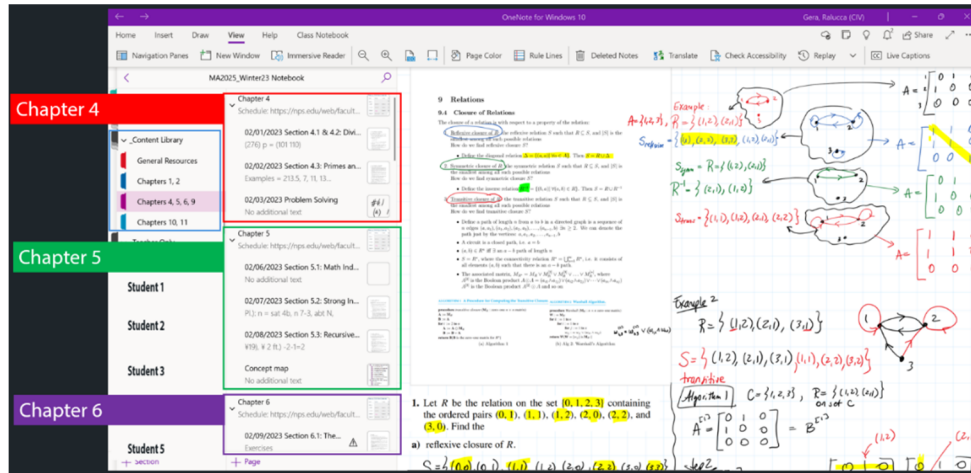
5. Conclusions

The integration of technology into traditional classroom settings has become increasingly prominent in recent years since technology has the potential to optimize the organization of multiple resources while supporting a variety of instructional methods to support effective and efficient learning. In this research paper, we present methods that aim to support flexible and meaningful learning by offering diverse and accessible opportunities for students to interact with the faculty, peers, and content. Meeting students where they are, rather than expecting their adaptation to distinct faculty engagement styles, creates a learner-centered environment that is central to ensuring student success.

The main goal behind the proposed strategic design of the digital space and digital annotation is to empower students to take ownership of their learning experiences in a student-centric learning environment. We achieve this by focusing on creating choices for learning experiences by thoughtfully curating a course setup that unlocks opportunities for optimized learning. This organization is supported by the utilization of digital notetaking and annotation tools for instruction, homework, and collaboration, promoting organized and efficient spaces for students, and ultimately enhancing academic performance.

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CURRENT AND PREVALENT TECHNOLOGIES IN WEB CURRICULUM

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Abstract

The Web Programming and Design major at Purdue University utilizes a variety of technologies within the curriculum to educate students in current and future web trends. This paper will investigate current and prevalent web development technologies that could enhance the program. Web development technologies are numerous, with each technology playing a critical role in building robust and interactive websites. At the core of every web page are HTML, CSS, and JavaScript, which combine to structure content, manage presentation, and create dynamic interactions. HTML (Hypertext Markup Language) provides the foundational structure, CSS (Cascading Style Sheets) handles styling, or the look and feel of the website, and JavaScript provides interactivity. Together, they collectively form the backbone of web development. PHP (Hypertext Preprocessor) remains a common and powerful technology used in sever-side scripting, contributing significantly to back-end development. PHP is embedded within HTML code and executes on the server, delivering dynamic content to the client, and is known for its ease of use. WordPress, one of the most popular content management systems, relies heavily on PHP for its core functionality, showcasing the enduring relevance of this scripting language in web development. Front-end libraries and frameworks such as jQuery, React, and Angular have gained prominence for enhancing the user interface and experience. The jQuery library offers developers an easier means of altering CSS and handling events as the page is used. React, developed by Facebook, facilitates the creation of reusable components for building efficient user interfaces, while Angular, a comprehensive framework by Google, offers a structured approach for dynamic web applications. Node.js has become a popular technology for server-side scripting, enabling developers to use JavaScript for server-side development and the creation of scalable and high-performance applications. Database technologies, the backbone of data storage and retrieval, include MySQL and MongoDB among many others. MySQL, a relational database management system, is renowned for its reliability and scalability, making it a preferred choice for data-driven applications. MongoDB, a NoSQL database, excels in handling unstructured data, providing flexibility and scalability for applications dealing with large datasets. The web development arena has a plethora of technologies that can perform similar tasks, each contributing to the creation of modern, scalable, and interactive web experiences. The combined effect of these technologies enables developers to deliver impactful and meaningful web solutions. Through the implementation of these technologies within the curriculum, students will be better prepared for the employment opportunities that lie ahead.

Keywords: Curriculum, web technologies, web pedagogy.

1. Introduction

In the ever-evolving landscape of technology, current web technologies play a pivotal role in shaping the way we interact, communicate, and access information online. From dynamic user interfaces to seamless data exchange, these technologies have transformed the web into a dynamic and interconnected ecosystem.

One of the cornerstones of contemporary web development is the use of responsive design. With the proliferation of various devices, including smartphones, tablets, and desktops, responsive design ensures that websites adapt fluidly to different screen sizes. Cascading Style Sheets (CSS) and frameworks like Bootstrap or Tailwind CSS enable developers to create visually appealing and functional interfaces that deliver a consistent user experience across platforms.

The shift towards Single Page Applications (SPAs) represents another significant trend in web development. SPAs use dynamic loading to update content on a single page, providing a smoother and faster user experience compared to traditional multi-page websites. Popular JavaScript libraries and

frameworks such as React, Angular, and Vue.js empower developers to build powerful SPAs, enhancing the interactivity and responsiveness of web applications.

Application Programming Interfaces (APIs) play a crucial role in connecting disparate systems and enabling seamless data exchange. Representational State Transfer (REST) and GraphQL are two prevalent approaches for designing APIs, facilitating communication between web servers and clients. This allows for the integration of third-party services, enhancing the functionality and feature set of web applications.

The rise of Progressive Web Apps (PWAs) represents a convergence of web and mobile app capabilities. PWAs leverage modern web technologies to offer an app-like experience, including offline functionality, push notifications, and improved performance. This approach blurs the lines between web and native applications, providing users with a versatile and efficient means of accessing content.

Security is paramount in the current web landscape, and technologies such as HTTPS, Content Security Policy (CSP), and JSON Web Tokens (JWT) are instrumental in safeguarding user data and preventing unauthorized access. With a focus on encryption, secure communication, and proper authentication mechanisms, these technologies contribute to building a safer online environment.

In the Web Programming and Design major at Purdue University, the goal of the curriculum is to prepare students for real-world applications by staying abreast of the most used technologies and languages. With the landscape changing constantly, some of the popular technologies change while others remain a staple of web development.

2. Web technologies and languages

PHP, or Hypertext Preprocessor, is designed for web development and is a widely-used server-side scripting language (Sotnik, Manakov, & Lyashenko, 2023). Created in 1994 by Rasmus Lerdorf, PHP has since become a cornerstone of dynamic website construction (Tatroe & MacIntyre, 2020).

One of PHP's key strengths lies in its versatility. It seamlessly integrates with HTML, allowing developers to embed PHP code directly into HTML pages (Sotnik, Manakov, & Lyashenko, 2023). This flexibility facilitates the creation of dynamic web content, enabling the execution of server-side scripts to generate dynamic web pages based on user interactions.

PHP supports a broad spectrum of databases, including MySQL, PostgreSQL, and MongoDB, making it an excellent choice for database-driven web applications (Tatroe & MacIntyre, 2020). Its open-source nature has fostered a large and active community of developers, contributing to a wealth of libraries, frameworks, and resources that streamline development processes.

Over the years, PHP has undergone significant updates and improvements, with the latest major version being PHP 8. This version brings enhanced performance, new features, and improved syntax, reinforcing PHP's relevance in modern web development. Despite facing competition from other server-side languages, PHP remains a popular and reliable choice for building dynamic, scalable, and interactive web applications.

Cascading Style Sheets (CSS) is a necessary technology in web development, serving as the styling language for HTML documents. Developed in the late 1990s, CSS enables developers to create and alter the presentation and layout of web pages, ensuring a separation of content and design. The "cascading" in CSS refers to its hierarchical nature, where styles can be defined at various levels and cascade down to affect the presentation of HTML elements. This hierarchy allows for consistent styling across a website and facilitates efficient maintenance and updates.

CSS empowers developers to control typography, colors, spacing, and layout, providing a high level of customization for the visual aspects of a website. Responsive web design is made possible through CSS media queries, enabling developers to adapt layouts to different devices, ensuring a seamless user experience across all devices.

The latest versions of CSS, such as CSS3, introduce advanced features like animations, transitions, and flexbox/grid layouts, enhancing the possibilities for creative and interactive web design. As an integral part of the front-end development stack, CSS continues to evolve, contributing to the creation of visually appealing, user-friendly, and responsive web interfaces

JavaScript is a dynamic, versatile programming language that plays a central role in modern web development. Initially developed by Netscape in the mid-1990s, JavaScript has evolved into a powerful tool for creating interactive and dynamic content on the client side of web applications. As a scripting language, JavaScript enables developers to manipulate and modify HTML and CSS dynamically, allowing for real-time updates without requiring page reloads. Its widespread adoption across browsers has solidified its position as an essential component of front-end web development.

JavaScript is an object-oriented language with a C-style syntax, making it accessible to a broad audience of developers. It supports asynchronous programming through features like callbacks and promises, facilitating the creation of responsive and interactive web applications.

The advent of Node.js has expanded JavaScript's capabilities beyond the browser, enabling server-side development as well. This full-stack versatility has contributed to JavaScript's popularity, as developers can use the same language for both client and server-side scripting, streamlining development workflows. Figure 1 illustrates an example full-stack application approach.

Figure 1. An example of a full stack web application setup using client-side and server-side languages along with a database for storage, maintenance, and retrieval of information.

Web databases are integral components of dynamic and data-driven websites, playing a pivotal role in storing, managing, and retrieving information. These databases enable web applications to handle large volumes of data efficiently, ensuring seamless user experiences and personalized content delivery.

One of the most commonly used types of web databases is relational databases, with MySQL, PostgreSQL, and Microsoft SQL Server being popular choices. These databases organize data into tables with defined relationships, offering a structured and efficient way to manage complex datasets. They are particularly well-suited for applications that require robust transactional support.

MySQL is a relational database management system (RDBMS) known for being open-source as well as its reliability, performance, and ease of use (Grippa & Kuzmichev, 2021). Developed by Swedish company MySQL AB, it is now owned by Oracle Corporation. MySQL uses Structured Query Language (SQL) as its primary interface, making it an integral part of the database landscape.

Structured Query Language (SQL), is a domain-specific language used to manage and manipulate relational databases. It provides a standardized way to interact with databases, allowing users to define, query, and manipulate data. SQL consists of several sub-languages, including Data Definition Language (DDL) for defining and modifying database structures, and Data Manipulation Language (DML) for querying and updating data.

MySQL uses SQL to perform a wide range of database operations. Developers and administrators use SQL commands to create and modify database tables, retrieve specific data using queries, update records, and manage permissions (Grippa & Kuzmichev, 2021). The structured and intuitive nature of SQL makes it accessible to users with various levels of expertise in database management.

MySQL's compatibility with SQL standards and its support for transactions, indexing, and complex queries make it a preferred choice for web developers, powering many dynamic and data-driven applications on the internet. The combination of MySQL and SQL provides a robust foundation for efficient and scalable database management in a wide array of applications.

NoSQL databases, such as MongoDB and Cassandra, provide an alternative approach, offering flexibility in handling unstructured or semi-structured data. These databases excel in scenarios where data structures may evolve rapidly, accommodating the dynamic nature of modern web applications.

Web developers interact with databases using languages like SQL (Structured Query Language) for relational databases or specialized queries for NoSQL databases. Server-side scripting languages, such as PHP, Python, or Node.js, facilitate the communication between the web application and the database, allowing for the retrieval and manipulation of data based on user interactions.

The use of web databases is crucial for e-commerce platforms, content management systems, social media, and a myriad of other web applications that rely on efficient data storage and retrieval to provide dynamic and personalized content to users in real-time.

Another common and popular technology in use today is Python. Python has emerged as a versatile and powerful programming language, gaining immense popularity for web development due to its simplicity, readability, and an extensive collection of libraries and frameworks. Whether it's building dynamic websites, web applications, or robust backend systems, Python has become a go-to language for developers seeking efficiency and ease of use (Forcier, Bissex, & Chun, 2008).

One of the key factors contributing to Python's prominence in web development is its readability. Python's syntax is clean and straightforward, resembling the English language, making it easy for developers to write and maintain code (Forcier, Bissex, & Chun, 2008). This readability not only enhances collaboration among developers but also accelerates the development process, allowing teams to build and iterate on web applications more efficiently.

Django and Flask, two of the most prominent web frameworks for Python, have played a pivotal role in shaping the language's dominance in web development. Django, a high-level web framework, follows the "don't repeat yourself" (DRY) principle and promotes rapid development by providing a plethora of built-in features such as an ORM (Object-Relational Mapping), admin panel, and a templating engine. Flask, on the other hand, is a lightweight and modular micro-framework that allows developers to choose and integrate components based on their project requirements, providing flexibility and customization.

3. Conclusions

In summary, current web technologies encompass a wide array of tools and practices that drive the dynamic and interactive nature of the modern web. When combined, PHP, JavaScript, CSS, and MySQL create a comprehensive web development stack. PHP handles server-side logic, MySQL manages data storage, JavaScript enhances client-side interactivity, and CSS ensures a polished and visually cohesive presentation. This integration enables the creation of feature-rich, dynamic, and aesthetically pleasing websites, providing users with a seamless and engaging online experience. From responsive design to powerful JavaScript frameworks and secure data exchange mechanisms, these technologies collectively shape the digital experiences we encounter daily, fostering a more connected and efficient online world. Additionally, Python's rise in web development can be attributed to its readability, powerful frameworks, extensive library ecosystem, and adaptability. Whether building large-scale web applications or crafting smaller projects, Python's versatility and community support make it a compelling choice for developers worldwide. As the landscape of web development continues to evolve, Python stands as a reliable and efficient language, empowering developers to bring their ideas to life on the web. Of the many options for web development, choosing the best one for educating students can be daunting. Staying appraised of the current trends along with knowledge of the most used and useful technologies can help keep curriculum moving forward.

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UNLOCKING CREATIVITY: KNOTS AND SONA DRAWINGS IN MATHEMATICS TEACHER PROFESSIONAL DEVELOPMENT

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Abstract

Art and mathematics, clearly distinct domains, converge in a fascinating exploration that transcends conventional boundaries. The essence of art lies in producing profound, individualistic responses, inspiring a search for coherence in the visual and emotional tapestry it weaves. Simultaneously, mathematics, conventionally confined to analytical rigor, reveals an unexpected facet as an incentive for creativity. This synergy forms the background for an enriching journey into the interplay of mathematics, art, and ethnomathematics. Within ethnomathematics, the bridge connecting mathematical practices and diverse cultural heritages emerges as a powerful tool for educators to generate a multifaceted understanding of both subjects. The core of a 2023 professional development course for mathematics teachers at the University of Aveiro was the fusion of mathematics, art, and ethnomathematics. Targeting grades 5 to 12, the chosen topics were knots and Sona designs. Knots, essential in everyday life, hold a particular place in mathematics through the theory of knots. The introductory concepts of this theory can be linked to the teaching of several mathematical school topics and provide a powerful tool for 3D visualization and reasoning. Sona designs and geometric sand drawings serve as memory aids in the Chokwe people's oral storytelling tradition in south-central Africa, among other African communities. These drawings have mathematical properties related to symmetry, graphs, and knots. The course unfolded in two phases: an exploration of mathematical concepts and their artistic applications, followed by the conception and execution of a project where participants translated some of these concepts into individual artistic creations, using ceramics for the Sona drawings and textile art for the knots. This study explores mathematics teachers' perceptions of an interdisciplinary approach connecting art and mathematics and its potential integration into teaching practices. The research question focuses on whether incorporating art in mathematics teaching enhances comprehension, facilitates interdisciplinary learning, promotes collaborative teaching experiences, and fosters a more positive attitude toward mathematics among students. Employing a mixed case study design, the research combines quantitative and qualitative methods, including direct observation, document collection, a final questionnaire, and field notes for a comprehensive data analysis. Findings are presented through artworks and analysis of questionnaire responses and field notes. In conclusion, the study underscores that infusing artistic contexts within an interdisciplinary framework strengthens and reshapes mathematical concepts. This approach establishes meaningful connections across diverse knowledge domains, nurtures collaborative and engaging teaching and learning environments, and facilitates the design of classroom activities fostering a positive attitude toward mathematics.

Keywords: Mathematics education, interdisciplinarity, art, ethnomathematics, knots, Sona drawings, professional development.

1. Introduction

Elliot Eisner (2004), a pioneer in art education, proposed that adopting an artistic approach to education can improve its quality and lead to a new vision of teaching and learning. Given his preference for aesthetic forms of knowledge and learning, he would certainly agree that the arts can contribute to developing more engaging, stimulating, and challenging mathematical tasks.

The connection between Mathematics and art is known since ancient times, and gained greater attention in recent years (Breda, Carvalho & Hall, 2023). This synergy may be further enriched by joining ethnomathematics. Connecting mathematical practices with diverse cultural heritages emerges as a

powerful tool for educators to generate a multifaceted understanding of both subjects (D'Ambrósio & Rosa, 2016). The authors of this work believe that using this tool promotes contextualized learning, which will help to engage and motivate students in learning mathematics. In this sense, and adopting a STEAM approach, the authors of this work organized a professional development course for mathematics teachers at the University of Aveiro, in which connections are established between mathematics, art, and ethnomathematics. The chosen topics were knots and Sona designs.

The theory of knots dates back to the second half of the 19th century when Kelvin attempted to interpret the properties of atoms in terms of knots in the ether. According to Kelvin's theory, each chemical element would correspond to a particular knot. Although Kelvin's model proved to be inadequate from a chemical point of view, it did lead to the emergence of a new area of mathematics as several mathematicians began to explore the properties of knots and list all possible knots. It is possible to intertwine two or more knots to form a link and there are several notations to identify knots and links. The most widely used, even today, was proposed by James Alexander and Garland Briggs in 1927 and is based on the number of crossings: a link X_n^m has m knots, X crossings, and occupies position n in the tables of knots or links. When $m = 1$, that is, if it is a single knot, the exponent is omitted.

Much of knot theory is concerned with telling which knot diagrams represent the same knot and which do not. Transforming one diagram into another without altering the knot (or transforming the real configurations) may be very difficult. These transformations provide a powerful tool for 3D visualization and reasoning. Some properties of knots are closely related to school topics. For instance, the addition of knots shares several properties with integer multiplication. It can be used as a practical hands-on illustration and application of abstract concepts.

The Chokwe people of south-central Africa and other people of East of Angola and neighbouring areas of Zambia and Congo have a tradition of storytelling using geometric drawings in the sand, called Sona, as memory aids. Typically, these drawings would be traced in the sand winding around a rectangular grid of dots using a finger, while telling the tale. Ideally, the entire figure would be traced without having to remove the finger from the sand so that the entire diagram is constructed with a single curve that does not retrace itself (monolinear design). Additionally, Sona designs are usually such that each region contains exactly one point (perfect designs) and present some type of symmetry. Often the figure could be drawn by following a simple geometric algorithm on a grid of points, such as the one described by Liu and Toussant (2008).

Sona drawings have mathematical properties related to symmetry, arithmetic, computational thinking, graphs, and knots. Therefore, it is not surprising that in the last decades they have been used in schools as a means to teach and promote mathematics, ethnomathematics and anthropology (Veloso, 2022).

2. Methodology

2.1. Methodological options

This study explores mathematics teachers' perceptions of an interdisciplinary approach connecting art and mathematics and its potential integration into teaching practices. The research question focuses on whether incorporating art in mathematics teaching enhances comprehension, facilitates interdisciplinary learning, promotes collaborative teaching experiences, and fosters a more positive attitude toward mathematics among students.

In this perspective, a mixed case study was developed (quantitative and qualitative, based on a logic of complementarity), grounded on a pragmatic paradigm and case study design (Yin, 1994). The study was undertaken in a Portuguese higher education institution involving the participants of a professional development course for in-service mathematics teachers. The teachers responsible for the course in consideration are simultaneously the researchers of this study. In order to develop this experience, the techniques of inquiry, direct observation, and documental collection were applied, and the following instruments were used: final questionnaire and field notes.

2.2. Description of the study

In the professional development course discussed in this paper, our aim was to incorporate all activities into the participants' school routines while providing an opportunity for both learning and a deeply satisfying experience, as previously done in other courses mentioned by Breda et al. (2023). Following the ideas presented by Borko, Jacobs and Koellner (2010), these courses are designed as "opportunities grounded in a conception of learning to teach as a lifelong endeavor", meant to be enjoyable and rewarding. Simultaneously, in this course, we opted for an artistic approach that aligns with Eisner's perspective of a practice rooted in the arts (Eisner, 2004). Teachers take on the role of an artist: they are given time to explore, to create and to surprise themselves.

The professional development course addressed in this paper was titled "Nós e a Matemática" ("Mathematics and Knots" or "We and Mathematics" given the double meaning of the Portuguese word *nós*). It took place at the University of Aveiro, in 2023, from January 7th to February 4th. Like all professional development courses for Portuguese teachers, it was recognized by the national scientific and pedagogical council for teachers' professional development (Conselho Científico-Pedagógico da Formação Contínua), being registered with the number CCPFC/ACC - 116242/22. This course lasted for 25 hours; had 13 participants who were mathematics teachers from grades 5 to 12. Given the range of grades taught and the specificity of each level of teaching, different activities were proposed for teachers of different levels (grades 5-6 and grades 7-12).

The course alternated sessions of mathematical topics and applied crafts/arts. In the first session (3h30 face-to-face), the course trainers introduced knot theory and Sona drawings. The topics were explored from a mathematical point of view and complemented with artistic applications. The trainees were given some tasks to apply the concepts. The second session (4h00 face-to-face) was dedicated to the elaboration of Sona drawings on ceramic plates, with the collaboration of the ceramist Purificação Barros. In the third session (3h00 face-to-face) the trainers deepened knot theory and Sona drawing concepts. The 4th session (2h30 face-to-face) was dedicated to further ceramic applications of knots and Sona drawings. In the 5th session (3h30 asynchronous) the trainees had to do some group work and in the 6th session (1h30 online) participants had group discussion about the ongoing homework. In the 7th session (4h00 face-to-face) the participants had to create artistic knots or links using textile materials and the last lesion (4h00 face-to-face) was dedicated to group presentation of all the work undertaken by the participants during the course.

3. Results

3.1. Participants' artistic outcomes

All participants were asked to make at least two artistic applications: one using knots/links and another using Sona drawings. In this section, we present a selection of the outcomes.

Figure 1 shows three knots made of textile materials. The first is the trefoil knot, 3_1, the second is the cinquefoil 5_1 and the third is the Whitehead link, 5_1^2.

Figure 1. Textile knots by Sandra Rocha, Ana Deolinda Silva e Teresa Mena.

Figure 2 shows three Sona drawings made on ceramic plates. The first is a 3-linear drawing (three intersecting closed lines) and represents Tshihongo's mask. The second is 2-linear and represents a human couple (Sachituco and Nachituco). The third shows the construction steps of a particular monolinear design. It represents a plant from which poison is extracted.

Figure 2. Sona drawings on ceramics by Graça Estima, Ester Lemos and Olga Almeida.

3.2. Other results

In this section we analyse of the answers to the questionnaire delivered at the end of the course. The questionnaire had three sections: a first section concerning the characterization of the respondent; a

second section concerning a general evaluation of the course; a third section concerning the use of an artistic approach during the course.

Section 1: Participant characterization

The questionnaire was answered by all the 13 participants. Two respondents taught 5th and 6th grades and the remaining 11 taught grades 7 to 12. Teachers' ages ranged from 43 to 61, with an average of 51.6 and a median of 51 years. Regarding their teaching practice, the participants were mostly very experienced: one participant had between 10 and 15 years of teaching practice and all the others over 20.

Section 2: General evaluation of the course

Teachers were asked to rate, through a five-point Likert scale (1-very negative; 5-very positive), their general evaluation of the course. As can be seen from the heatmap of responses and corresponding statistics in Figure 3, the course was very well evaluated and contributed to increase teacher's knowledge.

Figure 3. Heatmap of responses to the general aspects section; mean and standard deviation.

Question	1	2	3	4	5	mean	std.dev.
What is your global evaluation of the course?	0	0	0	1	12	4,9	0,3
The topics of the course were relevant.	0	0	0	1	12	4,9	0,3
The topics of the course met my expectations.	0	0	0	2	11	4,8	0,4
The activities were interesting.	0	0	0	0	13	5	0
The course contributed to consolidate previous mathematical knowledge.	0	0	1	2	10	4,7	0,6
The course contributed to increase my mathematical knowledge.	0	0	0	0	13	5	0
The course contributed to improve my teaching practice.	0	0	0	1	12	4,9	0,3

Participants were also asked to name three strengths and three weaknesses of the course. We highlight the following strengths: Creativity; New and interesting ideas to apply in the classroom; Broadening of mathematical knowledge and its history in the world; Develops the possibility of interdisciplinarity in the school context.

Section 3: An artistic approach to the teaching of mathematics

Regarding the artistic approach followed during the course, teachers were asked to answer the following Yes/No question: "*Did you like having the opportunity to use an artistic approach to explore mathematical concepts?*". Nine teachers (69%) replied "Yes" and four teachers did not answer. There were no negative answers.

Teachers were also asked to rate their agreement, on a five-point Likert scale (1-total disagreement; 5-total agreement), over a set of statements. As can be seen in Figure 4, the use of an artistic approach in the course was very well evaluated and stimulated the emergence of collaborative/interdisciplinary teaching experiences.

Figure 4. Heatmap of responses concerning the use of an artistic approach in the course; mean and std. dev.

The use of an artistic approach during the course...	1	2	3	4	5	mean	std.dev
contributed to a more positive view of mathematics.	0	0	0	0	13	5	0
made learning more active.	0	0	0	0	13	5	0
contributed to a better understanding, transformation and application of mathematical concepts to diversified contexts.	0	0	0	1	12	4,9	0,3
stimulated the emergence of collaborative teaching experiences, involving teachers and students from different areas.	0	0	0	1	12	4,9	0,3

Continuing the focus on interdisciplinary, teachers were asked to answer, through a five-point Likert scale (1-not at all; 5-very much), to the question "*Do you find it interesting to use an artistic approach in the teaching of mathematics?*" All participants replied "very much".

Finally, teachers were asked to give their opinion (open answer) to the question *"What opinion do you have regarding an artistic approach in the teaching/learning process of Mathematics?"* All ten responses revealed a positive opinion (three didn't answer). Almost all teachers mentioned the importance of this type of approach as a means to increase students' motivation.

Teacher field notes and direct observation confirmed high participant engagement throughout the professional development course. Their curiosity and enthusiasm led to a strong understanding of the

concepts, diverse applications of mathematics, and collaborative teaching experiences. Concrete objectives – exploring videos to use in the classroom and creating individual art pieces – fuelled their motivation to complete all tasks. Notably, even participants without prior artistic experience became increasingly enthusiastic about planning and executing their own projects.

4. Conclusions

The conclusions drawn from this study align with the findings of previous research such as Breda et al. (2023), Breda, Carvalho and Hall (2022), Hall and Pais (2021), Hall, Brás and Pais (2019), and Hall and Pais (2018). These studies all support the effectiveness of an artistic approach in maths education. The current study reinforces this notion by demonstrating the successful integration of artistic and cultural elements into the teaching of mathematics. Positive evaluations received through questionnaires completed by participants at the end of the course, combined with their enthusiastic feedback, provide strong evidence that the course achieved its intended goals. The teachers who participated in the study have enhanced their abilities to design interdisciplinary tasks and projects. The employed methodology has proven effective in fostering a more constructive outlook towards mathematics and increasing motivation among learners. Most importantly, participants have demonstrated a notable degree of enthusiasm and joy, essential ingredients for fostering effective teaching and learning environments.

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POST-TEACHING OBSERVATION FEEDBACK
IN THE UNITED ARAB EMIRATES:
COLLEGE MENTOR AND STUDENT-TEACHER PERSPECTIVES

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Abstract

School-based practice has long been considered an integral component of effective initial teacher education programmes. During school-based practice, mentor feedback is generally perceived as fundamental to student-teacher development. Post-teaching observation feedback (PTOF), given when mentors meet with mentees to discuss recently observed teaching, is the focus of this action research study. This study was conducted at an Emirati female initial teacher education institution in the United Arab Emirates. It explores, develops, and improves PTOF practice from the perspectives of Emirati and expatriate college mentors and female Emirati student-teachers. Cycle 1 explored college mentor and student-teacher perspectives on PTOF practice using qualitative questionnaires and focus group interviews. Cycle 1's findings informed a series of professional development sessions during which new practice guidelines were collaboratively developed with college mentors. Cycle 2 evaluated the effectiveness of the professional development and practice following implementation of the new practice guidelines. Cycle 2 data were collected through interviews and focus group interviews. Thematic analysis was used to analyse data from both cycles. Cycle 1's findings revealed an overall lack of consistency to PTOF practice. College mentors mostly implemented either directive or collaborative theoretical approaches to mentoring and PTOF. This resulted in confusion and differing levels of developmental support for student-teachers. The Covid-19 pandemic meant that Cycle 2 evaluated the implementation of the new practice guidelines while school-based practice and PTOF occurred online. Cycle 2's findings indicated a more consistent, structured approach to PTOF. A transition towards collaborative approaches to mentoring and PTOF was evidenced, although challenges to their implementation were apparent. Reflective practice was perceived as predominately descriptive. The online delivery mode revealed challenges specific to female Emiratis. More time, along with contextual developmental support, is recommended to improve future PTOF.

Keywords: Initial teacher education, lesson observation feedback, mentoring, reflective practice, Emirati student-teachers.

1. Introduction

Learning through practice has long been considered an integral component of effective initial teacher education (ITE) programmes (Allen et al., 2019). Darling-Hammond et al. (2017) recognise that during school-based practice (SBP), mentor feedback is essential for student-teachers to develop into well-qualified teachers. Mentor feedback, particularly the oral feedback mentors provide after they observe a student teach during SBP, is the focus of this research study. This support, defined in this study as post-teaching observation feedback (PTOF), is the mentor's act of meeting with a mentee to discuss recently observed teaching. Bjørndal (2020) argues that PTOF is crucial for student-teacher development and that effective mentor/mentee PTOF needs to be collaborative, critical and reflective. Clarke et al. (2014) argue that providing PTOF is a focal mentor role. However, an issue of concern is that much of the recent PTOF literature is Western-centric. This research study was conducted in the United Arab Emirates (UAE) because I wanted to understand if predominantly Western PTOF literature was applicable to the UAE ITE context.

This study investigated professional and programme development, evaluated a transition towards collaborative approaches and gave participants a voice in the process. It is an action research (AR) study consisting of two cycles. The first cycle explores the perspectives of expatriate and Emirati college mentors and female Emirati student-teachers on PTOF practice at a federal ITE institution. Cycle 1's

findings inform a series of professional development (PD) sessions, during which new practice guidelines were developed. Cycle 2 used participant perspective to evaluate the effectiveness of the PD and practice following the implementation of the new practice guidelines.

2. Background

This AR study was conducted within the ITE department at an Emirati female higher education (HE) institution in the UAE. This institution is the largest provider of HE in the UAE and has 16 gender-segregated campuses across the country. The ITE programme is an eight-semester (four-year) undergraduate bachelor's degree It runs on five female campuses across four different emirates. Twelve education faculty work on the campus at the research setting, evenly split between Emiratis and expatriates. The expatriate faculty originate from five different countries across four continents. Three are male. The majority of students join the education programme directly from school, although there are a small number of mature students.

The institution is currently accredited to offer a bachelor's degree in early childhood education, which qualifies graduates to teach in kindergartens and up to grade 2 in UAE public schools. Previous offerings included primary and English language teaching, but these are being phased out and new education programmes are at the planning stage. Student-teachers study both core and general education subjects, and take a School Based Practice (SBP) course every semester. Its learning outcomes and week-by-week course delivery focus on practice and theory to support SBP. Each semester, student-teachers receive an SBP handbook, which is informative and provides tasks to complete during SBP. During SBP, education faculty work as college mentors observing student-teachers and conducting PTOF.
School-based mentors (usually the class teacher) also observe student-teachers when they teach. Student teachers spend between 10 and 40 days in schools each semester. The length incrementally increases and in total, student teachers complete 155 days in school.

3. Research questions

The six research questions are investigatory. The first three explore participants' pre-intervention perspectives on PTOF, and their findings inform the interventions. The latter three evaluate the interventions and practice following the implementation of new practice guidelines, from participant perspectives.

The exploratory cycle: Cycle 1
Research question 1
How do college mentors and student-teachers describe their current experiences of giving and receiving PTOF?
Research question 2
How do college mentors and student-teachers describe their theoretical approach to, and/or practice of, mentoring and giving or receiving PTOF?
Research question 3
What suggestions, if any, do college mentors and student-teachers have to develop PTOF?
The evaluation cycle: Cycle 2
Research questions 4, 5 and 6 relate to the post-intervention cycle.
Research question 4
How do college mentors and student-teachers describe their post-intervention experiences of PTOF?
Research question 5
In what ways, if at all, do college mentors and student-teachers perceive the interventions have altered their theoretical approach to, and/or practice of, mentoring and giving or receiving PTOF?
Research question 6
What suggestions, if any, do college mentors and student-teachers have to further develop PTOF practices?

4. Action research model

Coghlan and Brannick's (2014) AR model was followed for this study because it supports the implementation of change to practice within an organisation and has been successfully applied to

education institutions. Coghlan and Brannick's (2014) model includes a context and purpose stage followed by four phases in the AR cycle.

5. Data collection

In cycle 1 of this study 18 student teachers participated in focus group interviews (three focus groups comprising of six student teachers in each). The focus group interview protocol included two main questions with eight additional questions and possible follow-up prompts. The student-teachers speak English as a second or additional language, so I ensured that the questions were short, clear, and included familiar language. The planned questions aimed to give participants as much opportunity as possible to talk about aspects they viewed as significant. Eight college mentors completed an anonymous online qualitative questionnaire. The questionnaire consisted of 21 questions. Three questions were closed, designed to be simple and easy to respond to. The remaining questions were open-ended to elicit unrestricted responses from college mentors. This was intentional because, as Cohen et al. (2011) explain, open-ended responses provide richer data.

In cycle 2 of this study 18 student teachers participated in focus group interviews (three focus groups comprising of six student teachers in each). The focus group interview protocol included five questions with six possible follow-up prompts. Six college mentors participated in one-to-one interviews. Each interview consisted of six open-ended questions and prompts. The initial question was intended to be easy to answer. Jacob and Furgerson (2012) suggest initial questions should be familiar but central to the research. The questions then became more in-depth, requiring more thought. Whiting (2008) suggests that this question order is likely to provide richer data.

All data was collected online due to the Covid-19 pandemic and mandated social distancing protocols.

6. Data analysis

I adopted thematic analysis (TA) to examine the data in this study. According to Braun and Clarke (2006), TA provides a "rich and detailed yet complex account of data" (p. 78) and is particularly useful for understanding participant perspectives (Brown & Stockman, 2013). I used Braun and Clarke's (2013, 2019) six-stage reflexive TA approach to guide each phase of the data analysis. I found that the six stages were not linear: the process was iterative as I moved backwards and forwards checking and rechecking data, codes, clusters and themes.

7. Cycle 1 findings

The first cycle of this AR study's findings revealed that most participants described their experience of PTOF as confusing. College mentors were uncertain of their roles and responsibilities. Student-teachers were unclear what college mentors expected from them, perceiving each college mentor to have different expectations. At the time, there were no institutional guidelines, policies, or procedures for PTOF practice. Although this institution's SBP handbook outlined college mentor roles and responsibilities, these were poorly defined, unspecific and not directly related to PTOF. Cycle 1 found consensus on beginning PTOF positively then moving onto developmental feedback; however, there was less consistency to ending PTOF, to conducting meetings before SBP, and to requesting student-teachers complete pre-PTOF self-reflections.

Most participants explained that there was not enough time to give and receive PTOF. College mentors considered their SBP workload too heavy, and student-teachers recognised that PTOF was often rushed. College mentors equated longer PTOF with quality feedback and student-teachers explained they needed time during PTOF to feel comfortable enough to discuss their practice openly. Time required to build relationships was perceived as important, particularly as student-teachers preferred to be paired with a college mentor who had taught them before. Additionally, college mentors explained that they spent time supporting school-based mentors.

All the college mentors provided examples of how they were positive, sensitive and tried to instil confidence in student-teachers during PTOF. While the student-teachers mostly recognised that college mentors tried to encourage and support them, they explained that they wanted college mentors to be considerate when they gave feedback. If college mentor language was negative, they felt it was detrimental to their development. A few student-teachers explained that on occasion they received contradictory positive oral PTOF and what they perceived as negative written PTOF. It was unclear whether student-teachers misinterpreted oral PTOF or college mentors withheld less positive oral feedback.

Opinion was divided when college mentors described their theoretical approach to mentoring and PTOF. Half the college mentors said that they mostly implemented directive approaches, while the remaining half indicated that they mostly implemented either a collaborative or a combination of directive and collaborative approaches. The student-teachers perceived that they mostly received and indeed wanted directive approaches to mentoring and PTOF. It appeared that college mentors implemented their preferred approach as and when they chose, rather than when it was developmentally appropriate for student-teachers. This inconsistent implementation likely accounted for student-teachers' perceptions of differing levels of mentoring and PTOF support.

The directive approach to mentoring and PTOF appeared to be influenced by the requirement to grade each observed lesson. Again, opinion was divided. Half the college mentors felt that grading individual lessons and discussing grades during PTOF motivated student-teachers and supported their development. The other half considered grading all formative lesson observations as not conducive to student-teacher learning. Interestingly, most student-teachers explained that they found grading individual lessons unmotivating and a distraction from the developmental feedback the college mentors gave. Although half the college mentors indicated that they implemented collaborative approaches to mentoring and PTOF, there was limited evidence of developmental feedback that was assertive, questioning or 'critical' as defined by Bjørndal (2020). Student-teacher comments indicated that college mentors mostly pointed out elements of their teaching they needed to develop and directly told them how to improve, indicating linear dialogue. These findings did not appear to support the reflective practice model that underpins ITE at this institution.

8. Cycle 2 findings

Cycle 1 findings informed a series of professional development sessions. New practice guidelines were developed and implemented during the next period of school-based practice (SBP). Due to the global pandemic this period of SBP was conducted online. Cycle 2 evaluated the professional development and implementation of the new practice guidelines.

Cycle 2's findings revealed that the new practice guidelines supported a more consistent and structured approach to giving and receiving PTOF. College mentors indicated that they knew what their roles and responsibilities entailed. The addition of meetings before SBP facilitated student-teachers' understanding of expectations and served to build mentor/mentee relationships. After the interventions, all college mentors indicated that they found the new formative lesson observation template easier to use. It supported their provision of evidence-based feedback to student-teachers during PTOF. Additionally, most college mentors found the PD useful, and the additional resources supported them to give PTOF. Most participants preferred the convenience and flexibility of online PTOF. However, the home environment was not always conducive to student-teacher development and learning. Student-teachers mostly switched off online cameras, explaining that their families would disapprove if they showed their faces. Cycle 2's findings raised concerns that Emirati female student-teachers who study from home may be disadvantaged. Despite no commuting, a lack of time to conduct PTOF remained a concern in Cycle 2. This suggested serious flaws in the institutional formula used to calculate lesson observation schedules.

There was a transition towards collaborative mentoring and PTOF after the interventions. Most college mentors acknowledged that the PD and new practice guidelines supported this transition. Before the interventions, these college mentors acknowledged that they mostly incorporated directive approaches to PTOF; this transition therefore represented a paradigm shift in their theoretical approach. The findings revealed that removing grades from individual observed lessons supported greater collaboration during PTOF. However, reflective practice was mostly found to be descriptive. Most student-teachers were positive, more relaxed and felt more comfortable during Cycle 2's PTOF than Cycle 1's. While the shift to online delivery likely accounted for some of this sentiment, this change indicated a transition towards collaborative approaches to mentoring and PTOF. However, challenges were experienced when holding learning conversations and giving and receiving assertive, questioning feedback, which were perceived as new practice for approximately half the college mentors. These college mentors found giving grades easier and student-teachers wanted college mentor direction to develop their knowledge and improve their teaching skills. These findings indicated that the participants could have perhaps been better prepared, suggesting directions for future development.

9. Conclusion and recommendations

Although this study is not generalisable, its recommendations for improved PTOF are likely to apply to other campuses conducting the ITE programme. It is recommended that the practice of not grading individual observed lessons continues. However, this needs to be coordinated with PD and

curriculum development. Student-teacher PTOF development is likely to be more effective if it is built into the SBP course curriculum. This study recommends that reflective practice and collaborative approaches to mentoring and PTOF are taught overtly. I suggest implementing a developmental approach.

While it is recommended that PTOF is conducted immediately after lesson observation, this study demonstrates it is not always feasible. To ensure PTOF is timely, Management have approved the continuation of online PTOF. Given the challenges surrounding online PTOF evidenced in this study, I recommend that online PTOF is only conducted when face-to-face PTOF is not possible on the same day as the lesson observation. The lack of time to conduct PTOF evidenced in this study suggested serious flaws in the institutional observation schedule formula. I therefore recommend replacing the formula. College mentors should teach the SBP course to the same student-teachers they mentor in school. This would allow time for relationships to be built and expectations established before the commencement of SBP. If class sizes were limited to 12 or 15 student-teachers, more manageable observation loadings would result.

I recommend that a college mentor development programme is developed and implemented. It should be contextually appropriate and include reflective practice and collaborative approaches to mentoring and PTOF. Adequate time needs to be allocated for mentor development: Wetzel et al. (2017) noted that it took over a year of mentor professional development before PTOF dialogue became less directive and more reflective, collaborative and forward-thinking. To enhance future college mentor PD offerings, I suggest establishing pedagogical partnerships to represent all perspectives and stakeholders. While Murphy and Ní Dhuinn (2022) acknowledge that in ITE discourse pedagogical partnership tends to be limited to school-university partnerships or staff-student partnerships, their study focused on pedagogical partnership between a university and the wider community. Similarly pedagogical partnerships could be between the MOE, schools and this institution. Emiratis, expatriates, mentors and student-teachers should be involved to research and plan a future PD programme. Once developed, piloted, implemented and evaluated, a similar programme for school-based mentors could be installed. This study found that the new practice guidelines and PD supported the development of practice, though there remains room for further improvement. While this study demonstrated that Western models of mentoring and PTOF can be applied in the research context, it highlights that developmental support is imperative for success.

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IMPORTANCE OF FACILITATING CROSS-CULTURAL ONLINE DISCUSSION

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Abstract

This study investigates the significance of facilitating cross-cultural online discussions to bolster cultural competence and communication skills among students, particularly within the context of a master's practicum counseling class. Employing a mixed-methods approach, the study integrated qualitative analysis of online discussion board interactions with quantitative assessments of students' perceptions and learning outcomes. The online discussion boards were structured using culturally and linguistically responsive strategies, aiming to create an inclusive environment conducive to cross-cultural engagement. Key findings underscore the transformative impact of culturally and linguistically responsive online discussions on students' cultural competence, communication skills, and ability to effectively engage with diverse populations. Qualitative analysis revealed themes emphasizing the exposure to diverse perspectives, experiences, and communication styles as pivotal in enriching students' cultural competence. Furthermore, students demonstrated significant improvements in communication skills, including active listening, empathy, and adeptness in expressing ideas across cultural boundaries. This suggests that engaging in cross-cultural online discussions facilitated the development of nuanced communication skills essential for effective counseling practice. Quantitative assessments corroborated these qualitative findings, with students reporting heightened confidence and readiness to engage with diverse populations in their counseling practice. This was attributed to the meaningful interactions and insights garnered from cross-cultural online discussions. Such experiences not only broadened students' cultural awareness but also equipped them with practical skills vital for navigating cultural complexities in their professional endeavors. Considering these findings, several recommendations for practice emerge. Educators are encouraged to implement culturally responsive facilitation techniques, fostering inclusivity and respect for diverse perspectives within online discussion settings. Active participation from students of varied cultural backgrounds should be promoted to maximize the benefits of cross-cultural exchange. Additionally, ongoing training and support for educators in facilitating cross-cultural online discussions are essential, ensuring the continued enhancement of students' cultural competence and communication skills within the evolving landscape of online education.

Keywords: Online course design, online pedagogy, social justice education, cultural.

1. Introduction

In today's diverse society, counselors play a crucial role in meeting the varied needs of their clients. Essential to this role are both cultural competence and effective communication skills. In our increasingly interconnected world, where globalization shapes interactions across numerous spheres, including education, the significance of culturally responsive teaching in online learning cannot be overstated. Culturally responsive teaching is a pedagogical approach that aims to design dynamic learning environments and utilize classroom practices that allow students from diverse cultural backgrounds to succeed academically. It involves recognizing and valuing students' cultural characteristics, experiences, and perspectives as conduits for effective teaching. Key principles of culturally responsive teaching, as outlined by Gay (2010), include validation, comprehensiveness, multidimensionality, empowerment, transformation, and emancipation.

With the expanding enrollment in online programs, educators must possess the knowledge and resources to cultivate inclusive learning environments that respect the cultural diversity of their students. This study delves into the potential of cross-cultural online discussions within counseling education programs, such as those offered at MSU Denver, to enhance students' cultural competence and communication abilities. By facilitating meaningful exchanges among students from diverse cultural

backgrounds, these discussions aim to equip future counselors with the skills needed to engage successfully with clients from various cultural contexts. Additionally, this paper explores the principles of culturally responsive teaching and their practical application in online education, offering insights and recommendations for educators and instructional designers alike.

2. Methodology

The study was conducted within a master's practicum counseling class, where students were tasked with sharing their backgrounds and culture on online discussion boards and responding to their peers' posts. A mixed-methods approach was employed, combining qualitative analysis of online discussion interactions with quantitative assessments of students' perceptions and learning outcomes. Culturally and linguistically responsive strategies were integrated into the design and facilitation of the online discussions. This research paper adopts a qualitative approach, synthesizing insights from existing literature on culturally responsive teaching and drawing upon practical examples from the authors' experiences in education and instructional design. The methodology involves analyzing key principles and best practices of culturally responsive teaching and exploring their application in the context of online education. Additionally, demographic data, such as enrollment statistics, are considered to provide context for the importance of culturally responsive teaching in addressing the diverse needs of students in online courses.

3. Findings and recommendations

Qualitative analysis revealed that students perceived cross-cultural online discussions as instrumental in enhancing their cultural competence and communication skills. Themes emerged highlighting the value of exposure to diverse perspectives, experiences, and communication styles. Students reported increased confidence in interacting with clients from different cultures, expressing reduced feelings of fear or incompetence. The online discussions facilitated a deeper understanding of cultural nuances, leading to enhanced therapeutic connections with clients and classmates.

Quantitative assessments supported these qualitative findings, indicating significant improvements in students' perceptions of their cultural competence and communication skills following participation in cross-cultural online discussions. The findings suggest that integrating culturally responsive practices into online discussions can effectively prepare counseling students for working with diverse populations in their professional practice.

Based on the findings of this study, several recommendations are proposed for integrating cross-cultural online discussions across counseling education programs. Educators should prioritize the implementation of culturally and linguistically responsive strategies in designing online discussion activities. Encouraging active participation and peer interaction can further enhance the benefits of cross-cultural exchange. Additionally, providing ongoing training and support for educators is crucial for ensuring the successful implementation of cross-cultural online discussions in counseling education.

Table 1. Assessment Tool for Cross-Cultural Online Discussions.

Assessment Criteria	Description
Cultural Competence	*Evaluate students' understanding and appreciation of diverse cultural perspectives through their contributions to online discussions.*
Communication Skills	*Assess the clarity, empathy, and effectiveness of students' communication with peers from different cultural backgrounds.*
Active Participation	*Measure the level of engagement and involvement of students in cross-cultural discussions, including frequency and quality of posts.*
Reflection and Growth	*Encourage students to reflect on their own cultural biases, communication styles, and learning experiences throughout the discussions.*
Peer Feedback	*Provide opportunities for students to give and receive constructive feedback on their cross-cultural interactions and contributions.*

*Assessment tool adapted from research findings and recommendations for practice in facilitating cross-cultural online discussions (see Sections: Findings and Recommendations, Key Findings and Recommendations).

Table 2. Comparison of Cultural Competence Assessment Tools.

Assessment Tool	Description	Advantages	Disadvantages
Cross-Cultural Adaptability Inventory	Self-report questionnaire measuring an individual's ability to adapt to different cultures and environments.	Quantitative data for comparison over time	Self-report bias; Limited cultural scope
Intercultural Development Inventory	Assesses intercultural competence based on developmental stages of sensitivity, understanding, and engagement.	Provides insights into developmental progress	Requires trained facilitators for use
Cultural Intelligence Scale	Measures an individual's capability to function effectively in culturally diverse settings.	Offers a comprehensive assessment	Complex scoring system
Multicultural Personality Questionnaire	Evaluates an individual's multicultural attitudes, beliefs, and behaviors.	Focuses on individual traits and behaviors	May not capture contextual factors

Table adapted from various assessment tools used in cultural competence research and practice.

This table provides a comparison of different assessment tools used to measure cultural competence. It outlines their descriptions, advantages, and disadvantages, offering insights into the suitability of each tool for different contexts and purposes.

Cross-Cultural Online Discussion Questionnaire
(Please answer the following questions honestly and to the best of your ability.)

1. Demographic Information:
Gender:
· Male
· Female
· Non-binary/Other

2. Age:
· Under 18
· 18-24
· 25-34
· 35-44
· 45-54
· 55-64
· 65 or older

3. Ethnicity/Race (optional):

4. Online Discussion Experience:

5. How frequently did you participate in cross-cultural online discussions during your counseling education program?
- Rarely
- Occasionally
- Frequently
- Very frequently

6. How comfortable were you participating in cross-cultural online discussions?
- Very uncomfortable
- Uncomfortable
- Neutral
- Comfortable
- Very comfortable

7. What aspects of cross-cultural online discussions did you find most beneficial for enhancing your cultural competence and communication skills? (Open-ended)

8. Were there any challenges you encountered while engaging in cross-cultural online discussions? If so, please describe. (Open-ended)

9. Did participating in cross-cultural online discussions influence your understanding of cultural diversity and its relevance to counseling practice?
- Yes
- No
- Unsure

Perceived Learning Outcomes:

10. How do you perceive your level of cultural competence before and after participating in cross-cultural online discussions?
- Significantly lower before
- Slightly lower before
- No change
- Slightly higher after
- Significantly higher after

11. How do you perceive your communication skills in engaging with individuals from different cultural backgrounds before and after participating in cross-cultural online discussions?
- Significantly lower before
- Slightly lower before
- No change
- Slightly higher after
- Significantly higher after

Overall Satisfaction:
12. On a scale of 1 to 10, how satisfied are you with the overall experience of participating in cross-cultural online discussions in your counseling education program?

Additional Feedback:
13. Is there any additional feedback or suggestions you would like to provide regarding the implementation of cross-cultural online discussions in counseling education?

4. Conclusion

In an increasingly interconnected world, facilitating cross-cultural online discussions holds immense importance for fostering cultural competence and effective communication skills among students. Our study, conducted within a master's practicum counseling class, highlighted the transformative impact of such discussions on students' abilities to engage with diverse populations. Through qualitative analysis and quantitative assessments, we found that culturally and linguistically responsive online discussions not only enriched students' cultural awareness but also enhanced their communication skills, including active listening, empathy, and the ability to navigate cultural complexities.

The findings underscore the need for educators to prioritize the integration of culturally responsive practices into online learning environments. By embracing principles of validation, comprehensiveness, empowerment, and transformation, educators can create inclusive spaces that honor the diverse perspectives and experiences of students. Active participation from students of varied cultural backgrounds is crucial for maximizing the benefits of cross-cultural exchange and preparing future counselors to effectively serve diverse populations.

Moving forward, it is essential for educators to receive ongoing training and support in facilitating cross-cultural online discussions. This will ensure the continued enhancement of students' cultural competence and communication skills within the evolving landscape of online education. Additionally, continued research and collaboration among educators, instructional designers, and practitioners are needed to refine best practices and advance the field of culturally responsive teaching in online counseling education.

In conclusion, facilitating cross-cultural online discussions is not merely a pedagogical strategy but a vital component of preparing students to navigate the complexities of our multicultural world. By embracing diversity and fostering intercultural understanding, educators can empower students to become culturally competent counselors capable of making meaningful contributions to the field.

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PEER MENTORING IN MULTIDISCIPLINARY FINAL BACHELOR'S THESIS OF ENGINEERING STUDIES

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Abstract

This work presents the results of implementing near-peer mentoring as a tool to facilitate the guiding of students developing their bachelor's thesis (BT) in the field of engineering studies. This strategy was found to be necessary as the BT were developed within a multidisciplinary research project in which it was important to ensure project's continuity and quality. Bachelor's Thesis (BT), typically done during the last semester of the final course of engineering studies, needs to be defined as a practical activity, as closer as possible to actual engineering professional practice. The possibility of developing the BT in a complex, collaborative, transdisciplinary, and practical project marks a difference in the skills acquired by students during its development. Initiative, autonomy, creativity, work organization, critical thinking, abilities for teamwork, and project management skills are valuable tools highly valorised in engineering professional practice. Therefore, involving students in ongoing complex practical projects as part of their BT is an optimum way to ensure the acquisition of learning goals in engineering studies while they acquire a valuable working experience. Nevertheless, it is difficult to combine the schedule of a 6 months' long work, as BTs are, with longer research projects, and the organization of both tasks is often demanding and complex. It is particularly important to keep a continuity in the process' development, so that results and valuable acquired knowledge is not lost in the transition from on student to the other one. For this purpose, peer mentoring can be a valuable tool, to reinforce the student guiding, learning, motivation, and empowerment towards a successful completion of the attributed work tasks. Results showed that peer mentoring was a useful strategy to help students not feeling lost during the developments of the practical tasks associated to the project to move in a more fluent way through the transdisciplinary contents. Students felt that the combination of peer and academic staff's guidance was important for an efficient transition between consecutive BT works without losing performance in the global project. Mentors reported to feel an extra workload related to the challenge of guiding peers, but, at the same time, they positively valued the implied motivation, the feeling of a sense of community, and the establishment of peer-mentoring relationships. Mentees highlighted the emotional support and the value of interdisciplinary collaboration for academic outcomes.

Keywords: Peer learning, engineering studies, bachelor's thesis, transdisciplinary projects.

1. Introduction

The present learning experience has been performed with students of Renewable Energies Engineering bachelor's degree at the University of the Basque Country, UPV/EHU. This is a four-years' degree composed by two years of fundamental engineering courses plus another two years of specific subjects related to renewable energies (technologies, installations, costs, etc.). The renewable energies sector is experiencing significant growth, which materializes in an increase of the demand of specialized professionals for a wide range of jobs in areas as manufacturing, consulting, design, construction,

installation and commissioning, operation and maintenance, or research and development. Therefore, there is a necessity to engage the needs of this industrial sector and the skills, knowledge and competences acquired by the students of these engineering degrees for a successful match into capable and competitive professionals (Beagon et al., 2023). In the second semester of the fourth-year students develop the final bachelor's thesis (BT) as the final task before graduation. BT in engineering studies often includes experimental and practical tasks, and it is related to the learning of research methods. Students are expected to cover learning outcomes as literature survey, project design and development, scientific research ability, report writing and defending or knowledge in giving and receiving scientific critique. BT should represent an actual engineering professional practice, so it is remarkably interesting for students to develop the BT in collaborative, open-ended, cross-disciplinary, complex socio-technical projects. This opportunity will make a difference in the skills acquired by students during its development (Tejedor et al, 2019). Nevertheless, guiding and evaluating students BT' through this type of complex projects is often a challenging task in which they can get lost and face non-desired consequences which may delay or prevent from a successful completion of their BT.

Near-peer mentoring (NPM) has been identified as an effective tool to facilitate the guiding of students developing their BT in engineering studies (Andrews & Clark, 2011). This work describes the experience and results of using NPM to coordinate BT-students through complex cross-disciplinary-research projects. Two goals were prioritized in the guiding strategy; the first one was to establish the basis to ensure project continuity and quality and the second one was to define a balanced and robust evaluation system as the core of the NPM development. The following sections will describe the structuration of the NPM as an effective strategy to ensure a successful mentors-mentees relationship and BT-students' continuation and completion rates.

2. Methodology

Various terminologies are used to describe mentoring activities in the literature (guiding, tutoring, assisting, coaching), reflecting the complexities of the term (D'Abate et al., 2003). Moreover, published studies report mentoring experiences applied in different scenarios and circumstances, for example, to welcome first-year-students and give assistance with acclimatising to university life, or to help with non-study related matters as personal problems or difficulties with culture or language. Andrews and Clark defined seven diverse types of peer mentoring (Andrews & Clark, 2011), as briefly summarised in Table 1.

Table 1. Typology of peer mentoring (PM) (adapted from Andrews and Clark, 2011).

Peer mentoring (PM) type	Mentor	Mentoree	Characteristics
Pre-entry PM	Existing students	Future students	Offered to all first year-students.
One-to-one PM at transition	More experienced students	New students	Offered to individuals or small groups. Careful matching and appropriate academic requirements.
One-to-group PM at transition	More experienced students. Typically, one mentor to four or five mentees.	New students	Provides a 'friendly face' upon arrival making transition positive for students. One mentor to four or five mentees.
One-to-one longer-term PM	More experienced students	Less experienced peers or peers at same level.	Mentoring pairs carefully matched, with close supervision of student pairings. Relationships often last throughout the university career and beyond.
One-to-group longer term PM	Mentoring partners can be at same or distinct levels of study		Mentors may need support with group dynamics. Usually organised across a year group.
Partnershipled PM	Two peer mentors at same or higher level of studies.	Small group of 4-10	Can be long or short term (inter or intra year basis).
Group PM	A group of students working together with the aim of mutual support. Usually, mentors and mentees from same year.		Usually offered on a short-term basis. Resource intensive as management of groups may be problematic.

This work describes the use of NPM for BT-students who are about to complete their last task before graduating, so, in this case, the goals and boundaries of the NPM are quite specific and focused in passing down knowledge regarding project' organization, development and completion to a less experienced colleague. The main characteristics of the NPM used strategy are described in Table 2.

Table 2. Main characteristics of the NPM used strategy.

Project coordinator	Director of the BT who acts as coordinator of the group of professors from different disciplines involved in the project development.
Mentor	Student who has completed his/her BT in a complex, cross-disciplinary project and is about to defend it.
Mentee	Student who is starting her/his BT in the context of the same project.
Temporal contextualisation	Last semester of the fourth year of the bachelor's degree.
Goal	- Ensure BT-students' continuation and completion rates. - Fulfil the project milestones within established deadlines
Strategy	- The project coordinator together with the rest of professors proposes potential BT works to be developed within the project by new students. Each of them is suitable BT according of the learning outcomes that the student should acquire to finish the engineering bachelor's degree. - A call is open for students willing to develop their BT as part of the project. - Proposals are evaluated and a match of mentors and mentees is proposed, discussed, and accepted. - Each mentor makes available the following information to her/his mentee: - Getting started: basic information about the content of the project. - Project contextualisation. - State of the art: what has been already done and current situation of the research work. - Definition of goals and contents to be covered as his/her BT: learning outcomes, associated experimental tasks, involved cross-disciplinary concepts, milestones, deadlines, expected results, contingency plan. - Presentation of the working team: professors and mates involved in the project development. - Definition of roles: project coordinator, laboratory responsible, task coordinator, milestone responsible, mentor, mentee. - Definition of handouts: laboratory diary, weekly report, monthly group presentation, task report, BT final document. - Definition of the evaluation procedure (see evaluation section).
Requirements	Students need to cover several compulsory fulfilments to defend their BT: - Get a positive evaluation by the BT's director and ALL professors involved in the project development, as well as by her/his mentor. - Have completed within deadline all required tasks and associated handouts. - Acquire the compromise of mentoring a new student to work together during the last half of her/his BT. - Have participated, together with the project coordinator and professors' team, in the recruiting of new students who will develop their BT in the next call, and match each of them (new mentee) with a mentor. - Participate in the annual student's day organized by the UPV/EHU with a poster presentation including the main highlights of the BT.
Evaluation	- Evaluation is done accordingly to the official procedure of the UPV/EHU for BT. - When the student completes the tasks and prepare the final report, it is sent to the BT's director and to the rest of professors involved in the project development, as well as to her/his mentor for approval. They will give feedback for amendments up to the accepted last version, which will be uploaded to the public repository of the UPV/EHU. From this moment on, student can start the procedure for the BT defence. BT's director will send a report with the evaluation of the report which entails the 25% of the final mark. - A panel of three professors will be evaluate the final defence and their mark will entail the other 75% of the final mark.

3. Results

Follow-on surveys were conducted to receive feedback from mentors and mentees and capture their perspective about the NPM experience. The survey included questions related to the personal, social, and academic impact of participation in the mentoring programme. Statistical analysis is ongoing so, preliminary results have been extracted by the moment. Relevant issues about the implementation of

NPM were identified and classified as key themes and subthemes. Then, several relationships between them were established and will be further explored. Table 3 includes the main identified positive aspects and recurrently faced difficulties.

Table 3. Positive and faced difficulties related to the NPM used strategy.

Positive aspects	Faced difficulties
NPM worked as a link between the mentee and the BT's director and professor's team.	The introduction of the NPM programme needed a well thought through meaning a high workload for the involved professors.
Mentors and mentees agreed that their overall student experience had been enriched along the project development by applying 'learn how to learn' at a higher level, enhancing their sense of belonging, and exchanging on-going support.	Continuous support, training, and a level of on-going care and maintenance for mentors was required through the development of the BT.
Benefits realised in terms of student retention and success were considerable.	Rigorous mentor selection processes were required, which were time and energy consuming.
Mentors were able to develop valuable transferable skills to mentees, in terms of scientific competences and cross-disciplinary aspects, easing the process continuity and fluidity.	Pairing mentees and mentors to ensure successful matches was difficult sometimes and required attention to make modifications as soon as possible in case of incompatibilities.
Motivation to do well academically and to be involved was reported to be much higher than in the case of students developing their BT by themselves.	As a result of some unsuitable pairings, it was necessary to define a protocol to apply in these moments. At the beginning of the BT, students would accept to face changes in pairings if required by one of the mentors or mentees and accepted by the supervisor.
Personal and social benefits: satisfaction, identity development, listening and coaching skills, friendship, belonging, self-confidence.	It was difficult to make mentors feel part of the process of new BT students' recruitment, even if this was a compulsory activity within the requirements before starting to work in the project.
Improved transdisciplinary skills: self-management, leadership, communication skills, increased productivity, achievement, connecting and caring.	It was difficult to coordinate the students' official calendar calls to start and finish their BTs so that mentors and mentees could work simultaneously in the project for, at least, three months.
Improved research-related skills associated to a BT work: • Search for, read, understand, and summarize scientific papers and technical reports. • Identify key concepts and core knowledge. • Plan, organise, schedule, develop and finish experimental tasks on time. • Analyse, discriminate and discuss results, and extract related conclusions. • Give and receive scientific critique in a suitable register. • Synthetise the developed BT work and expose it in an appropriate way.	

4. Conclusions

As it can be concluded from the results summarized in Table 3, the presented experience has offered many positive aspects, even if several weaknesses needed to be corrected and many difficulties were faced during the design, implementation, development, and conclusion of the BT works in combination with the ongoing research project. The use of experienced students to guide and advise starting ones was felt as a big support by the involved professors and BT supervisors, specially in terms of continuity, effectiveness, timesaving, and management of experimental work and characterisation analyses. Indeed, the implementation of NPM has been the key to success in being capable of offering to the students the opportunity of developing their BT as a part of a bigger complex existing research project.

Acknowledgments

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ON SCORING COMPETENCE

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Abstract

The overall objective of any learning process is (at least) threefold; to increase a learner's competence, confidence, and learning ability. The totality of the learning process should improve the learner's social ability to learn from the whole process on how to be able to have stylistic flexibility and, by that, use her learning preferences to handle a test optimally, so her learning preferences make the best fit to the test. Here, we are focusing on introducing scoring techniques to assess a learner's competence concerning a specific subject from responses to multiple-choice tests, thereby being able to provide autonomous adapted feedback within the constraints of increasing learner awareness of own learning style and thereby strengthen confidence and learning ability. How a learner decides to act is essential for acquiring and maintaining satisfactory situational and learning style awareness. Therefore, information of the test and evaluation design is mandatory during the learning process. Feedback to the learner should ideally include the history characterizing the learning process so far, an estimate of the current state of the learning process, and a forecast of both the expected, an optimistic and for some learners, maybe even a worst-case scenario of the learning outcome. Feedback should be formed to strengthen the learner's situational awareness regarding her learning style, thereby reducing the probability of human failure, motivating the learner (e.g., by experiencing mastery), and suggesting beneficial learning strategies.

Keywords: Assessments in education, scoring competence, multiple-choice tests.

1. Introduction

During the last decades learning has again become a key topic. This time not only at learning institutions, but also in political and economic contexts. One reason for this is that a high level of competence (i.e., knowledge, understanding, and/or skills) in nations, organizations and individuals are considered both a necessity and a crucial competitive advantage in the present knowledge society and the globalized market (Aarset & Johannessen, 2022).

The overall objective of any learning process is (at least) threefold. It is to increase a learner's competence, confidence, and learning ability to improve the learner's ability for analytical and critical thinking and social skills, and thereby preparing them for society (Aarset & Johannessen, 2022).

Here, we are focusing on introducing scoring techniques to assess a learner's competence with respect to a specific subject from responses to assessments, for thereby being able to provide adapted feedback. Such an assessment is thus a quantitative or qualitative estimate to indicate the competence level of the learner. For this being successful, the assessment score should, as close as possible, correspond to the "true level" of competence. How to measure this competence has for ages been discussed and debated without any clear conclusion being accepted in the literature, though.

A learner's understanding of her own learning process and her own competence (i.e., her situational and learning style awareness), will control her attention and influence how she decides to act. By learning style awareness, we mean the conscious dynamic reflection of the learning process by an individual learner. Situational awareness is often understood as a summary, a mental "picture", of what's going on in our world, and by some, also including the process of acquiring this summary. People make bad judgments when their overall understanding of what's going on is insufficient. This goes also for the learning process.

To acquire and maintain satisfactory situational and learning style awareness during a learning process, feedback to the learner needs to be provided. For this feedback being beneficial, learners must know the premises of the test clearly in advance so that the test can become part of the learning process.

Knowledge of the framework of the test will strengthen the learning process associated with it. Feedback should be formed to strengthen the learner's situational and learnings style awareness, and thereby reduce the probability of human failure in addition to motivate the learner (e.g., by experiencing mastery) and suggest beneficial learning strategies.

The objective of this manuscript is to suggest a way of scoring competence and provide this as feedback to an individual learner during a learning process. Even though competence clearly is a multidimensional concept, competence is commonly measured on a scale from 0 – 100 (%), where 0 means "*Non-competent*" (or *Incompetent*) and 100 "*Fully competent*". This attribute is typically measured by the metric "Percentage of correct answers" on a multiple-choice test. Here, we will use the scale [-1, 1], or a sub-set of this interval, when scoring competence.

Basically, such assessments seek to discriminate between learners who have a satisfactory competence within a specific field and those who hasn't. Thus, the goal is to discriminate between learners in what we have called group I and III in figure 1 below, and simultaneously (mis-)placing as few as possible learners into group II or IV.

Figure 1. Classification of learners.
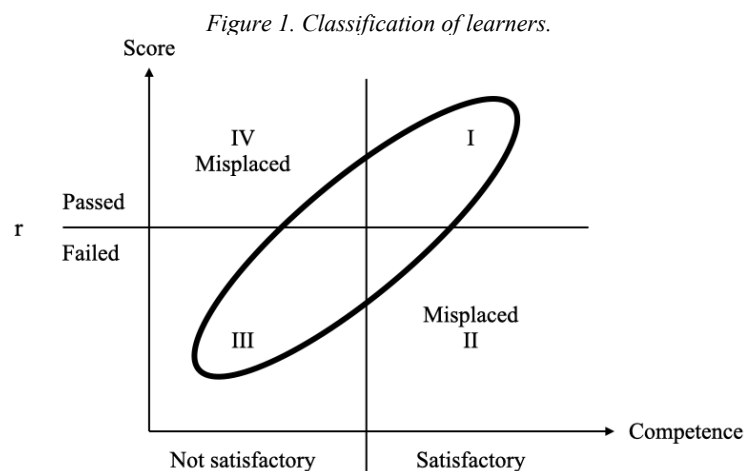
All teachers (facilitators) hope learners end up in group I, having both a thorough competence of the field they are supposed to learn and being able to communicate this in an assessment by for example passing a test. Simultaneously, it's important for a teacher (and e.g., a learning institution) to identify the learners without satisfactory competence. In a good assessment, the vast majority of learners will either belong to group I or III.

In group IV learners have managed to discover the correct answers to enough assessment items without satisfactory competence. They typically accomplish this by guessing, or by cramming and memorizing "type problems" and procedures. To (partly) rectify this we might require a high total score for passing the assessment (indicated with a large *r* on figure 1).

Requiring a high total score for passing an assessment will on the other hand increase the problem regarding learners in group II that have managed to acquire a satisfactory level of competence in the specified field, but still fail the test. Thus, the assessment of their accomplishment is not measured correctly and the validity with respect to measuring competence is not satisfactory. To (partly) rectify for this we might require a low total score for passing the assessment (indicated with a small *r* on figure 1), contrary to what was just suggested to minimize the probability of misplacing a learner into group IV.

Measuring knowledge, understanding and skills are difficult, if not impossible, in both a classroom setting and in a "real life" situation. As testing competence by automatic test procedures such as multiple-choice tests, sometimes even presented by an AI system, has become popular it is of fundamental importance to establish good testing procedures.

Another concern is that learners can answer correctly through guessing, making it impossible to distinguish between correct answers based on competence versus pure luck. Without the ability to solve a particular item, learners may gain marks by guessing and thereby introduce a random factor into test scores that lowers reliability and validity.

2. Scoring competence

A *Multiple-choice* test where the learner is instructed to identify the one correct statement among k_j statements in J items (i.e., one correct statement and k_j -1 distractors for each item, j=1, …, J) is a common type of scoring competence in assessments. Traditionally, multiple choice tests have been scored

using a conventional *Number Right* scoring method. Correct answers are scored with a value of 1, incorrect answers and omitted answers with a value of zero, and the sum of the scores for correct responses is the score of the assessment.

Now, let X_j (j = 1, … , J) be a stochastic variable characterizing the score for answering item (question) number j, and $X = \sum_{j=1}^{J} X_j$ the sum of scores, where

$$X_j = \begin{cases} 1 & \text{if correct} \\ 0 & \text{if incorrect} \\ 0 & \text{if omitted} \end{cases}$$

In a multiple-choice test with one correct answer out of k_j alternatives on item j (j = 1, … , J), the expected value of each X_j will be positive if a learner doesn't know the correct answer and is just guessing.

$$EX_j = 1 \cdot \frac{1}{k_j} + 0 \cdot \frac{k_j - 1}{k_j} = \frac{1}{k_j}.$$

So basically, it is expected to be beneficial for a learner to guess if she doesn't know the correct answer. And if she does, it is impossible for a teacher (facilitator) to distinguish between competence and pure luck.

Therefore, various scoring formulas have been presented to correct for guessing. The *Rights Minus Wrongs* (or *Negative Marking*) scoring method penalizes the learner for incorrect responses. The fundamental idea behind this scoring method is that learners acknowledge they will lose marks for incorrect answers and become discouraged to guess. This is expected to increase test reliability and validity because the test score will more truly reflect the learner's competence.

If the learner decides to guess with such a scoring technique, the expected score is

$$EX_j = 1 \cdot \frac{1}{k_j} + (-1) \cdot \frac{k_j - 1}{k_j} = -\frac{k_j - 2}{k_j}.$$

With more than two alternatives per item ($k_j > 2$), a learner with no knowledge is discouraged from guessing because the expected score will be negative. And the more distractors, the less will the expected score become and the more the learner is discouraged from guessing. But this may be too much discouraging, introducing a level of risk acceptance among the learners as a bias when assessing competence.

A favourable characteristic with a scoring method may be that the expected score should be zero if a learner is guessing an answer at random. For this to happen when the reward for getting the question correct is 1, the penalty for an incorrect answer should be *-1/(k_j-1)*, where k_j is the number of alternatives. Omitted items is given a score 0.

$$X_j = \begin{cases} 1 & \text{if correct} \\ \frac{-1}{k_j - 1} & \text{if incorrect} \\ 0 & \text{if omitted} \end{cases}$$

Now, in a multiple-choice test with k_j alternatives where only one alternative is correct, the expected score on such an item is

$$EX_j = 1 \cdot \frac{1}{k_j} + \left(-\frac{1}{k_j - 1}\right) \cdot \frac{k_j - 1}{k_j} = 0.$$

This kind of neutrality with respect to guessing may be beneficial. If the learner is able to eliminate one or several alternatives, though, it will be beneficial to guess.

3. Partial competence and partial knowledge

Learners may be able to determine that some of the choice options are (clearly) incorrect even though they cannot identify the correct answer. Being able to eliminate some incorrect alternatives (distractors) is reflecting what is called "*partial competence*" and "*partial knowledge*".

If a learner eliminates *one* distractor correctly in a multiple-choice test as mentioned above, the expected score is

$$EX_j = 1 \cdot \frac{1}{k_j - 1} + \left(-\frac{1}{k_j - 1}\right) \cdot \frac{k_j - 2}{k_j - 1} = \frac{1}{(k_j - 1)(k_j - 1)}.$$

If the learner eliminates *two* distractors correctly, the expected score is

$$EX_j = 1 \cdot \frac{1}{k_j - 2} + \left(-\frac{1}{k_j - 1}\right) \cdot \frac{k_j - 3}{k_j - 2} = \frac{2}{(k_j - 1)(k_j - 2)}.$$

And so on.

Table 1. Expected score after correctly elimination of distractors.

EX$_j$		Correctly eliminated distractors				
		0	1	2	3	4
Number of alternatives, k$_j$	2	0	1			
	3	0	.25	1		
	4	0	.11	.33	1	
	5	0	.06	.17	.38	1
	6	0	.04	.10	.20	.40

Table 1 illustrates that with the scoring method mentioned above, the effect of guessing is neutral, and a learner who is not able to identify any distractors (i.e., a non-competent learner) will have an expected score equal to 0. If a learner manages to correctly eliminate some distractors, though, guessing will have a positive expected effect. To avoid this positive effect by guessing, it is possible that an effective penalty that discourages guessing should exceed the standard penalty of $-1/(k_j - 1)$, but by implementing such negative marking, this will reflect the learners' answering strategies and risk-taking behaviour instead of actual competence. In fact, we see it as beneficial that for a learner able to eliminate some distractors (i.e., a learner with partial knowledge) the expected score is positive (> 0).

Therefore, we define a learner

- to have *full knowledge* if E(X$_j$) = 1
- to have *partial knowledge* if $0 < E(X_j) < 1$, because of incomplete information, lack of confidence, or both
- to be *non-competent / incompetent* if E(X$_j$) = 0, i.e., the learner is guessing or omitting to answer.

Frary (1989) introduced *partial-credit scoring methods*, and a variety of different partial-credit scoring methods are presented in the literature. We distinguish between three main formats:

- The *liberal multiple-choice test* allows learners to select more than one answer to a question if they feel uncertain which alternative is correct (Bush, 2001).
- In *elimination testing* learners are instructed to cross out all alternatives they consider to be incorrect (Kurz, 1999).
- In *confidence weighting* learners are instructed to indicate what they believe is the correct answer and how confident they are about their choice (Kurz, 1999).

Still an alternative model, proposed by Traub et al. (1969), rewards a learner for not guessing by awarding points for omitting items rather than penalizing for incorrect responses. This presents a psychological advantage since it rewards the desired behaviour rather than penalizing undesirable behaviour. Learners do not feel threatened by receiving a reward for skipping items, as compared to receiving a penalty for incorrect responses.

Hattie (2012) writes that to make learning and teaching visible, it is essential that the teacher also acts as an evaluator who activates and manages to embed good learning strategies in the students. It makes one distinguish between surface and in-depth knowledge and understand the conceptual difference between them. The teacher must have insight into learning styles so that she can communicate this to the learners and help them understand the connection between what they are learning and the feedback they will receive through multiple-choice tests. One of the points about excellence in education is that both the teacher and the learner need to know the intentions of what is going to be learned and what criteria there are for evaluation. This means that they must know how to meet these criteria and thus take the steps to fill the gap between the learner's current knowledge and the level needed to pass the test. Good teachers, therefore, introduce to the learners how to learn and arrange for them to be prepared for the type of test they receive. It is essential that the learning process has a clear intention and that the success criteria are explicitly known among the learners during the learning process. Therefore, the learners must understand the necessity of being able to answer the test questions precisely.

Furthermore, the learners must have some relationship to whether their answers meet the success criteria of the multiple-choice tests and that they can distinguish between correct and incorrect answers. The learners must know why the answer is correct and, if necessary, also know what other information it will be necessary to have to meet the requirements of the test. Feedforward is a relevant term in this context. It is the process by which one imagines that something is going to happen, or could happen, sometime after the event and investigates whether the performance held up. It is thus an understanding or an assumption that something particular will happen with a subsequent investigation of whether what was done to realize the performance also happened. This will make students aware of what kind of calibration they should have in relation to the test they are going to conduct. This will help to strengthen the test's success rate (Hermansen, 2003).

Zhang et al. (2012) writes that a thinking style or learning style is the preferred way of thinking. It is not a trait but instead how we use our properties. We do not have a style, but a profile of styles. Zhang et al. (2012) discuss thinking styles and instruction methods and writes that thought-based questions are closest to the two learning styles, the Judicial and Legislative ways of thinking. They write that memory-based analysis and time allocation are the skills used on short answer assignments or multiple-choice tests. One of the ways one learns is to work for oneself, and that is central. This affects the Executive, Local, Judicial, and Hierarchical Learning styles. It emphasizes the importance of learners being introduced to the main features of their own way of thinking and how it can be utilized in such a test situation. In the "Handbook of Intellectual Styles" (Zhang et al., 2012), they write, referencing Furnham, Swami, Arteche, and Chamorro-Premuzic (2008), that what is called "surface learners" prefer multiple-choice and group work rather than being assessed based on essays or dissertations. Those who are "deep learners" need to practice mastering the multiple-choice form well to get usable results. For this to happen, the teacher must include a review of different learning styles in their course and evaluation design so that the students receive an optimal and fair outcome (Biggs & Tang, 2011).

4. Conclusion

Depending on how strong a learner's preferred learning style is on the different styles, it will be beneficial for the student to have a conscious relationship with her learning styles. Practicing and adapting relevant learning styles before such a test situation will allow the student to get the most out of both the learning process and its evaluation (Zhang et al., 2012).

We suggest introducing a scoring of competence where the effect of guessing is neutral, but if a learner manages to correctly eliminate some alternatives before guessing, guessing should have a positive expected effect reflecting "*partial knowledge*".

It seems too spendable to reward a learner for managing to identify less than the expected correctly identified alternatives if she is just guessing. We therefore suggest introducing a penalty when a learner is scoring less than the expected score when guessing. Introducing and explaining this evaluation method will strengthen her awareness of the necessity of having precise and thorough knowledge before the test.

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THE IMPACT OF A FIRST-YEAR ORIENTATION TEAM-BUILDING EVENT

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Abstract

Students' post-intervention perceptions of an event provide insight relative to their understanding and appreciation of the intervention, as well as the impact thereof. Experience and anecdotal evidence indicate that first-year construction management students experience challenges in terms of adapting to the first year of study at a South African university where the study was conducted. The purpose of the study was to determine the impact of a one-day orientation seven-activity team building event (TBE) directed at enhancing first-year students' ability to manage themselves, work as a team, interface with each other, strategise, plan, evolve tactics, and take action that would lead to their team winning the 'amazing race' style event. A thirteen-question questionnaire was used to determine the students' perceptions. Twelve questions were close-ended, and one was open-ended. All close-ended questions were Likert scale type questions. Twenty-two students attended the event and completed the self-administered questionnaire survey. Findings include that the TBE activities contributed to: enhancing participants' skills, emotional intelligence, and ability to communicate with their peers; built confidence in their abilities including that of completing a task, and enhanced participants' alternative thought processes, ability to be creative, strategise, evolve tactics, take action, and plan. The students benefited from, enjoyed the TBE activities and believed it contributed to improving their time management skills. Conclusions include that the TBE had the desired impact in terms of the development of the first-year students' skills, abilities, and emotional intelligence. Recommendations include that the TBE should continue to be undertaken on an annual basis, and the impact on participants should be assessed. Furthermore, the study should evolve into a longitudinal study and be reported on in that context to determine any trends.

Keywords: Construction management, event, orientation, students, team building.

1. Introduction

Construction management graduates must be empowered to manage the business of construction, and projects, which requires the development of surface competencies in the form of knowledge relative to a range of knowledge areas, and skills (Smallwood, 2006). Furthermore, given the dynamic and ever-changing environment in which construction is undertaken, and that it is influenced by a range of stakeholders during the design, procurement, and construction processes, it is imperative that graduates are emotionally intelligent, and able to strategise, plan, evolve tactics, and take action. Therefore, it is critical that tertiary construction management education develops students' ability to manage themselves, work as a team, and interface with each other and through others to achieve objectives (Love et al., 2001).

Personal development and performance are a function of confidence, and can be engendered by students exploring practices that increase interaction with each other, and exploring other boundaries outside the traditional lecturing and learning environment, thus providing opportunities to tackle any deficiencies (Kamardeen, 2013). Furthermore, the exposure of students to the management of others during tertiary education through TBE activities contributes to overcoming the challenge of managing others in the field and applying concepts learned in the lecture environment (Farrow, 2016).

Given the above, and the Department of Construction Management's focus on 'lecturing and learning' research, a survey was conducted among the participants of a further first-year orientation one-day TBE, styled on the 'Amazing Race' television programme, which was introduced at the commencement of the first year of study.

The aim of the study was to determine whether the TBE as a contributed to preparing the students for the challenges of first year, and the undergraduate programme. The objectives were to determine the extent to which the TBE activities:
- enhanced participants' skills;

- impacted on participants;
- enhanced participants' abilities to strategise, plan, evolve tactics, and take action;
- enhanced participants' attributes / states, and manage themselves, work as a team, and interface with each other, and
- resulted in enjoyment and benefit.

2. Review of the literature

2.1. Competencies

There are two categories of competencies, namely surface and core, the core competencies differentiating between average and above average performance (Singh, 2004). The surface competencies include knowledge and skills. A study conducted by Smallwood (2006) investigated the frequency of use of 78 knowledge areas, and 45 skills, which informed the study reported on. Skills are dependent on knowledge; however, they require practice. This is reinforced by Jackson (2015) who emphasises the importance of refining, developing, and practicing skills, as opposed to learning them, which amplifies the need to expose students to a pseudo or simulated work environment.

2.2. Emotional intelligence

Smallwood et al. (2013) note in 'Emotional Quotient and Managing Construction Projects', the impact of fifteen attributes / states of emotional intelligence (EI) on construction managers' performance. Therefore, tertiary construction management education programmes and training must develop such attributes / states.

3. Research method and sample stratum

Given the challenges recorded in the introduction, the department arranged a TBE involving the first-year students at a resort near to the university during orientation week. The TBE entailed seven activities: Hoolahop; Human Fooseball; Bomb Squad; Leaky Pipe; Gutterball; Human Skis, and Full Throttle – Quad Crawl. Each of the activities entailed one or more of the following: strategising; planning; evolving of tactics, and taking action.

A quantitative approach was adopted, which entailed the completion of a self-administered questionnaire to determine the impact of the team-building event on the students. Twenty-two students from the first-year cohort who could attend the TBE completed the 'print format' questionnaire immediately after the event. However, one questionnaire was incomplete and was not included in the analysis of the data. The questionnaire consisted of thirteen questions, twelve closed-ended, using either a five-point or a six-point Likert scale question. Due to paper length constraints, this paper reports on the findings relative to five of the twelve close-ended questions, as these were central to the intervention.

The analysis of the data captured in MS Excel, included the computation of frequencies, and a measure of central tendency in the form of a mean score (MS) between 1.00 and 5.00 (five-point), and 0.00 and 5.00 (six-point) was computed based upon the percentage responses to the points on the respective scales to enable interpretation of the responses and to rank variables where necessary.

4. Research findings

Table 1 indicates the extent to which the team building event (TBE) activities enhanced seventeen skills in terms of percentage responses to a scale of 1 (minor) to 5 (major), an additional sixth point 'did not', and MSs between 0.00 and 5.00, the midpoint being 2.50. The skills were identified from a total of 42 skills identified relative to the practice of construction management (Smallwood, 2006). It is notable that all the MSs are > 2.50, which indicates that in general the TBE activities contributed more of a major than a minor extent to an enhancement in participants' skills.

It is notable that only 2 / 17 (11.8%) MSs are > 4.17 ≤ 5.00, which indicates the TBE activities enhanced team building, and motivating as skills between a near major extent to a major extent / major extent. Furthermore, team building, the primary objective of the event, predominates with a MS of 4.38, followed by motivating, the MS being 4.25. Thereafter, 6 / 17 (35.3%) MSs are > 3.34 ≤ 4.17, which indicates the TBE activities enhanced the related skills between some extent to a near major / near major extent – these include the skills ranked second to eighth include planning, leadership, decision making, communicating (oral), leading, and coordinating.

The remaining 9 / 17 (52.9%) MSs are > 2.50 ≤ 3.34, which indicates the extent is between near minor to some extent / some extent – organising, negotiating, initiating, interpersonal, procedures development, technical, supervisory, persuading, and controlling.

Table 1. Extent to which the TBE activities enhanced participants' skills.

Skill	Response (%)							MS	R
	Un-sure	Did not	Minor …………………………...Major						
			1	2	3	4	5		
Team building	0.0	0.0	0.0	0.0	14.3	33.3	52.4	4.38	1
Motivating	0.0	0.0	0.0	0.0	30.0	15.0	55.0	4.25	2
Planning	0.0	0.0	5.0	10.0	15.0	45.0	25.0	3.75	3
Leadership	0.0	0.0	0.0	9.5	28.6	47.6	14.3	3.67	4
Decision making	0.0	0.0	0.0	4.8	38.1	47.6	9.5	3.62	5
Communicating - oral	0.0	0.0	4.8	9.5	38.1	23.8	23.8	3.52	6
Leading	0.0	0.0	9.5	14.3	28.6	9.5	38.1	3.52	7
Coordinating	4.8	0.0	4.8	23.8	28.6	9.5	28.6	3.35	8
Organising	4.8	0.0	4.8	9.5	38.1	38.1	4.8	3.30	9
Negotiating	4.8	4.8	14.3	4.8	23.8	19.0	28.6	3.30	10
Initiating	10.0	0.0	10.0	20.0	10.0	35.0	15.0	3.28	11
Interpersonal	14.3	0.0	9.5	14.3	28.6	19.0	14.3	3.17	12
Procedures development	20.0	5.0	0.0	10.0	35.0	25.0	5.0	3.13	13
Technical	19.0	0.0	0.0	28.6	23.8	23.8	4.8	3.06	14
Supervisory	4.8	0.0	9.5	28.6	19.0	28.6	9.5	3.00	15
Persuading	10.0	5.0	10.0	20.0	30.0	20.0	5.0	2.72	16
Controlling	4.8	4.8	14.3	19.0	33.3	14.3	9.5	2.70	17

Table 2 indicates the extent to which the TBE activities impacted on participants in terms of percentage responses to a scale of 1 (minor) to 5 (major), an additional point 'did not', and MSs between 0.00 and 5.00. It is notable that all the MSs are > 2.50, which indicates that in general the TBE activities impacted more of a major than a minor extent on participants. However, a review of the MSs in terms of ranges provides a more detailed perspective. 2 / 7 (28.6%) MSs are > 4.17 ≤ 5.00, which indicates the impact can be deemed to be between a near major extent and a major / major extent – building confidence in your own abilities, and removing you from your 'comfort zone'. 4 / 7 (57.1%) MSs are > 3.34 ≤ 4.17, which indicates the impact can be deemed to be between some extent to a near major extent / near major extent - your ability to communicate with your 1st year colleagues, your ability to complete a task, enhancing alternative thought processes, and improving your time management skills. The last ranked impact, namely your ability to be creative, has a MS > 2.50 ≤ 3.34, which indicates the extent is between a near minor extent to some extent / some extent.

Table 2. Extent to which the TBE activities impacted on participants.

Impact	Response (%)							MS	R
	Un-sure	Did not	Minor …………………………...Major						
			1	2	3	4	5		
Building confidence in your own abilities	0.0	0.0	0.0	4.8	9.5	42.9	42.9	4.24	1
Removing you from your 'comfort zone'	0.0	0.0	0.0	4.8	19.0	23.8	52.4	4.24	2
Your ability to communicate with your 1st year colleagues	4.8	0.0	0.0	14.3	9.5	19.0	52.4	4.15	3
Your ability to complete a task	0.0	0.0	0.0	4.8	14.3	47.6	33.3	4.10	4
Enhancing alternative thought processes	4.8	0.0	0.0	14.3	4.8	42.9	33.3	4.00	5
Improving your time management skills	4.8	0.0	4.8	0.0	28.6	38.1	23.8	3.80	6
Your ability to be creative	0.0	0.0	9.5	9.5	23.8	52.4	4.8	3.33	7

Table 3 indicates the extent to which the TBE activities enhanced participants' various abilities in terms of percentage responses to a scale of 1 (minor) to 5 (major), an additional point 'did not', and MSs between 0.00 and 5.00. It is notable that all the MSs are > 2.50, which indicates that in general the TBE activities enhanced participants' various abilities to more of a major than a minor extent. It is

notable that all the MSs are > 3.34 ≤ 4.17, which indicates the enhancement is between some extent to a near major extent / near major extent. Strategise, ranked first is followed closely by evolve tactics, take action, and plan.

Table 3. Extent to which the TBE activities enhanced participants' abilities.

Impact	Response (%)							MS	R
	Un-sure	Did not	Minor ……………………...Major						
			1	2	3	4	5		
Strategise	0.0	0.0	4.8	0.0	19.0	47.6	28.6	3.95	1
Evolve tactics	9.5	0.0	4.8	4.8	14.3	38.1	28.6	3.89	2
Take action	0.0	0.0	4.8	0.0	33.3	28.6	33.3	3.86	3
Plan	0.0	0.0	0.0	9.5	19.0	52.4	19.0	3.81	4

Table 4 indicates the extent to which the TBE activities enhanced participants' attributes / states in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs between 1.00 and 5.00. It is notable that all the MSs are > 3.00, which indicates that in general the TBE activities enhanced participants' attributes / states to more of a major than a minor extent. The attributes / states were identified in a study conducted by Smallwood et al. (2013).

It is notable that only 1 / 15 (6.7%) MSs is > 4.20 ≤ 5.00, which indicates the TBE activities enhanced the participants' happiness between a near major extent to a major extent / major extent.

A further 9 / 15 (60.0%) MSs are > 3.40 ≤ 4.20, which indicates the TBE activities enhanced the participants' attributes / states between some extent to a near major extent / near major extent - social responsibility, problem solving, flexibility, interpersonal relationship, empathy, emotional self-awareness, self-actualisation, self-regard, and independence.

The remaining 5 / 15 (33.3%) of MSs are > 2.60 ≤ 3.40, which indicates the TBE activities enhanced the participants' attributes / states between a near minor extent to some extent / some extent - stress tolerance, reality testing, assertiveness, optimism, and impulse control.

Table 4. Extent to which the TBE activities enhanced participants' attributes / states.

Attribute / State	Response (%)						MS	R
	Un-sure	Minor ……………………...Major						
		1	2	3	4	5		
Happiness	5.0	5.0	0.0	0.0	40.0	50.0	4.37	1
Social responsibility	0.0	0.0	5.3	10.5	47.4	36.8	4.16	2
Problem solving	0.0	0.0	0.0	20.0	45.0	35.0	4.15	3
Flexibility	10.0	0.0	10.0	25.0	20.0	35.0	3.89	4
Interpersonal relationship	0.0	0.0	15.0	25.0	25.0	35.0	3.80	5
Empathy	5.0	10.0	5.0	15.0	40.0	25.0	3.68	6
Emotional self-awareness	0.0	0.0	20.0	5.0	65.0	10.0	3.65	7
Self-actualisation	5.3	0.0	10.5	36.8	26.3	21.1	3.61	8
Self-regard	10.5	0.0	5.3	47.4	26.3	10.5	3.47	9
Independence	0.0	14.3	9.5	28.6	14.3	33.3	3.43	10
Stress tolerance	5.0	5.0	10.0	35.0	35.0	10.0	3.37	11
Reality testing	15.0	0.0	20.0	30.0	20.0	15.0	3.35	12
Assertiveness	10.5	5.3	10.5	31.6	36.8	5.3	3.29	13
Optimism	20.0	0.0	25.0	20.0	30.0	5.0	3.19	14
Impulse control	5.0	10.0	20.0	20.0	35.0	10.0	3.16	15

Table 5 indicates the extent to which participants enjoyed and benefitted from the TBE activities in terms of percentage responses to a scale of 1 (minor) to 5 (major), an additional point 'did not', and MSs between 0.00 and 5.00. The MSs of enjoyed (4.71) and benefited from (4.37) are > 4.17 ≤ 5.00, which indicates that the enjoyment and benefit is between a near major extent to a major extent / major extent.

Table 5. Extent to which participants enjoyed and benefitted from the TBE activities.

Aspect	Response (%)							MS	R
	Un-sure	Did not	Minor ……………………...Major						
			1	2	3	4	5		
Enjoyed	0.0	0.0	0.0	0.0	4.8	19.0	76.2	4.71	1
Benefited from	0.0	0.0	0.0	0.0	10.5	42.1	47.4	4.37	2

5. Conclusions and recommendations

TBEs, which constitute non-traditional academic programme interventions, impact on first-year students' ability, to manage themselves, strategise, plan, evolve tactics, and take action, which in turn should contribute to their ability to manage their studies, and successfully complete assignments, tutorials, projects, tests and exams, and the undergraduate programme, although this can only be quantified on completion of a full academic year. This conclusion amplifies the need for the inclusion of non-traditional academic programme interventions construction management and related tertiary programmes.

Given that the TBE activities enhanced participants' skills more to a major than a minor extent, it can be concluded that non-traditional academic programme interventions can enhance skills, which is not necessarily easy to achieve in the lecture environment.

The impact of the TBE events on participants in terms of removing them from their 'comfort zone', increasing their confidence, improving their ability to communicate with peers, manage time, and complete tasks, and enhance alternative thought processes, and ability to be creative, further amplifies the role of non-traditional academic programme interventions.

The extent to which the TBE activities enhanced participants' attributes / states relative to emotional intelligence, indicates the role of non-traditional academic programme interventions in terms of addressing this need during the tertiary education process.

The extent to which participants enjoyed and benefitted from the TBE activities leads to the conclusion that tertiary education should include non-traditional academic programme interventions.

Overall, the impact should contribute to their ability to respond during employment interviews, integrate more effectively into the construction industry in terms of vacation work, and after graduation, and to fulfil a form of management function in the industry.

The TBE should continue to be undertaken on an annual basis, and the impact on participants should be assessed. Furthermore, the study should evolve into a longitudinal study and be reported on in that context to determine any trends.

The conclusions amplify the need for the inclusion of non-traditional academic programme interventions in construction management and related tertiary programmes.

Further potential events directed at enhancing students' abilities and increasing confidence in their abilities, as well as providing them opportunities to test alternative thought processes, should be investigated.

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GUESS WHO'S COMING TO DINNER! THE IMPACT OF (VIRTUAL) GUEST SPEAKERS IN A BUSINESS CLASS: A STUDENT PERSPECTIVE

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Abstract

This research explores students' perceptions and expectations of the impact of guest speakers on their educational experience. This approach identifies the benefits and contributions made to students' learning experience. The rationale for this research is to examine and identify the impact of guest speakers on student learning and understand how this experience can act as a portal to a deeper understanding of how students' learn. The inclusion of guest speakers is important as it integrates the universal design for learning framework with different teaching approaches appealing to the phenomenon of multiple intelligences. From January to May 2022 and 2023, guest speakers presented to postgraduate students in the module EC6622: Global Business Strategy and Business Relationships. A mixed methods approach was adopted to incorporate both quantitative and qualitative elements within the survey. Results suggest that 59.1% think they "always or often" benefit from attending guest speaker presentations. Just over 10% reported that having guest speakers present in the module was very "relevant and useful". Finally, the thematic approach revealed that some of the students found it beneficial to have in-person guest speakers as they were "more valuable and interactive". They reported they felt it was "easier to ask a question" as opposed to delivering the presentation virtually. Findings suggest that students see guest speakers in the classroom as beneficial but do not always see the relevance of their presentations to the module material. This suggests that, while guest speakers lead to a more rounded learning experience, more work may be needed to link the speakers' content to the taught material.

Keywords: Educational experience, multiple intelligences, mixed methods.

1. Introduction

Having guest speakers in the classroom is a form of scholarship known as experiential learning, whereby guest speakers are invited to provide invaluable insights, perspectives and experiences of the workplace. This creates opportunities for students to engage with real-world experts. Guest speakers offer the opportunity of diverse viewpoints with practical applications of their experiences which exposes students to insights to which they would not necessarily be exposed to in the traditional classroom.

The inclusion of guest speakers as a teaching tool is important, regardless of the subject being taught, because presenting learning materials using multiple approaches appeals to differences in how students learn, drawing on the phenomenon of multiple intelligences (Gardner, 1983, 2004). By providing multiple means of representation, engagement and expression, this can enhance the inclusivity and accessibility of the learning environment linking with the principles of Universal Design for learning (UDL). Teaching a topic in multiple ways helps students to understand and build their confidence in the subject matter. In addition, there is a positive externality because conveying the topic in different ways not only bridges the gap between academic teaching and business practice but also reinforces and increases a teacher's mastery of the subject.

Biggs and Tang (2011) emphasise that effective teaching should discourage surface learning and promote an in-depth learning experience. Guest speakers need to be carefully selected to produce depth and granularity in their presentations to benefit the future workforce (Malhotra & Miller, 1999; Cooper et al., 2004). Experienced speakers can often lead to advancement in learning and enhance human capital, generating in the long term a competitive advantage in the global marketplace by producing a well-rounded, experienced student exposed to 'real-life' workplace situations. Exposure to real world business experiences gives student an intuitive understanding of business operations (Roth, 2001). Incorporating speakers can also contribute to the scholarship of teaching by fostering collaboration

between academia and industry while also promoting interdisciplinary collaborations and promoting innovation in teaching methods.

Riebe et al. (2013) highlight the need to select guest speakers carefully to contribute to active learning. Ormrod (2004) highlights that sometimes students can use inappropriate thinking skills or learn insufficient content, while also not fully participating in the experience. Active learning is promoting a community of learning through engagement in the classroom. Having guest speakers in the class provides students with the opportunity to discuss, problem solve and, where possible, actively engage with the teaching material to promote deeper learning and understanding of the material. Engagement is one of the fundamental tools for learning and leads to a better understanding of the topic under discussion. Engagement in the learning process, through activities such as these, is associated with improved learning outcomes, and can help students to retain information as well as have a deeper understanding of concepts. Deeper learning promotes the use of new ideas/approaches and links them to the theory, principles and concepts learnt in class to critically problem solve real life applications (Weigel, 2002). This research examines how invited guest speakers in the classroom (virtually and in person) impact on students' learning.

2. Objectives

Therefore, the objective of this research was to explore students' perceptions and expectations of the impact of guest speakers on their educational experience at postgraduate level.

3. Methods

During semester 2, from January to May 2022 and 2023, guest speakers presented to postgraduate students in the module EC6622: Global Business Strategy and Business Relationships, with a class size of approx 91 national and international students. This module aims to introduce students to methods of understanding competitive dynamics, the interactive nature of players in the market, including stakeholders such as government. National and international business relationships are explored, including cooperation, conflict and ethics. Strategic decision making in a global setting is examined in order to produce learning outcomes around how to analyse the nature of business relationships and explain firm flexibility in conditions of uncertainty as well as assessing game theory for understanding strategic interactive decision making. The course material and case studies take a broad cross-sectoral and international approach, and the module is worth 5 credits (2 hours per week) out of 60 credits in Part 1 of the MSc in Business Economics in University College Cork, Ireland (Part 2 being a dissertation).

Preparation is key, so speakers were invited at least three months in advance in order for us and them to prepare well in advance of the presentation to maximise their impact, as recommended by Ostorga and Farruggio, 2013. In preparation, we agreed to provide some guidance to speakers, ranging from helping to prepare their slides, to identifying a relevant topic, to possible student questions. We also released a document in advance of the presentation to the students, to briefly explain who the guest speaker was and the type of business in which they operate. This advance preparation was done to try to construct a more active learning environment. The pre-confirmed guest speakers were chosen in order to demonstrate diversity in terms of their demographic characteristics, the size and location of the private firms and organisations (Irish Business and Employers Confederation (IBEC)) and the range of services offered to different customers. There were four speakers in total: *Mr Ger Brady, Head Economist IBEC Dublin (virtual & in person), Ms Sandra Cardoso, CEO Primeslot Portugal (virtual), Mr Ed Donovan, CEO Heart Aid Cork (in person),* and *Mr Jack McGrath, Director of Strategy & Change Ingenium Australia (virtual).* Two of the speakers were previous graduates of the Department of Economics in UCC. Having at least two of these presenters from UCC was important from the Departments' perspective to demonstrate quality and success.

Within the Scholarship of Teaching and Learning literature there is an emphasis on the need to consider both quantitative and qualitative approaches by adopting a mixed methods approach (Zhou, 2022; Sammons & Davis, 2017). There was a mix of open and closed questions included on the survey disseminated to students on the 8th of May 2023 measuring the impact of all four guest speakers on students' educational experiences. When designing the questionnaire, a matrix question was also included, using a Likert scale to determine the level of agreement. The low response rate and consequent small sample size (n=36) affected the type of analysis that could be applied. However, descriptive statistics were produced. Open questions were included to ensure richness in response. With the qualitative data, a thematic analysis (Braun & Clarke, 2006) was applied in order to determine the main themes emerging from the responses and support the research findings. The proposal obtained ethical approval from the Social Research Ethics Committee in UCC.

4. Discussion

The respondents comprised of 61% male and 36% female students with a further 3% preferring not to say. The average age of the class was 24 years old (standard deviation 2.4). Within the class 47% were Irish, 50% were International/Non-EU students and 3% were International/ EU students. A question on employment was also included, with 43% not working, 11% working a 40-hour week and 46% working between 6 and 35 hrs per week. 57% planned to seek employment in Ireland with the remaining 43% having secured employment in Ireland, planning to emigrate (with or without secured employment) or with other (unspecified) plans.

Most (91%) reported being interested or very interested in the programme, while a majority found it challenging some (58%) or most (36%) of the time. Most expected to achieve a similar grade to their previous year. Students report a benefit from attending Economics lectures sometimes (33%), most of the time (42%) or always (22%).

Figure 1. Number of Guest Speaker Presentations Attended.
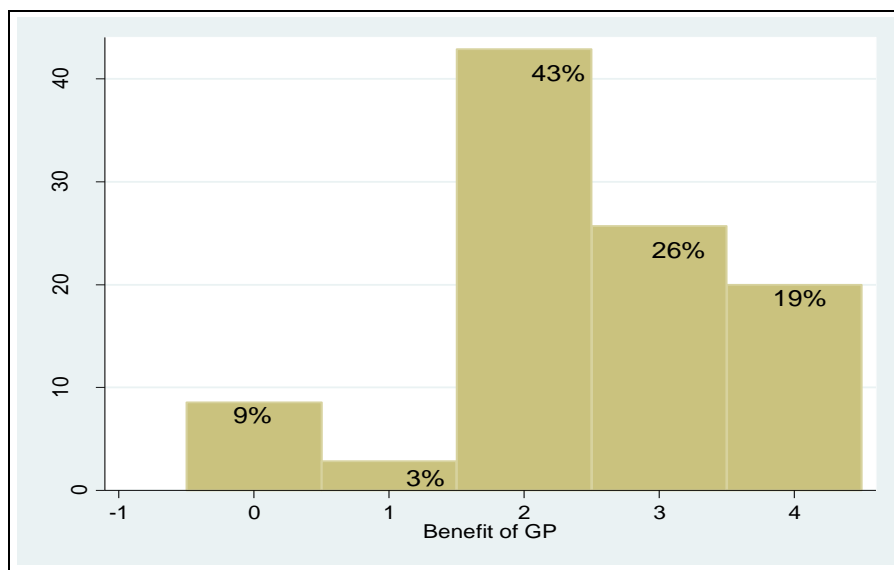
Note: GP-Guest Speaker

Table 1. Impact of the Guest speaker from Students' perspectives.

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
The speaker related the theory learnt in class to professional examples discussed during the presentation.	14.3%	62.9%	8.6%	5.7%	8.6%
The speaker made my learning experience more relevant.	28.6%	45.7%	2.9%	8.6%	14.3%
The speaker provided an insight into industry.	45.7%	45.7%	0%	5.7%	2.9%
The speaker spoke about something I didn't know already.	40%	51.4%	5.7%	0%	2.9%
The speaker gave a different perspective on the topic.	31.4%	48.6%	8.6%	2.9%	8.6%
The speaker provided information that will benefit my career plans.	31.4%	40%	2.9%	5.7%	20%

Overall, the majority of respondents either 'strongly agree' or 'agree' with the above statements measuring the impact of a guest speaker on their educational experience (See Table 1). Within the 'strongly agreed' category, the highest percentage of students 45.7%, 'strongly agreed' that the speaker gave them an insight into their industry, with the lowest percentage of students, 14.3%, strongly agreeing that the speaker related the theory learnt in class to professional examples. Within the agreed category, it ranged from 62.9% agreeing that the speakers related the theory learnt in class to professional examples to 40% agreeing that the information will benefit career plans. Those that 'disagreed' or 'strongly

disagreed' with the statements ranged from the highest of 8.6% to the lowest of zero. In the 'no opinion' category 20% had 'no opinion' on whether the speaker provided information that will benefit their career plans with only a low minority of 2.9% having 'no opinion' on whether they provided an insight into the industry and whether they spoke about something they did not know already.

Table 2. Characteristics of the presentations.

	Not at all	Not very	Quite	Very	Extremely
Appropriate	5.7%	8.5%	22.9%	48.6%	14.3%
Informative	5.7%	2.9%	37.1%	28.6%	25.7%
Interesting	5.7%	11.4%	45.7%	20%	17.1%
Necessary	8.6%	17.1%	42.9%	25.7%	5.7%
Relevant	8.6%	11.4%	25.7%	40%	14.3%
Useful	2.9%	11.4%	28.6%	42.9%	14.3%

A majority of respondents felt that the presentations were appropriate, informative, relevant and useful, but there was less agreement about whether they were interesting or necessary (see Table 2). Attitudes were almost evenly split as to whether the content of guest speaker presentations should be examinable. Some respondents felt that, to improve the guest speaker sessions, it was important to have the guest speakers visit the classroom rather than present online (n=6).

There was also an open-ended question included to measure whether students felt there were other ways that guest speakers could impact their educational experience. "Help with finding a future career" (n=3) was cited as having an impact. Students felt that the guest speaker "could engage in practical issues or real-life situations" and "the topics could be more relevant" (n=4). Students also suggested to pique their interest by highlighting "some of the challenges they faced and how they overcame them" (n=1) or to play some games to catch their attention" (n=1).

Finally, a question was included about what the students perceived as the most valuable information learned from the experience. Some reported that they learnt about the 'real world' and it gave then an 'insight into the industry with some practical applications' (n=3). Business development and analytical skills were also identified (n=3), as were career path and life choices (n=2). Interestingly, interpersonal skills such as confidence and flexibility were also highlighted by some students from the experience (see Table 3).

Table 3. Learning outcomes from a student perspective.

Themes	No
Real world experience/Industry insight/Practical application	3
Business development/analytical skills	3
Career paths (and changes)/life choices of past graduates	2
Have confidence in what you do	1
Flexibility	1
Applicability of programme to diverse fields	1
Other	2

5. Conclusion

Students report some benefit in guest speaker sessions, but perhaps demonstrate less enthusiasm than expected. They see it as a complement to existing material but not always directly relevant to the material. However, they do see the benefits of having invited guest speakers citing them as useful and providing insights and understanding of the guest speakers' experiences.

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PERCEPTUAL-VISUAL-MOTOR SKILLS AND SPEED AND LEGIBILITY OF HANDWRITING IN MIXED SUBTYPE DYSLEXIA

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Abstract

For handwriting to be acquired, it is necessary to combine coordination of visual-motor skills to the motor planning, cognitive planning and to the perceptual skills.A study showed that all students with Dyslexia of the Mixed subtype have lower performance in writing quality and visual-motor perceptual ability. This study aimed to present a case study on the relationship between the perceptual-visual-motor skills, the speed and legibility of handwriting in schoolchildren with mixed dyslexia. Ten schoolchildren of both sexes, aged between 9 years and 13 years and 1 month with an interdisciplinary diagnosis of mixed subtype dyslexia participated in this study. The translated and adapted Brazilian Portuguese version of the Detailed Assessment of Speed of Handwriting (DASH) and the Visual Perception Development Test 3 (DTVP 3) were applied. DASH consists of five tasks: best copy, alphabet writing, quick copy of a sentence, quick graphic and free writing. DTVP 3 consists of subtests with reduced motor skills, general visual perception and visual-motor integration. For the study of the relationship between the variables in this study, a correlation analysis was performed for variables with non-parametric distributions, using the Spearman coefficient, in order to measure the degree of association between two quantitative variables of interest. The results revealed relationships between the skills of general visual perception, reduced motor skills and viso-motor integration with the speed and legibility of handwriting, showing that the altered visual component present in mixed subtype dyslexia may be responsible for the viso-motor alterations that compromise speed and legibility of the handwriting of these students. the findings of this study allowed us to conclude that the better the hand-eye coordination, the greater the number of written words and the number of readable words and that the greater the use of automaticity for writing letters of the alphabet and number of words written, the lesser the use of figure-ground visual ability.

Keywords: Handwriting, assessment, dyslexia.

1. Introduction

The perceptual-visual-motor function can be understood as the result of the visual-motor skills, motor and cognitive planning, visual perception, position in space, spatial relations, figure-ground and shape constancy (Brown & Rodger, 2008). However, if a student presents alterations in the development of visual perception, it may cause difficulties in visual-motor skills, that is, in the ability to coordinate vision with body movements, in object recognition, in the relationships between themselves and space and in the basic acquisitions of size, shape and spatial orientation, which in turn may interfere with the typical development of learning processes (Fusco, Okuda, & Capellini, 2011).

The literature indicates that complaints related to difficulties in handwriting have increased and point to the lack of perceptual-visual-motor skills as a justification (Howe et al., 2017). Such difficulties in handwriting can be seen in students with learning disabilities and dyslexia has a high prevalence among these disorders.

Dyslexia of the Mixed subtype is characterized as a specific learning disorder of reading (APA, 2013). Students with Dyslexia of the Mixed subtype have lower performance in writing quality and visual-motor (Sellin, 2020)

2. Methods

This study aimed to relate the visual-motor perception skills and the speed and readability of handwriting in students with mixed subtype dyslexia.

This study was approved by the Research Ethics Committee (4.862.668) of the Faculty of Philosophy and Sciences of the São Paulo State University "Júlio de Mesquita Filho" - FFC/UNESP, Marília, São Paulo, Brazil.

2.1. Characterization of students

Ten students of both genders aged between 9 years and 13 years and 1 month, diagnosed with mixed subtype dyslexia were selected by convenience, that is, they all come from the Specialized Rehabilitation Center CER/CEES II, located in the city of Marília, São Paulo, Brazil. These students underwent multidisciplinary assessment and diagnosis, including speech therapy, neurological and neuropsychological assessment and were not submitted to any speech therapy or psychoeducational intervention prior or during data collection for this study.

2.2. Description of the procedures

To achieve the objective of this study, the following instruments were used: The Detailed Assessment of Speed of Handwriting – DASH is a procedure used to assess the speed and readability of handwriting (Barnett et al., 2007; Cardoso, 2014; Cardoso, Henderson, & Capellini, 2014) and The Developmental Test of Visual Perception, third edition (DTVP-3) (Hammill, Pearson, & Voress, 2014).

- **Analysis of results**

Data were statistically analyzed using the IBM SPSS Statistics Software (Statistical Package for the Social Sciences) version 25.0. The level of statistical significance defined in this study was set at 0.05 (5%), that is, all confidence intervals built throughout the work were constructed with 95% statistical confidence. The statistical test used was Spearman's Correlation Analysis, in order to verify the degree of relationship between the variables of interest.

3. Results

Table 1. Shows the relationship between DTVP-3 subtests and Copy Best task from the DASH.

Variable	Statistic	[DTVP- score] EH	[DTVP- score] CO	[DTVP- score] FG	[DTVP- score] VC	[DTVP- score] FC	[DTVP- terms 1] EH	[DTVP- terms 1] CO	[DTVP- terms 1] FG	[DTVP- terms 1] VC	[DTVP- terms 1] FC	[DTVP- terms 2] VMI	[DTVP- terms 2] MRVP	[DTVP- terms 2] GVP
W2	CC (r)	0.667	-0.095	-0.180	0.034	-0.019	0.469	-0.205	-0.519	0.053	0.134	0.336	-0.052	0.310
	Sig. (p)	0.035*	0.794	0.620	0.926	0.960	0.172	0.571	0.125	0.883	0.712	0.343	0.886	0.383
	N	10	10	10	10	10	10	10	10	10	10	10	10	10
LW2	CC (r)	0.653	0.461	-0.172	0.062	-0.344	0.436	0.285	-0.494	0.102	-0.177	0.612	-0.317	0.381
	Sig. (p)	0.041*	0.180	0.634	0.864	0.331	0.207	0.425	0.147	0.779	0.624	0.060	0.372	0.278
	N	10	10	10	10	10	10	10	10	10	10	10	10	10
LWPM	CC (r)	0.581	0.437	-0.354	0.098	0.171	0.607	0.306	-0.470	0.227	0.144	0.671	-0.205	0.387
	Sig. (p)	0.078	0.206	0.316	0.787	0.636	0.063	0.390	0.170	0.529	0.691	0.034*	0.570	0.269

Note: EH: eye-hand coordination, CO: copying, FG: figure-ground, VC: visual closure, FC: form constancy, VMI: visual-motor integration, MRVP: motor reduced visual perception, GVP: general visual perception, W2: words written in 2nd minute, LW2: legible words in 2nd minute, LWPM: legible words per minute

Table 1 showed that the better the eye-hand coordination, the higher the number of written words and number of readable words in the second minute, also which showed that the better the visual-motor integration, the greater the amount of readable words per minute.

Table 2. Correlation between the subtests of DTVP-3 and the DASH alphabet writing task.

Variable	Statistic	[DTVP-score] EH	[DTVP-score] CO	[DTVP-score] FG	[DTVP-score] VC	[DTVP-score] FC	[DTVP terms 1] EH	[DTVP terms 1] CO	[DTVP-terms 1] FG	[DTVP-terms 1] VC	[DTVP-terms 1] FC	[DTVP-terms 2] VMI	[DTVP-terms 2] MRVP	[DTVP-termos 2] GVP
Total letters written	CC (r)	-0.003	0.282	-0.630	0.153	-0.350	0.094	0.330	-0.709	0.140	-0.336	0.149	-0.582	-0.160
	Sig. (p)	0.993	0.430	0.051	0.674	0.321	0.796	0.351	0.022*	0.699	0.343	0.681	0.078	0.658
	n	10	10	10	10	10	10	10	10	10	10	10	10	10

Note: EH: eye-hand coordination, CO: copying, FG: figure-ground, VC: visual closure, FC: form constancy, VMI: visual-motor integration, MRVP: motor reduced visual perception, GVP: general visual perception

In Table 2, the correlation between the DTVP-3 subtests and the DASH alphabet writing task, which indicated that the greater the use of automaticity for the writing of alphabet letters, the less the use of visual figure-ground skill.

Table 3. Correlation between the DTVP-3 subtests and the DASH copy fast task.

Variable	Statistic	[DTVP-score] EH	[DTVP-score] CO	[DTVP-score] FG	[DTVP-score] VC	[DTVP-score] FC	[DTVP terms 1] EH	[DTVP terms 1] CO	[DTVP-terms 1] FG	[DTVP-terms 1] VC	[DTVP terms 1] FC	[DTVP-terms 2] VMI	[DTVP-terms 2] MRVP	[DTVP-terms 2] GVP
W2	CC (r)	0.664	0.095	-0.489	0.185	0.043	0.521	-0.061	-0.690	0.211	0.080	0.505	-0.228	0.237
	Sig. (p)	0.036*	0.794	0.151	0.610	0.906	0.123	0.868	0.027*	0.559	0.827	0.136	0.526	0.509
	N	10	10	10	10	10	10	10	10	10	10	10	10	10

Note: EH: eye-hand coordination, CO: copying, FG: figure-ground, VC: visual closure, FC: form constancy, VMI: visual-motor integration, MRVP: motor reduced visual perception, GVP: general visual perception, W2: words written in 2nd minute

Table 3 shows the relationship between the DTVP-3 subtests and the DASH copy fast task, indicating that the better the eye-hand coordination, the greater the number of words written in the second minute. This table also indicated that the greater the number of words written in the second minute, the less the use of the visual figure-ground skill, thereby demonstrating that automaticity in writing words has little dependence on the task of visual closure.

Table 4. Correlation between the subtests and variables of the DTVP-3 and the DASH free writing task.

Variable	Statistic	[DTVP-score] EH	[DTVP-score] CO	[DTVP-score] FG	[DTVP-score] VC	[DTVP-score] FC	[DTVP terms 1] EH	[DTVP terms 1] CO	[DTVP terms 1] FG	[DTVP terms 1] VC	[DTVP terms 1] FC	[DTVP-terms 2] VMI	[DTVP-terms 2] MRVP	[DTVP-termos 2] GVP
LW2	CC (r)	0.602	-0.483	0.263	-0.102	0.210	0.659	-0.592	0.082	-0.057	0.456	0.067	0.317	0.303
	Sig. (p)	0.066	0.157	0.463	0.780	0.561	0.038*	0.072	0.821	0.877	0.186	0.854	0.373	0.394
	N	10	10	10	10	10	10	10	10	10	10	10	10	10
IW2	CC (r)	0.154	-0.590	0.115	0.160	0.123	-0.034	-0.678	-0.203	0.176	0.108	-0.240	0.290	-0.125
	Sig. (p)	0.670	0.072	0.753	0.659	0.734	0.925	0.031*	0.574	0.626	0.766	0.505	0.416	0.730
	N	10	10	10	10	10	10	10	10	10	10	10	10	10

Note: EH: eye-hand coordination, CO: copying, FG: figure-ground, VC: visual closure, FC: form constancy, VMI: visual-motor integration, MRVP: motor reduced visual perception, GVP: general visual perception, LW2: legible words in second minute, IW2: illegible words in second minute

Table 4 shows the correlation between the subtests and variables of DTVP-3 and the DASH free writing task, indicating that the better the eye-hand coordination, the better the legibility in writing the words. It was also observed between copying and illegible words in the second minute, which indicates that the lower the performance in copying, the greater the number of illegible written words.

It was possible to observe that the visual-motor perception skills are related to handwriting. The results of this study showed that the difficulty in perceptual-visual-motor skills compromises the performance of handwriting related to the speed and legibility of handwriting (Racine et al., 2008).

Another hypothesis that would justify the low performance in DASH tasks in the cases presented in this study would be due to difficulties in visual perception, visuospatial orientation, visual memory and visual-motor integration (Feder & Majnemer, 2007), it can be justified by the fact that the processing of these skills is concentrated in the occipital lobe responsible for information, detailing and visual association (Rotta & Pedroso, 2015).

4. Conclusion

Through this study, it was possible to relate the visual-motor perception skills and the speed and readability of handwriting of students with mixed subtype dyslexia. Despite the justifications presented, further studies are still needed to help verify how factors related not only to visual skills, but also attention, perception, fine motor function and memory can interfere with handwriting.

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THE CONTRIBUTION OF A COLLABORATIVE APPROACH IN UNDERSTANDING RESISTANCE FACTORS WHEN IMPLEMENTING CHANGE

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Abstract

Students' wellbeing and their educational success are playing an increasingly important role in the policies, decisions, and actions of educational administrators. Therefore, the desire to meet students' needs is the driving force behind changes in the school environment, which can lead to a degree of resistance from educational staff who do not always see the merits of the proposed actions.The aim of this development research is to equip educational administrators with a better understanding of the resistance factors, concerns, reactions, and obstacles encountered when implementing change to promote educational success and well-being in a context of diversity. This development research, carried out with partners representing five francophone schools and community organizations involved with youth in four Canadian provinces, members of the RÉVERBÈRE research network.The research resulted in a preliminary report with the aim of developing a questionnaire to determine the presence of resistance, concerns, and organizational obstacles to change.The questionnaire then developed will be used by educational administrators to demystify and better understand the presence and the types of resistance in their institutions with the objective of establishing an initial portrait of their context reality in order to better support their staff members. This tool will consider current changes with a view to well-being, inclusion, and openness to diversity. In this communication, we most of all highlight the contribution of the development research process to the co-construction of the items in the preliminary report and the accumulation of evidence firstly based on research based knowledge , and then, during activities carried out with our partners. Validating items with partners in the field adds relevance to this report and enriches it with concrete examples from their respective environments where changes are taking place. In a context of major change, we will also highlight the benefits of a partnership approach, i.e. research and development, to encourage collaboration between members of the research and practice communities with a view to better understanding the factors of resistance to change in educational context.

Keywords: Educational change, resistance, development research, inclusion, diversity.

1. Introduction

The education sector is constantly changing to better support the diversity of learners. Educational changes require efforts and most of all adjustments from the education community, most of all teachers and the different partners involved in childrens' diverse learning and growing needs. These changes are not always easy, and they all too often lead to resistance on the part of educational partners, for a variety of reasons that we seek to better understand. It is through a development research process that this research aspires to better understand factors related to resistance within the educational system,, both school and community based, who are trying to meet the diversified needs of students. The aim of this collaborative project is also to promote a better understanding of concerns, reactions and obstacles associated with resistance. To do so, we wish, with our collaborative partners, to develop tools for administrators that would provide insight upon the anatomy of resistance within their organization. This project is part of the

RÉVERBÈRE research network[*]. Their mandate is to collaborate with various actors of the educational field by starting from their needs and then identify the knowledge gained from current research in order to generate a popularized, synthesized and contextualized product. The presence of resistance, concerns, reactions and obstacles encountered when implementing change for educational success and well-being in a context of diversity are part of this research development. We seek to bring to light the contribution of a collaborative approach to meeting the needs of local players.

2. Literature review

Educational change requires effort, a major investment by the educational community, and the active involvement of teachers (Lomba-Portela et al., 2022). The current context of social diversity calls for a review of past practices (Shields, 2013). Since change is an integral part of today's reality, schools must prepare learners to live in a changing society (Duclos, 2015). Change means the presence of resistance in the environment. According to Rousseau (2012), resistance to change can be defined as the fear of the unknown, losing power and of losing gains. It also involves the lack of relevant information, the real or perceived uselessness of change, the lack of resources and poor timing of the proposed change. For Collerette (2021), certain obstacles can hinder the implementation of change like inadequate staff training, a state of comfort or inertia with established practices, or traditions and practices deeply rooted within the organization. Although there are several levers for improving the implementation of change, as identified by Collerette (2021), it is essential to be aware of the resistance, concerns, reactions and obstacles encountered in the organization. Through his research, Shwering (2003) proposes to demystify the forces likely to enhance the change process or hinder the desired change. His attributes are largely concerned with the person's own attributes, such as cognitive style, personality, previous experience, ability to organize and plan.

3. Methodology

The research-development methodology (RD) model of Bergeron et al. (2021)[†] has been chosen for this project. This methodology is carried out with the involved partners in five distinct phases: identification of the development idea, innovative solution structuring, prototype developments, prototype improvement, and product dissemination. Since the proposed product is a questionnaire, we superimposed on RD the methodology for questionnaire development proposed by DeVellis (2012).

The first phase of RD for this project consists of identifying development ideas that support solutions for the well-being and educational success of young people in given contextes. As part of the RD process, meetings were held and a proposal was validated with partners. They requested a questionnaire that would support administrators to better understand resistance within their organization. A decision was taken to involve the partners in the various stages of the RD project, according to their respective levels of commitment. This phase identified the central themes related to the research topic. A literature review was conducted and articles selected were those representing resistance as perceived by educational managers. This phase was also associated with Devellis's (2012) vision of identifying the object of measurement.

The second phase of RD is to structure the solutions by making decisions, while formalizing guidelines for keeping records and developing a product. A collective work of formulation and reformulation of items related to resistance was launched with our partners inspired by themes previously extracted from the scientific literature review. Two types of resistance emerged from the survey: "internal" resistance from individuals, and "external" resistance from the organization. A lengthy process of co-construction led to the identification of items highlighting the resistance experienced by administrators in the field. This phase of the RD is associated with Devellis's research (2012) of generating a bank of items based on the knowledge gained from past research.

The third phase of RD is the development of prototypes by the team, resulting in a concrete product, in this case a preliminary report. Re-reading, categorizing and modifying enabled new structuration of the items and a first draft of the preliminary report to be drawn up. The partners were able to contribute to this stage by validating existing items. This phase of the RD is associated with determining

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[*] RÉVERBÈRE is a "Réseau de recherche et de valorisation de la recherche pour le bien-être et la réussite" (Research and Valorization Network for Well-Being and Educational Success) The RÉVERBÈRE is a pan-Canadian French-language network of university-community collaborations that aims to develop popularized, synthesized and contextualized products based on a research-and-development approach, and shared on an open-access basis. https://reverbereeducation.com/

[†] Bergeron et al. (2021): Research and development at The RÉVERBÈRE, see page 7. https://reverbereeducation-1fc82.kxcdn.com/wp-content/uploads/2022/02/Doc_cadre_Reverbere_2021_Interactif_final1.pdf

the format of the measurement scale and carrying out an initial evaluation of the statement bank with the help of experts from Devellis (2012).

The fourth phase of the prototype improvement in RD allows the team to test the product in partnership with education stakeholders. This phase was carried out with partners. Working in the field, they enriched certain items by bringing in real-life examples from their respective environments, while validating certain items gathered from the review. This phase of the RD is associated with that of determining the format of the measurement scale and carrying out an initial evaluation of the statement bank with the help of experts from Devellis (2012).

The fifth phase of RD remains to be developed, namely that of dissemination. This phase involves disseminating the products, i.e. making the tools available to various partners on the Réverbère website.

3.1. Participants

Participants came from school divisions and youth centers for teeangers with special needs in four Canadian provinces: Nova-Scotia, Quebec, Ontario, and Saskatchewan, as well as members of the Reverbère research network. The partners collaborated in all phases of the product's development. A special consultation during a symposium involving an estimated 100 participants coming from various educational fields responded to a Mentimeter survey from our emerging themes on resistance. The team responsible for developing this product includes an after degree student and research assistant, and four researchers from different Canadian universities. Members of the RÉVERBÈRE organizational management team were also involved at different phases to ensure that the product's aim respected the organization's mission well-being and educational success in a context of diversity.

3.2. Data collection and analysis

RD adopts a collaborative approach, which distinguishes it from other types of research, since it is carried out with the people involved in the field (Bergeron et al., 2021). The method of data collection and analysis for RD is an iterative process, as partners collaborate with the research team on an ongoing process. The team obtains results from items in the research-based knowledge review (RBK), but also from data collected from partners and from the Mentimeter done during an educational symposium.

A first stage of analysis of RBK on resistance in organizations led to the identification of items which became a preliminary document of reference. Data was then collected from partners in the four Canadian provinces. Interviews were conducted with partners to validate the items identified, and to add elements to the preliminary report. Data analysis was carried out by the research team and validated with the partners. Figure 1 illustrates the results of the Mentimer survey done in French. The main themes have been translated in English for the purpose of this article.

Figure 1. Themes emerging from the Mentimeter survey.
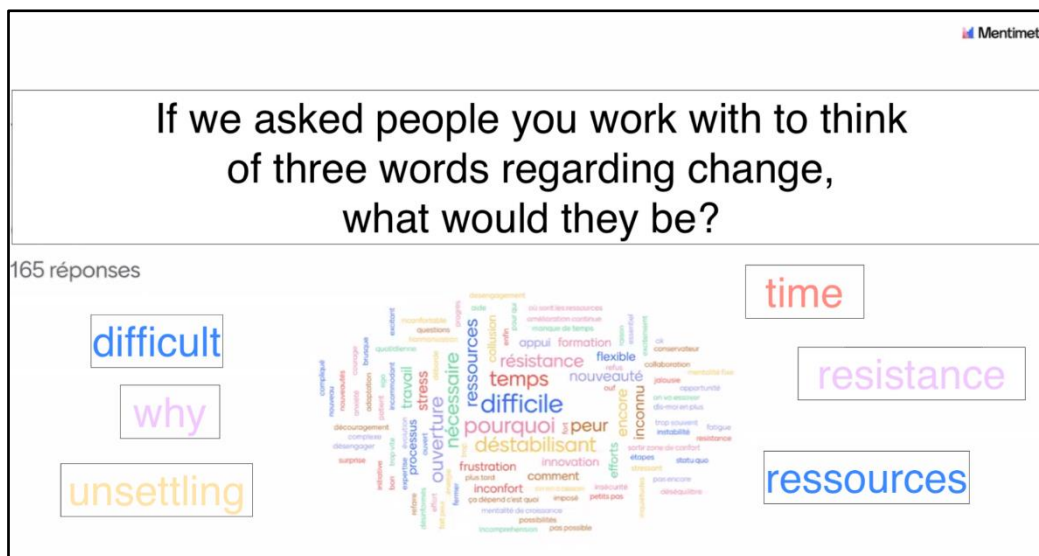
4. Findings

The items that emerged from the collaboration with partners were divided into different categories according to two major types of resistance: individual or organizational. A lengthy process of co-construction, rewriting and restructuring the categories was carried out. This said, it is still an ongoing process and our results are preliminary. They still give us a good insight into the factors, concerns, reactions, and obstacles when implementing change to promote educational success and well-being in a context of diversity. The final stage of the RD process is scheduled for autumn 2024. As we still need to finalize the product, validate it with partners and the RÉVERBÈRE members organizational management team.

4.1. Examples of preliminary items emerging from the RBK

The following are examples of the broad categories and related items identified from the RBK. They also reflect the RÉVERBÈRE mission to promote educational success and well-being in a context of diversity.

Figure 2. Preliminary items emerging from RBK.

Values, beliefs and paradigms
- People are not aware of the heterogeneity organization's needs.

Physical and emotional states triggered by change
- People feel unsettled by the proposed change.

Organization's culture
- Because of society's great inequality, making the organization more egalitarian through targeted change seems complicated.

Employee competencies (knowledge, skills and attitudes)
- People's usual practices do not adequately meet the needs of the youth attending the organization.

4.2. Examples of preliminary items merging from the activities with partners

The following items were developed in collaboration with our partners and also reflect the RÉVERBÈRE mission to promote educational success and well-being in a context of diversity.

Figure 3. Preliminary items emerging from partners.

Values, beliefs and paradigms
Change disrupts people's educational philosophy.

Change-related tasks
Staff perceive their work has become more complex and onerous because of the diversity of youth (e.g. language, culture and special needs)

Change-related tasks
Staff commitment to youth is compromised by the perceived difficulty of taking their diversity into account.

Change-related tasks
Change is perceived as difficult to initiate because it involves inclusion.

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5. Discussion, recommendations and conclusions

The knowledge gained from the research and the collaborative approach enabled us to develop an initial preliminary report on the resistance experienced by staff members in the context of change for the well-being and success in educational environments. Although this report is preliminary, several findings emerging from Bergeron *et al*.'s (2021) collaborative RD approach adds value to the research design by bringing together the scientific and practice community. Collaboration involves a diversity of players, enabling complementary backgrounds and expertise, while forming part of a pan-Canadian network. The purpose of the questionnaire for administrators is to demystify the resistance present in the community, with a view to bringing about educational change in the light of current issues. The tool, produced in collaboration with researchers and partners, responds to the educational environment by involving the players concerned by organizational change. Collaboration remains a central asset for the research community and we truly believe that our initiative will bring insight about resistance factors, concerns, reactions, and obstacles encountered when implementing change to promote educational success and well-being in a context of diversity.

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INCREASING GEOMETRIC LITERACY SKILLS OF FUTURE MATHEMATICS TEACHERS THROUGH 3D PRINTING ACTIVITIES IN GEOGEBRA ENVIRONMENT

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Abstract

Integrating digital technologies into education, particularly in the area of geometric literacy, is transformative. GeoGebra's dynamic mathematics software facilitates interactive learning of geometry and algebra that is consistent with constructivism's principles. Utilizing 3D printing further enriches the experience; it allows for a hands-on approach to understanding geometric concepts combined with manipulative activities and activities aimed at understanding mathematical concepts. Geometry became more tangible and engaging when students used GeoGebra to design three-dimensional representations of geometric figures. These designs were then brought to life through 3D printing, allowing students to interact with their geometric creations physically. At the same time, it allowed for removing formalism from mathematics education. Since visualization is a key component in developing the ability to interpret and understand geometric shapes, manipulating these 3D models enhanced the learning experience. In our research, we presented a series of activities that both enhance spatial understanding and geometric reasoning and promote creativity and personal expression. Such activities were particularly beneficial for our students - future mathematics teachers. In addition to providing valuable technology skills, including 3D printing activities in the geometry curriculum helps prepare teachers to use this innovative tool in their future teaching, thus improving their students' geometry education. Our observations support the suitability of 3D printing as a tool to promote geometric literacy and demonstrate its potential to improve spatial perception and understanding in geometry.

Keywords: 3D printing, GeoGebra, geometric literacy.

1. Introduction

The integration of digital technologies into education is a transformative process, reshaping traditional pedagogical approaches and enhancing the learning experience across various domains. In the context of geometric literacy, the use of digital tools such as GeoGebra and 3D printing represents a significant advancement. GeoGebra, a dynamic mathematics software, supports interactive and visual learning of geometry and algebra. Its alignment with constructivist principles underscores its ability to facilitate a deeper understanding of mathematical concepts through active engagement and exploration.

Constructivism, as a learning theory, posits that knowledge is constructed through active participation and reflection on experiences (Piaget, 1972). This theoretical framework emphasizes the importance of learners being actively involved in the learning process, rather than passively receiving information. GeoGebra's interactive features enable students to manipulate geometric figures, observe the effects of transformations, and explore algebraic relationships dynamically. This hands-on approach aligns with constructivist ideals, promoting a deeper and more meaningful understanding of geometry (Hohenwarter & Lavicza, 2007).

The incorporation of 3D printing technology further enhances this learning paradigm by providing a tangible, hands-on dimension to geometric exploration. 3D printing allows students to design and create physical models of geometric shapes, bridging the gap between abstract concepts and concrete understanding. This tactile experience is particularly valuable in mathematics education, where visualization and spatial reasoning play crucial roles in comprehending geometric relationships (Cohen et al., 2015).

Visualization is a critical component in the development of geometric literacy. It involves the ability to interpret and understand the properties and relationships of shapes and spaces (Bishop, 1980). By enabling students to interact with three-dimensional models, 3D printing enhances their spatial perception and geometric reasoning. The physical manipulation of these models facilitates a deeper engagement with geometric concepts, making the learning process more interactive and engaging (Canessa et al., 2013).

In the context of training future mathematics teachers, incorporating 3D printing into the geometry curriculum offers dual benefits. It not only equips them with valuable technological skills but also prepares them to integrate innovative tools into their teaching practices. This forward-thinking approach ensures that future educators are well-prepared to enhance their students' geometry education using advanced technological tools (Chrysanthou, 2018).

Our research highlights a series of activities designed to enhance spatial understanding, geometric reasoning, creativity, and personal expression. These activities have proven particularly beneficial for our students, who are prospective mathematics teachers. By engaging with 3D printing, they develop a hands-on approach to teaching geometry, which in turn has the potential to improve their students' learning outcomes (Martínez et al., 2020).

2. Design, objectives and methods

2.1. Design and objectives

This pilot study aimed to integrate theoretical knowledge with practical application in the calculation of the volume of 3D objects using planar sections. The activities were inspired by Dr. Diego Lieban from Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Sul, Brazil, and aimed to bridge the gap between theoretical mathematics and practical application through the use of 3D printing technology. During the winter term of the 2023/2024 academic year at the University of Ostrava, the research involved seventeen second-year bachelor's degree students specializing in teaching for the second grade of elementary schools. The objectives of these activities were:

- ✓ Connect theoretical knowledge of volume calculation with practical problems involving planar sections.
- ✓ Foster creativity, spatial visualization, and logical thinking.
- ✓ Enhance digital competencies using 3D printing technology.
- ✓ Create educational aids to be used in teaching practice, demonstrating the practical application of mathematical concepts.

2.2. Methods

The activities were structured into three main teaching sessions:

2.2.1. Theoretical introduction. The first session focused on explaining the principles of volume calculation using planar sections. The teacher provided examples of complex printed objects and guided students through solving real-life volume calculation problems. Emphasizing collaborative learning, students worked together to discover solutions. The goal was to motivate students to creatively apply their theoretical knowledge and to introduce the use of 3D printing in mathematics education.

2.2.2. 3D modeling. In the second session, students worked in pairs to design and model their 3D objects using GeoGebra 3D software. Each pair created a 3D object composed of several basic geometric shapes. This session aimed to enhance students' skills in spatial visualization and geometric modeling. For those lacking experience with GeoGebra 3D, the teacher demonstrated the modeling process using a simple example before allowing students to work independently. The teacher provided individual consultations as needed to support the students' learning.

2.2.3. Practical application and 3D printing. The final session involved using PrusaSlicer software to prepare the models for 3D printing. Students exchanged their designs as .ggb files, converted them into .stl files, and imported them into PrusaSlicer. They adjusted the models by scaling, copying, and rotating them to facilitate planar sections suitable for volume calculation. The teacher assisted with PrusaSlicer usage, ensuring students correctly prepared their models for printing. After slicing, the .gcode files were printed on a 3D printer. During printing, students discussed the accuracy of their sectioning methods and volume calculations. This session provided practical 3D printing experience and reinforced theoretical knowledge application.

Figure 1. Students observing the printing of their 3D models/table.

2.3. Observations and data collection

Throughout the sessions, observational data were collected to assess student engagement, collaboration, and practical application of theoretical knowledge. Observations indicated high levels of engagement and enthusiasm for using 3D printing technology. Students actively collaborated and assisted each other during the modeling and printing processes, demonstrating a strong grasp of the geometric concepts involved.

The study was evaluated using a questionnaire filled out by the students. The questionnaire assessed their understanding of geometric concepts, ability to apply theoretical knowledge practically, and overall experience with 3D printing technology in mathematics education. Observational data provided additional insights into student behavior and learning outcomes.

3. Results

Positive feedback from the questionnaires indicated that students successfully combined theoretical knowledge with practical skills. These activities enhanced their understanding of geometric relationships, improved digital competencies, and problem-solving abilities. The 3D printed objects served as valuable teaching aids, demonstrating the practical application of mathematical concepts. Observational data supported these findings, showing high levels of student engagement and collaboration.

4. Discussion and conclusions

The pilot study demonstrated the benefits of integrating 3D printing technology into mathematics education. It provided students with a deeper understanding of geometric concepts, enhanced their digital literacy, and offered practical experience with advanced technology for educational purposes. The positive outcomes suggest that similar approaches can be beneficial in other areas of mathematics and science education.

In conclusion, the integration of GeoGebra and 3D printing into geometry education represents a significant step forward in promoting geometric literacy. These tools not only enhance spatial perception and understanding but also foster creativity and innovation in mathematical thinking. Our observations support the suitability of 3D printing as a relevant tool for improving geometric education, highlighting its potential to transform the teaching, and learning of geometry (Cohen et al., 2015).

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"OPENING MINDS": THE IMPACT OF A CULTURALLY AND LINGUISTICALLY IMMERSIVE TEACHING EXPERIENCE FOR PRE-SERVICE TEACHERS

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Abstract

Being an effective educator within culturally and linguistically diverse schools means having a rich understanding and broad perspective on attending to students from a wide variety of cultural and linguistic backgrounds. Historically, students from such backgrounds, and the ways in which to leverage their cultural identities and linguistic strengths, were not considered in teacher education programs as pre-service teachers learned to create learning experiences. Some pre-service teachers from more rural and remote communities have limited experiences to understand how to support students from diverse backgrounds as they come from more homogeneous communities. However, students in pre-service teachers' future classrooms will speak multiple languages, whose first language is not the same as the nation's official language, and the parents of these students could potentially have different cultural norms than the pre-service teacher. This means learning that the intersection of school, community, and families from different cultural perspectives is an important aspect in preparing pre-service teachers for the reality of teaching in a more global society. Thus, the purpose of this project was to provide unique and highly applicable experiences to learn first-hand about teaching all students from culturally and linguistically rich backgrounds as this will better prepare them for teaching careers.

Keywords: Pre-service teachers, cultural competency, international teaching.

1. Introduction

Teaching is a complex endeavor that requires educators to possess both content and pedagogical knowledge to be effective. Part of this pedagogical knowledge is an understanding of the role students' culture plays in the classrooms (Berns, 2015). These cultural aspects include such things as their attitudes, beliefs, language, faith, and customs. Given the diversity of classrooms globally, it is important that pre-service teachers have cross-cultural experiences to help them prepare for the reality of teaching, to perceive and value cultural diversity in a more positive and strengths-based way and to view peoples of other cultures without stereotyping (Cushner, 2007). This means that teacher preparation programs, and the schools that host pre-service teachers for field-based practicum experiences, have a substantial role in helping pre-service teachers understand these complexities. However, many pre-service teachers have limited experiences working with students from cultures other than their own or in supporting students whose home language is different than that of the primary language spoken in school. This means these pre-service teachers are potentially at a disadvantage when they step into their own classrooms as the teacher of record and need to work with students whose language and culture do not match their own. However, when they are immersed in a different culture, they can develop important skills such as global competency, intercultural sensitivity, and foreign language abilities and pedagogies (Rahatzad, et al., 2013). Thus, the purpose of this project was to better understand how a culturally immersive field experience promotes intercultural learning and competence, confidence in their teaching in different contexts, as well as pre-service teachers' personal growth.

1.1. Teacher preparation programs

Traditional teacher preparation programs often include some, albeit sometimes limited, opportunities for pre-service teachers to work with K-12 students and to gain experience with designing and delivering instruction as well as assessing learning. Field experiences continue to be one of the most effective strategies for increasing pre-service teachers' effectiveness (Education Commission of the

States, 2003) but they often occur during the final stages of their training and only in select schools or contexts. Because of this, pre-service teachers have limited opportunities to develop a deeper understanding of the interplay between teaching and learning in culturally and linguistically diverse settings. As early as 1995, the National Council for Accreditation of Teacher Education (NCATE) recognized the importance of these culturally rich experiences and mandated teacher education programs to provide global and international education (NCATE, 1995). This means that teacher preparation programs have an obligation to the profession, to pre-service teachers and to communities to ensure that teachers have the academic and cultural competencies to support all children (Ladson-Billings, 2016). In fact, by under-preparing pre-service teachers for teaching within culturally diverse contexts, negative stereotypes around race, culture and poverty can be reinforced (Santoro, 2014). This further highlights the importance of culturally immersive field-based work.

Furthermore, field experiences create opportunities to develop practices and dispositions that substantially impact teacher effectiveness. For example, field experiences allow pre-service teachers to apply theory in real settings (Bartolome, 2017) and understand the nuances of complex practices such as facilitating whole-class discussions, responsively attending to classroom management incidents and reinforcing classroom norms. All of these complex teacher actions require opportunities to practice, rehearse, or otherwise try out complex teaching practices in authentic situations (Lampert et al., 2023). Likewise, field experiences help shape pre-service teachers' identity, confidence and self-efficacy (Ateşkan, 2016) all of which impact their effectiveness as teachers.

1.2. Building cultural awareness and competence

When pre-service teachers have opportunities to directly interact with people who are culturally different within real-life settings, it can promote self-awareness and cultural sensitivity. When such experiences are combined with classroom instruction, pre-service teachers develop a more robust understanding of culture and the role it plays in teaching and learning (Palmer & Menard-Warwick, 2012). However, this awareness of culture, and the role teachers have in creating meaningful interactions and shared cultural discussions, means that pre-service teachers have had experiences where they reflect and think about their own beliefs, values, biases and judgements within an unfamiliar context (Santoro, 2014). As they critically analyze their own culture as well as become aware of how human differences are used by people in power to rationalize inequality and maintain their position of authority in society, they are better able to see students as individuals, coming from different contexts and situations (Smolcic & Katunich, 2013). They then can see that a one-size-fits all method of teaching is potentially ineffective, and come to see that a student centered approach to teaching is necessary.

Teachers' intercultural competence is necessary to teach all students effectively, as teachers must recognize that culture shapes how individuals see themselves and the world around them. Intercultural competence refers to the ability to understand other people across cultural barriers and includes the attitudes, knowledge and skills required to function effectively with those from cultures different from our own (Smolcic & Katunich, 2017). One way teacher education programs can build cultural awareness and intercultural competency is through immersive field experiences in schools with students from different cultures. In doing so, pre-service teachers have opportunities to interact with other people and to learn about other ways of thinking and being (James, 2008). Given the cultural differences often found between teachers and their students (King & Butler, 2015), such interactions become increasingly more important prior to end-of-program, field-based experiences. In addition to an increased intercultural competency, Willard-Holt (2001) found that even in short-term international experiences, participants develop greater global awareness, flexibility and reflectivity in teaching along with a heightened sense of professionalism in collaborating with colleagues and teaching students in other countries. Such professional dispositions are also the hallmark of effective teachers.

Essentially, field-based work in teacher preparation, when viewed through the lens of diversity in culture and language, is essential for developing culturally responsive skills, fostering cultural competence, and preparing future teachers to navigate the complexities of diverse classrooms. As such, the purpose of this project was to better understand how a culturally immersive field experience promotes intercultural learning and competence, confidence in their teaching in different contexts, as well as pre-service teachers' personal growth.

2. Design

This study, which is part of a larger study, used a mixed methods approach (Creswell, 2020) as it allowed for interpretations of participants' perceived experiences and allowed for the development of understandings based on multiple qualitative data sources as well as descriptive statistics. While this project is in its second year, the data and findings in this paper are only from the first year of the project and are only based on some of the qualitative data.

2.1. Methodology

The broader study used a mixed methods approach, and included data from field notes, observations, daily reflections with open-ended questions and the Likert scale type questionnaires, interviews, and post experience reflections. However, for the purpose of this paper, only the field notes and post experience reflections will be discussed. As such, emphasis was placed on the interpretations and meanings that the researchers had towards developing intercultural learning and competence from these qualitative data in order to identify key themes (Patton, 2002).

2.2. Participants and setting

Participants included 11 pre-service teachers attending a university in a more rural and mountainous region of the United States. Of these 11 participants, nine of them were focusing in primary education and two were focusing in secondary education. Additionally, only four of the eleven participants had traveled outside of North America though three others had been to Mexico. Participants varied in their progress of completing their program; two had only one year remaining while the other nine had between two and three years remaining. Additionally, only one participant fluently spoke the language of the host nation, which is Spanish.

The host school, the American Island School (AIS), is a private American curriculum school located in the Caribbean and includes students from pre-kindergarten through grade twelve with nearly ninety-eight percent of graduates going on to pursue a post-secondary degree. Approximately 60% of students are citizens of the nation with the other 40% representing nationalities from 31 other countries. While English is the primary language of instruction at the school, nearly 70% of all students are English Language Learners. participants were placed with one cooperating teacher and were asked to support the teacher throughout the day. By the end of the week, participants were supporting the teacher of record by teaching multiple-mini lessons or an entire class period.

While the majority of the time was spent at AIS experiencing what it means to teach within an internationally diverse context, participants also had opportunities to independently engage with the community. This often meant going out for meals together, but without university faculty, visiting cultural heritage attractions or museums, or visiting markets to make purchases. During these times, participants were faced with interacting with locals and trying to communicate their needs or wishes despite not being fluent in the local language. This allowed for participants to further consider the intersection of families and communities within the broader school community.

2.3. Limitations

As with all qualitative studies, the findings from this study are not broadly generalizable. It is left to others to determine the extent to which this study aligns with other cases or contexts. However, given the increase in cultural and linguistic diversity of students in schools globally, it is possible that understandings from this study may be applied to other relevant or similar contexts wherein further insights can be developed (Patton, 2002).

3. Findings

The findings are based on the field notes, daily, and post experience reflections. From the analysis of this data, several themes emerged but for the sake of this paper, only two of the more prominent themes are shared. These two themes focus on a personal change with respect to identity, self or professional purpose and an awareness of culture in teaching and in learning.

3.1. Change in identity, self and professional purpose

The first major theme is in relation to participants' perceived change with respect to their purpose in the profession or in how they perceived themselves. Collectively, participants wrote about this experience as being a major transformative process that had an impact on them in one of these ways; it was reported often as a "life changing" experience. Many also wrote about a new found joy for teaching. "There is a fire in my heart once again for teaching," and they came away "with a new outlook and renewed passion for teaching" wrote two participants. This suggests that even short-term immersive experiences can impact pre-service teachers' views of teaching.

Others recognized a substantial change in their own identity or shift in their own self-confidence. One participant stated they came back "no longer quiet and small, but confident." Whereas another wrote that "when I got off the plane, I was not the same person who got on the plane a week prior." Others indicated they were surprised with themselves because they were in new situations and had to adapt to these situations, which took a kind of courage that they did not know they had. "I just had to jump in,

[I] have to be brave." These reflections indicate that personal growth, confidence, and nuances in identity can also be developed and strengthened within intense and immersive field-based experiences.

Others discussed more subtle, and perhaps a more profound understanding about commonalities across cultures. One participant reflected on an evening sitting in the plaza watching families interact and the children at play and how this reminded them of a greater connection regardless of culture and language.

> "As I watched these people living their lives and enjoying an evening with family and friends, I was struck with gratitude for this opportunity. I had spent an entire week getting to know the people. I attended their school, ate their food, tried to speak their language, and learned about their history, music, and dance. This significant moment at the plaza was a point of reflection and understanding about what it means to be human."

Collectively, this immersive experience impacted each participant's sense of self, identity and their personal purpose, which were not inherently a focus of the project.

3.2. Cultural awareness in teaching and learning

The second major theme centered on a cultural awareness, specifically in aspects of teaching and learning that they did not previously have or did not fully appreciate prior to the experience. While this immersive experience was only one week long, it seems to have been enough for them to understand the important role community, culture and language play in teaching and learning. One participant wrote "I learned what it was like to feel like an outsider and to be in the minority" whereas another reflected that "I will hopefully be able to help students of diverse backgrounds feel accepted, loved, and welcome because I know better what it's like to be in a new place and to stick out." This awareness of cultural diversity and individual differences is something that can be included in coursework but can be difficult to fully process without experiencing it firsthand.

Some developed a more practical understanding of how culture and language impact learning. One participant elaborated on this when they wrote "our culture is what drives us. This culture also [gives] students a sense of identity and purpose. For this reason, it is my profound belief that a child's culture should be embraced in the classroom." Others pointed out how being able to speak to all students was something they had taken for granted. "I now understand what it is like to be in a school setting where the language that is spoken is not your native language," which was something they had not previously experienced. Others wrote about how they began to understand what it meant to create a successful learning environment for English Language Learners because they were able to have discussions with teachers about specific interventions and then immediately try these interventions with students. "I saw a struggling student learn a new skill and saw the happiness he felt when he knew he could do it." This pre-service teacher went on to state "this is what I want to be able to do for all my students when I become a professional educator."

Likewise, participants were able to also see that along with cultural differences, there can be cultural similarities even when there are appearances of differences. "These people were just like the people I interact with on a daily basis at home. I could see the light of humanity in their eyes. As different as everything felt, it also felt much the same." And as simple as it may sound, several talked about how they began to realize that despite where children live, what they wear, or what language they speak, they share many things in common; "No matter where you go, kids are kids." From this shift in perspective that "even though we are all different, we are more similar than we realize," participants recognized that their role as a teacher remains the same regardless of a child's culture or language.

4. Discussion

All pre-service teachers, without exception, reported the trip had impacted them in a powerful way, and that they had experienced significant personal and/or professional changes. Culturally immersive experiences empower pre-service teachers to apply the theoretical knowledge they gained from coursework in authentic educational settings to better understand the interplay between theory practice. This seems to also be the case with respect to culturally responsive teaching. And while traditional teacher preparation programs are often designed to balance theory and practice, some teaching attitudes, beliefs, and skills may be challenging to learn without a more immersive experience wherein pre-service teachers and students can learn from each other (Ladson-Billings, 2016). Likewise, complex topics, such as culturally responsive teaching, require experiences in which one is not from the dominant culture but these experiences need not be semester-long study abroad experiences (Jones & Bond, 2019);

short-term immersive experiences can also impact one's cultural awareness. Shorter trips can also be beneficial since they can increase the number of pre-service teachers who can participate. Likewise, participating pre-service teachers can also share their learning with their peers back home which may lead to an even further reaching, and rippling effect on the global education of many future students.

5. Conclusion

One aspect of effective teaching includes being culturally responsive and possessing a cultural competence to support all students. For some pre-service teachers, their limited experiences working with students from culturally, linguistically or ethnically diverse settings means they have ways of thinking about teaching and learning that are underdeveloped. When teacher preparation programs and the schools where pre-service teachers are placed for field-based practicum do not work to address these deficiencies, pre-service teachers are then at a potential disadvantage. With the shift in student demographics changing in schools across the globe, the need to prepare pre-service teachers for different kinds of diversity becomes even more important. This study showcases the impact that even small, immersive opportunities can have on pre-service teachers' cultural competencies, empathy, and awareness of students' cultural and linguistic strengths. And as such, the potential to "open minds" to the possibilities of culturally responsive teaching takes root.

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SOCIO-ECONOMIC STATUS AND STUDENTS' MATHEMATICAL LITERACY ABILITIES

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Abstract

Socio-economic status is a comprehensive concept designed to reflect the financial, social, cultural and human resources available to students. Moreover, it is a factor which is strongly associated with students' performance in mathematical literacy. The present study aims to investigate the abilities of students in mathematical literacy upon completing their compulsory education and answer the research question, if there are statistically significant correlations between the students' performance in mathematical literacy and the variables shaping the students' socio-economic status. The variables which shaped the factor of socio-economic status which were investigated in the current study, were the parents' education, the parents' occupation and a number of household possessions that can be taken as proxies for material wealth or cultural capital, like the number of books at home or the number of several digital devices or other objects that belong to the family. The research was carried out in 650 students from all over Greece who were completing 9th grade or were at the beginning of the 10th grade and whose schools were selected based on the degree of urbanization of the area where the respective school was located (large urban center, small urban center, rural area). The findings of the research showed that there are statistically significant correlations in the average performance in mathematical literacy and the parents' education, the parents' occupation, the number of books and the number of laptops owned by the family.

Keywords: Socio-economic status, mathematical literacy, Greece, compulsory education.

1. Introduction

Extensive research indicates that a student's family is one of the most reliable predictors of their success in school and future career. PISA results suggest that schools can play a pivotal role in mitigating the impact of students' family socioeconomic status on their future lives. Social factors such as parents' education and the broader standard of living within the family are directly associated with students' performance in mathematics (Caygill & Kirkham, 2008; Wylie & Hogden, 2007). The exploration of the correlation between family socio-economic and cultural levels and students' performance in mathematical literacy has gained significant attention, particularly through the international PISA survey.

The socio-economic and cultural status, as defined by PISA, encompasses a comprehensive concept that mirrors the economic, social, cultural, and human resources available to students (OECD, 2016, 2019). It serves as an indicator of students' access to family resources, including financial capital, social, cultural, and human capital, as well as an assessment of their family's social status. PISA gauges the socio-economic status of students through the Economic, Social, and Cultural Status (ESCS) index, calculated based on data pertaining to their family background, specifically considering parents' education, parents' professional status, and household possessions. A higher ESCS index corresponds to a higher socio-economic and cultural level for both students and their families.

In all countries participating in PISA, there exists a direct correlation between student performance and socio-economic and cultural background, although this relationship is not labeled as causal. Across all nations, including Greece, students classified as socio-economically disadvantaged—those falling within the bottom 25% of the ESCS index—demonstrate lower proficiency in mathematical literacy compared to their socio-economically privileged counterparts, specifically those within the top 25% exhibiting the highest ESCS index values (Zhu, 2018). Aligned with these findings emphasizing the statistical significance of students' family socio-economic and cultural levels in influencing mathematical literacy performance, secondary analyses of PISA data and international samples support this conclusion (Cheema & Galluzzo, 2013; Güre et al., 2020; Kriegbaum & Spinath, 2016; Lara-Porras et al., 2019; McConney & Perry, 2010;

Shala et al., 2021; Takashiro, 2017; Zhu, 2018). Similar investigations have been conducted for Greek representative samples as well (Hiller et al., 2022; Karakolidis et al., 2016a, 2016b; Kalaycioğlu, 2015; Usta, 2015). In summary, in Greece, students hailing from families with a high socio-economic and cultural level exhibit statistically superior performances in mathematical literacy compared to their counterparts from lower socio-economic strata (Hiller et al., 2022; Karakolidis et al., 2016a, 2016b; Kalaycioğlu, 2015; Sofianopoulou et al., 2017; Usta, 2015).

In the latest PISA 2022 results from Greece, students from higher socio-economic backgrounds (the top 25%) outperformed their disadvantaged counterparts (the bottom 25%) in mathematical literacy by 76 score points. While this discrepancy is narrower than the OECD average of 93 points, it still indicates a significant gap. Interestingly, from 2012 to 2022, Greece saw a reduction in mathematical literacy performance gap between socio-economic groups, whereas the OECD average remained unchanged during the same period (OECD, 2023).

2. Research

The study comprised 650 students undergoing compulsory education. Two distinct research tools were devised and employed: a mathematical test and a questionnaire. The mathematical test featured five real-world problems spread across 11 items, with the resulting performance or score serving as the dependent variable for assessing mathematical literacy achievement. The items covered a spectrum of subjects, from routine experiences to broader topics reflecting students' interests and their world, demonstrating mathematical skills pertinent to everyday life. Furthermore, the mathematical principles and information presented in each specific item corresponded to the curriculum of mandatory education in Greece, encompassing mathematics taught in junior high school. The second research tool, the questionnaire was crafted to gather data on participants' family background, encompassing socio-economic and cultural factors such as parents' education, parental occupations, household digital devices or possessions, and the quantity of books at home.

This study aimed to address the research question, if there is a statistically significant correlation between students' performance in mathematical literacy and the socio-economic and cultural variables that influence their status?

3. Results

After conducting ANOVA for independent samples, it was determined that there is a statistically significant correlation between students' performance in mathematical literacy and the educational level of their mother ($F_{(8,641)}=6.494$, $p<.001$), as well as the educational level of their father ($F_{(8,641)}=7.69$, $p<.001$). Additionally, significant correlations were found with the mother's occupation ($F_{(9,616)}=7.37$, $p<.001$) and the father's occupation ($F_{(9,610)}=8.33$, $p<.001$), as well as the number of books at home ($F_{(6,636)}=11.03$, $p<.001$) and the number of laptops owned by the students' family ($F_{(3,638)}=12.36$, $p<.001$).

Table 1. Analysis of Variance (ANOVA).

	df	F	Mean square	p-value
Performance in ML – mother's education	8	6.49	610.65	.000
Performance in ML-father's education	8	7.69	713.40	.000
Performance in ML-mother's occupation	9	7.37	689.96	.000
Performance in ML-father's occupation	9	8.33	760.81	.000
Performance in ML-number of books at home	6	11.03	1010.26	.000
Performance in ML-number of laptops at home	3	12.36	1181.99	.000

ML=Mathematical Literacy

After conducting Post Hoc testing, it was observed that students whose mothers or fathers have completed higher education tend to achieve statistically higher average scores in mathematical literacy compared to students whose mothers or fathers respectively have completed secondary education, as well

as those whose mothers or fathers respectively have attained knowledge from compulsory education levels. Similarly, students whose fathers have completed secondary education exhibit better average performance in mathematical literacy than those whose fathers have knowledge only from compulsory education levels. Furthermore, Post Hoc testing revealed that students whose mothers or fathers work in specialized professions tend to achieve statistically significantly higher average scores in mathematical literacy than students whose mothers or fathers respectively work in semi-specialized occupations or in elementary (or labor) occupations. Likewise, students whose mothers or fathers work in semi-skilled occupations demonstrate better average performance in mathematical literacy than those whose respective mothers or fathers work in elementary or manual occupations. Additionally, following Post Hoc testing, it was noted that there is a statistically significant positive correlation between the number of books and laptops in students' homes and their average performance in mathematical literacy. More specifically, a higher number of books or laptops in the household is associated with better performance in mathematical literacy.

Table 2. Post Hoc Test Bonferroni (1).

variables	categories	Mother			Father		
		N (%)	Mean	SD	N (%)	Mean	SD
Parent's education	ISCED levels 6-8	363(55.8)	18.05	10.07	303(46.5)	18.70	10.34
	ISCED levels 2-5	244(37.5)	14.84	9.83	277(42.6)	15.12	9.30
	ISCED level 1	35(5.4)	10.66	7.50	59(9.1)	11.47	8.96
Parent's occupation	High skilled white collar	294(45.2)	19.28	10.05	277(42.6)	19.68	10.49
	Low skilled white collar	211(32.4)	15.69	10.01	119(18.3)	16.14	9.39
	High and low skilled blue collar	121(18.6)	11.31	7.98	224(34.5)	12.70	8.40

Table 3. Post Hoc Test Bonferroni (2).

		N (%)	Mean	SD
Number of books at home	No books	10(1.5)	9.00	5.03
	1-10	47(7.2)	11.02	6.44
	11-25	62(9.5)	11.76	7.86
	26-100	178(27.4)	15.19	9.88
	101-200	143(22)	17.90	9.72
	201-500	132(20.3)	19.13	10.68
	More than 500	71(10.9)	20.61	9.79
number of laptops owned by the family	No laptops	69(10.6)	13.68	9.93
	1 or 2	439(67.5)	15.54	9.41
	3-5	124(19.1)	20.79	10.67
	More than 5	10(1.5)	22.10	13.10

4. Conclusion

The socio-economic and cultural status of students or their families which is determined by various factors directly associated with the students' family backgrounds significantly influences students' performance in mathematical literacy, as consistently highlighted in the literature (Hiller et al., 2022; Karakolidis et al., 2016a; Kalaycioğlu, 2015; OECD, 2004, 2013; Usta, 2016). In the current study, we examined these components individually, including parental education levels, both for mothers and fathers, their respective occupations, and household possessions, which encompass items and digital devices owned by the family, along with the quantity of books in the student's home. The study comprised a sample of 650 students from Greece who were either in the process of finishing or had recently completed compulsory education. Their schools were chosen based on the level of urbanization in the respective areas where the schools were situated. The current research findings, consistent with existing literature, demonstrate that certain factors within the socio-economic and cultural context significantly correlate with students' mathematical literacy performance. Notably, the educational levels of both parents, their respective professional roles, and the availability of books and laptops in the household exhibit statistically significant associations.

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GIVING THANKS IS THE KEY TO TRANSFORM THINGS THAT HAPPENED INTO GOOD THINGS AND POSITIVE EMOTIONS

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Abstract

Barbara L. Fredrickson (1998) posits that joy, interest, contentment, and love positive emotions serve to broaden an individual's momentary thought-action repertoire, which in turn has the effect of building that individual's physical, intellectual, and social resources. Experiences of certain positive emotions prompt individuals to discard time-tested or automatic (everyday) behavioral scripts and to pursue novel, creative, and often unscripted paths of thought and action. This study explored how to transform things that happened into good things. By inviting 24 participants to write weekly or bi-weekly "Something good happened" in my "Principles of Teaching" course for 8 weeks. PERMA was used to analyze all "something good happened" statements: positive emotion, engagement, relationships, meaning, and accomplishment. Words such as *thanks, fortunately, feeling good, happy, feeling warm,* and *relaxed* were classified as positive emotions. Words like "thanks" were further analyzed by what things happened to the participants. The result showed that "giving thanks" is the key to transforming things that happened into GOOD things and positive emotions. There might be routine or tough things happening. However, by giving thanks, things will turn into good things that we appreciate, and then produce positive emotions.

Keywords: Giving thanks, grateful, positive emotion, tough thing, something good happened.

1. Introduction

1.1. Why viewing interactions in a more optimistic and positive lens may be beneficial

Fredrickson (1998) posits that joy, interest, contentment, and love positive emotions serve to broaden an individual's momentary thought-action repertoire, which in turn has the effect of building that individual's physical, intellectual, and social resources. Experiences of certain positive emotions prompt individuals to discard time-tested or automatic (everyday) behavioral scripts and to pursue novel, creative, and often unscripted paths of thought and action.

When people confront adversity or difficulty, they experience a variety of emotions, ranging from excitement and eagerness to anger, anxiety, and depression. The balance among these feelings appears to relate to people's degree of optimism or pessimism. Optimists are people who expect to have positive outcomes, even when things are hard. This confidence should yield a mix of feelings that is relatively positive. Pessimists expect negative outcomes. This doubt should yield a greater tendency toward negative feelings—anxiety, guilt, anger, sadness, or despair (Scheier & Carver, 1992).

Relationships between optimism and distress have been examined in diverse groups of people facing difficulty or adversity. Aspinwall & Taylor (1992) examined students making their adjustment to their first semester of college. Optimism, self-esteem, and other variables were assessed when the students first arrived on campus. Measures of psychological and physical wellbeing were obtained at the end of the semester. Higher levels of optimism upon entering college predicted lower levels of psychological distress at the end of the semester. The relationship was independent of effects of self-esteem, locus of control, desire for control, and baseline mood (Carver & Scheier, 2002).

Both gratitude and optimism can serve as coping mechanisms during challenging times. Expressing thanks for the positive aspects of a situation, even in difficult times, can help individuals find silver linings and maintain a hopeful outlook for the future (Scheier & Carver, 1992).

1.2. Approaching complex situations or interactions in a more optimistic manner may have positive outcomes

Studies have shown that practicing gratitude is linked to improved well-being, increased life satisfaction, and reduced symptoms of depression. Similarly, optimism is associated with better mental health, increased resilience, and a more positive approach to life's challenges (Carver & Scheier, 2002).

In one experiment, 4-year-old children were randomly assigned to recall an emotional or non-emotional experience from their lives before doing a learning task (Masters, Barden, & Ford, 1979). The experimental manipulation crossed three levels of affect (positive, neutral, negative) with two levels of tempo (active and passive). The positive affect, active tempo condition resembled joy ("Can you remember something that happened to you that made you feel so happy that you just wanted to jump up and down?"), whereas the positive affect, passive tempo condition resembled contentment (". . . so happy that you just wanted to sit and smile?"). Children were given 30 seconds to recall and think about their assigned memory before learning a shape discrimination task. Both passive and active positive emotion conditions produced significantly faster mastery of the task compared to all other conditions (Fredrickson, 1998, p. 310).

Similar experimental studies have yielded comparable results among students ranging from elementary to high school, and for those with and without learning disabilities (Bryan & Bryan, 1991; Bryan, Mathur, & Sullivan, 1996; Yasutake & Bryan, 1995). Remarkably, simply asking students to think for less than 1 minute of a happy moment from their lives before learning or test taking produces significant increases in intellectual gains and performance (Barbara L. Fredrickson, 1998, p. 311).

Giving thanks is a positive emotion or attitude involving the recognition and appreciation of the good things, people, experiences, or aspects of life. It involves acknowledging and being thankful for the positive elements in one's life, whether they are big or small. Giving thanks fosters optimism. When individuals focus on what they are thankful for, it tends to shift their perspective towards the positive aspects of their experiences. This shift in perspective contributes to a more optimistic outlook on life, as individuals become more attuned to the good things happening around them (Emmons & McCullough, 2003).

2. Purpose of this study

This study explored how university students transform things that happened into GOOD things and Positive emotions.

3. Method

By inviting 24 participants to write weekly or bi-weekly "Something good happened" in the author's "Principles of Teaching" course for 8 weeks. The author used PERMA model to analyze all "something good happened" statements: positive emotion, engagement, relationships, meaning, and accomplishment. Words such as *thanks, fortunately, happy, feeling good, happy, warm,* and *relaxed* were classified as positive emotions. Words like *thanks* were further analyzed by what things happened to the participants.

4. Results

The result showed that "giving thanks" is the key to transforming things that happened into GOOD things and positive emotions. There might be routine or tough things happening. However, by giving thanks, things will turn into good things that we appreciate, and then produce positive emotions. Table 1 showed by giving thanks that routine things happened transform to something GOOD happened.

Table 1. Routine things happened transform to something GOOD happened.

Something happened (routine things)	Key	Something GOOD happened
1. Teachers help students to practice their non-elective question answering skills	Giving Thanks	*Thanks* to the teachers in the department who are willing to take time to help students in the master's class who are preparing to take the teacher qualified test this year to practice their non-elective question answering skills, which has **helped me to get a better grasp of the direction when I originally didn't know how to prepare for the test**.

2.	Teachers answered my questions	Giving Thanks	I would like to thank the teachers who answered many of my questions this week. I know that the speed and effectiveness of my learning is very slow, but I am deeply *grateful* to them for **their willingness to answer my questions without complaining**, and for **helping me to regain the joy of learning**, and I am so glad to have you all!
3.	Service learning	Giving Thanks	There were a lot of service-learning opportunities to participate in this week. Although I was physically tired and had a small cold during the week, I was *grateful* for **the opportunity to learn and practice different ways of dealing with children and adults.**
4.	Digital learning companion	Giving Thanks	This week is the opening week of the Digital Learning Companion, I am very happy that my elementary school companion is happy to see that I am the one who takes him again, and he interacts with me very well, and he even said that he wants me to take him to the end of his third year of study. I am *grateful* to my elementary school companion's words and reactions, which convinced me that my decision is not wrong, and let me know that **there are people who are looking forward to me** and are happy about it, so that I can **forget about the worries of life gradually, and pick up my smile** to continue to walk on the road of education with perseverance.
5.	It didn't rain	Giving Thanks	*Thanks* to today's weather, it didn't rain when I rode back to school from my house! It also didn't rain **when I participated in the Wilderness Program**, **which made the event go smoothly,** and it didn't rain when I had to go out to eat with my friends after the event, and **it didn't start raining until I got to the dormitory, so I didn't get caught in the rain**!
6.	Storytelling	Giving Thanks	*Thanks* to the Association for giving me the opportunity to interact with children in storytelling, I have a feeling that **my dream is getting closer and closer**. I also thank my family, friends and teachers for their support during the process of growing up, so that I can also have the opportunity to teach others.
7.	Have breakfast with my mom	Giving Thanks	*Thanks* to my mother quitting the job that she had worked for ten years, the empty home began to come to life. Today, I woke up early and went to a nearby breakfast place with my mom to enjoy breakfast, **which was ordinary but very happy.**
8.	My parents gave birth to me	Giving Thanks	Although my family did not provide any assistance for college, either mentally or materially, I am still *grateful* to my parents for giving birth to me and **giving me the opportunity to work hard to make myself complete, so that I can have the ability to enrich my life by studying in my favorite field at this very moment, and I believe that everything is for the best.**

Table 2 showed by giving thanks that tough things happened transform to something GOOD happened.

Table 2. Tough things happened transform to something GOOD happened.

Something happened (tough things)	Key	Something GOOD happened
9. My father was hospitalized for a stroke	Giving Thanks	Last January, my father was hospitalized for a stroke. On 4/1, I was suddenly notified by the nursing staff that my father's blood oxygen level had suddenly dropped to 60, so he was sent to the emergency room. Luckily, the oxygen level stabilized after a few hours of observation at the hospital, so I felt more relieved and was able to return to the convalescent center. This year, my family and I look back at how we felt at that moment and can

		only say that God was having an April Fool's Day, too! We *thank* God for **allowing us to be with our dad.**
10. It's been more than a year since my father's collapse	Giving Thanks	4/3~4/9 In the past, my dad would go back to my hometown in Taichung to visit the graves with my uncle on Ching Ming Festival, but last year, due to my dad's unexpected situation, my brother went back to help on behalf of my dad, and this year, it was my turn to go back. In the evening, I sat in the living room with my uncle and aunt and chatted with them. During the conversation, many childhood memories were mentioned, which made me miss the carefree times in the past, and also made me realize how hard my parents had worked to bring us up in the beginning. It's been more than a year since my father's collapse, and I originally chose to take a break from school to look for a job, but I'm really *thankful* **to my mom for insisting on letting me finish my master's degree during such a difficult time.**
11. I didn't play well with badminton	Giving Thanks	This Saturday is the Emperor Cup Badminton Tournament. In fact, I have not been feeling very good these two days. And I was very nervous on the court. I didn't play well. But I am very *thankful* to my teammates. **They not only didn't blame me, but also encouraged me all the time**. They also helped me to overcome my mistakes on the field. **They made me feel happy to be able to play with these guys on the team. They are partners, teammates and family.** And I hope that in the future I can continue to work hard. I hope that in the future I can continue to work hard to become a better person. I hope I can continue to work hard to become a better person. I hope that one day I can become a guardian of others!
12. To see my grandma for the last time	Giving Thanks	Although my emotions are painful and shocking, I still want to be *grateful* that I have no regrets, and I am grateful that **all my family members who are still around me are still healthy and safe**.

5. Discussion and conclusion

5.1. What is learned

The results of this study showed giving thanks is the key to transforming things that happened into good things and positive emotion. This finding is according with the study of Emmons and Stern (2013):

The initial step of a gratitude practice is attention, an awareness of the good that one might normally take for granted：in this study case 1. teachers help students to practice their non-elective question answering skills; 2. teachers answered my questions; 3. service learning; 4. digital learning companion; and 6. Storytelling. Then tuning in to the many reasons to be grateful that already exists in this study case 5. It didn't rain; 7. Have breakfast with my mom; and 8. My parents gave birth to me.

Directing attention in this manner is helpful for blocking out thoughts and emotions that are incompatible with a gratitude practice: in this study case 9. My father was hospitalized for a stroke; 10. It's been more than a year since my father's collapse; 11. I didn't play well with badminton; and 12. To see my grandma for the last time. These four cases also in line with g to. According to Ryff and Singer (1996), self-acceptance is one of the six categories of psychological well-being. Self-acceptance is associated with a positive attitude toward the self, acknowledging and accepting both good and bad qualities. Others may feel dissatisfaction with the self and with the past, possibly wishing to be different than what they are.

5.2. What to be learned

This is a pilot study by analyzing college students' "something good happened" statements, to show the possible key to transform things that happened into good things and positive emotion might be gratitude. The potential benefits for students to keep on reflecting and writing something good, happened statement and the strength to focus on good things then become more optimistic need further study.

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AN EMPIRICAL RESEARCH TO RE-CONTEXTUALISE
THE IDEA OF CARE IN PRESCHOOL EDUCATION

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Abstract

Care is an essential dimension of human life, but international educational policies in ECEC (Early Childhood Education and Care), especially where a neoliberal culture dominates, pay little attention to this paradigm, relegating care to a position of subalternity or interpreting it as a prerequisite to education. If education has the primary intent of favouring the full and integral development of all the dimensions of the person in order to allow each existence to realise its being in the world to the fullest, it is necessary to bring to the centre of pedagogical attention the paradigm of care that is little or scarcely conceptualised, in order to understand how schools, and in particular pre-schools, can be configured as contexts of concrete expression of care. The qualitative research at hand is situated within the ecological paradigm and a naturalistic epistemology, and is based on the generative question "What does a school of care consist of?". Answers to the first analytical question "What is caring?" has been provided by a scoping review analyzing the scientific literature aimed at identifying the scope of the concept of caring: the scoping review included 14 peer-reviewed, English language studies published between 2014 and 2022. The second sub-question "What are the behavioural indicators of caring?" is being investigated starting from a mapping of the behavioural indicators of caring traced in the literature, subsequently put into dialogue with the empirical phase of the research in order to allow for the capture of those indicators capable of defining the specificities of a caring-oriented educational action in early childhood education services through a phenomenological approach. The third question articulation of the research question, "How does the involvement of teachers help to promote the creation of care-oriented educational contexts?" has led to the elaboration, from the perspective of participatory research, of a 3-5 year old curriculum capable of supporting teachers in the creation of educational contexts oriented towards care paradigms. In ECEC, there is a need to move away from dichotomous visions in favour of integrated approaches. In order to do this, it is necessary to reconceptualize the idea of care in education and policy through the ethical and political perspective of care. The relationship that emerged between theoretical and empirical dimensions has allowed to increase the pedagogical knowledge and to qualify teachers' professionalism promoting the development of "schools of care".

Keywords: Care, education, preschool, participatory approach, teachers training.

1. Introduction

Although care is an essential dimension of human life (Heidegger, 1976) because it is what allows life to flourish (Plato, 2000) and every existence to realise its being in the world, international educational policies in ECEC (Early Childhood Education and Care) do not place this paradigm at the centre, especially where a neo-liberal culture dominates. They frequently misunderstand the fact that human beings need both to be cared for from the moment they are born, and to care for themselves, others, the world, and nature, in order to respond to the needs of the reality (Lévinas, 1997; Mortari, 2019; Mortari, 2021).

If we agree that education, and early childhood education in particular, must be related to what is essential and necessary in life, then education "can only be education to care through care" (Mortari, 2019, p.16). Education is therefore to be understood as that relational process that promotes in the learner the desire to take care of oneself (Mortari, 2013). To this end, it becomes central to understand how schools, and specifically pre-schools, can be configured as places of concrete expression of care (Noddings 1984, 1992).

2. Design

Qualitative research design is based on the generative question "What does a school of caring consist of?". This initial stimulus is articulated in three subsequent questions: a) what is caring? b) what are the behavioural indicators of caring? c) "How does involving teachers help promote the creation of care-oriented educational contexts?"

3. Objectives

Starting from a perspective of participatory research, this study intends to promote and disseminate good practices within pre-school educational contexts by developing an educational curriculum capable of supporting teachers in the creation of educational contexts oriented towards the paradigms of care. The involvement of teachers in research experiences that promote reflection (Dewey, 1961) is intended to increase the teachers' professional skills (Mortari, 2009) and, consequently, improve the quality of educational action through a better understanding of the ways in which they act in their daily work. The research also intends to contribute to disseminating a research style that combines theoretical and empirical aspects, in the belief that this strategy is the best way to increase pedagogical knowledge while at the same time qualifying teachers' professionalism.

The findings will provide a useful contribution to interpreting the role of the teacher as an 'investigative teacher' (Dewey, 1984, p. 35) or, to put it another way, as a reflective researcher (Schön, 1993; Cochran-Smith & Lytle, 1999). Such a teacher knows how to legitimise spaces for reflection and the construction of new knowledge *in itinere* during the unravelling of experience grounded in an idea of research characterised by a pragmatic vision and strongly rooted in practice.

Finally, the research aims to contribute to shifting the paradigms of care back at the centre of the pedagogical debate by reconceptualising the idea of care.

4. Methods

In keeping with the phenomenon being investigated (care) and the natural context within which the investigation takes place (the pre-school), the research is embedded within the framework of the ecological paradigm (Bateson, 1984; Mortari, 2007). Within the naturalistic inquiry (Lincoln & Guba, 1985; Erlandson, Harris, Skipper & Allen, 1993), the complexity of educational phenomena suggests a qualitative approach. The research philosophy is phenomenologically oriented (Husserl, 2002), focussing on the experiences and attributions of meaning of the subjects involved in the investigation (Mortari, 2007).

4.1. What is caring? The ideas of caring that have emerged in the empirical studies and possible spillovers into ECEC contexts

Answers to the first analytical question "What is caring?" have been provided by a scoping review Arksey & O'Melley, 2005) analysing the scientific literature aimed at identifying the scope of the concept of caring: the scoping review included 14 peer-reviewed, English-language studies published between 2014 and 2022. Some conceptual issues that emerged from the analysis of the selected studies can be summarised as follows: caring is a practice that occurs in relationships within or outside the self, promoting the satisfaction of needs and creating conditions of well-being (Gilligan, 1982; Ruddick, 1993), care has an ethical core that is constituted by the ways of being with others (Mortari & Ubbiali, 2017) and is a relational process that considers the perspective of who is receiving care (Noddings, 2013). More specifically, educational care is characterised by having an asymmetrical nature, which entails the need to be aware that it can easily convey forms of power (Held, 2006). Care in education poses implications that inevitably concern the political dimension (Tronto, 1993) owing to the influence of structural and organisational factors in the very construction of care-oriented experiences (Langford & Richardson, 2020). Going deeper into the concept, the process of Educational Care can be structured in four stages: discerning a need, accepting responsibility, the practice of giving care, and receiving care (Tronto, 2013).

Care is a holistic and multifaceted process characterised by closeness, intimacy, a sense of trust and compassion (Cekaite & Bergnehr, 2018). Within the educational process, it is possible to grasp a relationship between the complexity of the educational proposal and the dimension of ethical care: proposals that are too simple and trivial, a limited level of children's participation, and the poverty of the predisposed contexts do not allow for the manifestation of more complex processes of ethical care (Langford & Richardson, 2020).

In line with studies that interpret caring as a practice that is not confined to meeting basic needs, but considers the development of potential, McCormick (2018) states that children construct caring experiences to reduce the discomfort or pain of others, support relationships, promote positive emotions, improve healthy and safe habits, and ensure the longevity and sustainability of shared resources. Caring is interpreted as a multifaceted construct, characterised by the presence of the following factors: connection, attention, responsiveness, competence and sensitivity (McCormick, 2018). The concept of care is connected to a sense of responsibility, attention to the other and the community: care understood as attention to Self, others and the environment (understood both as a physical and relational place and including non-human living things). Care should therefore be recognised as a reflexive practice, also to counter the widespread focus on the individual child and his or her skills (Hellman, 2016).

The concept of care, understood as a way to stimulate child development, needs to be extended to include the valorisation of differences, including gender differences. (Adriany & Warin, 2014). Some non-anthropocentric theories invite to re-conceptualise care as something that does not belong to the individual, but rather as something that lies in the dimension of encounter (*care-in-the-middle*), has a collective and impersonal nature, neither totally human nor non-human. This vision aspires to promote changes in education, focussing on outdoor education, within a holistic, inclusive and open framework, including through new materialistic approaches (Vladimirova, 2021).

The selected studies invite to re-conceptualise the relationship between education and care from a theoretical and practical point of view in order to act both on the level of professionalism of practitioners and on that of the overall quality in ECEC (Rentzou, 2019), highlighting the need to work towards a different vision of the identity and training of professionals in ECEC (Löfdahl & Folke-Fichtelius, 2015) operating a redefinition of the idea of care according to dimensions linked to the ethics of care (Archer, 2017). It becomes essential to counteract the process of non-visibility or intellectualisation of care so prevalent in a society centred on development and performance, by paying attention to the child here and now, and to his or her well-being, promoting the ability to care for each other (Löfgren, 2016).

4.2. The first empirical phase of the research: Behavioural indicators of care

The analysis of the literature has thus made it possible to answer the first question, "what is care?", and defining it as a practice (Tronto 1993; Held 2006) that is made visible through what Noddings calls "behavioural indicators of care" (Noddings, 1984, 1992), i.e. those ways of being that restore the intent to procure benefit on the part of the one who cares (Heidegger, 1976; Mortari, 2015).

The second question "What are the behavioural indicators of caring?" was investigated starting from a mapping of the behavioural indicators of caring found in the literature (Mortari, 2015, 2022), which was subsequently juxtaposed to the first empirical phase of the research to identify those indicators capable of defining the specificities of a caring-oriented educational action.

The participatory approach to the research involved 18 teachers belonging to three municipal preschools in Correggio (Reggio Emilia), for children aged three to five. The initial data collection tool concentrated on the written narratives of experiences of good and bad care related to their own personal and professional history by the research participants, because narration allows to approach the meaning of first-hand experience, which is particularly fertile in the educational sphere as it is conducive of the knowledge of that which is practical (Dewey, 1993; Clandinin & Connelly, 2000; Mortari 2007).

The analysis of the collected data followed the empirical phenomenological method (Mortari, 2023) and was oriented by certain principles and heuristic actions that also considered certain procedures belonging to grounded theory (Strauss & Corbin, 1990). The choice of method resides in a circumstantial vision, i.e. an evolutionary and emergent vision that conceives of the method itself as something that emerges during the research (Zambrano, 1986; Mortari, 2007) and values the possible intertwining of different methods. According to this perspective, only at the end of the research is it possible to give the method its final form (Mortari, 2009). The analysis of the narratives (60) revealed a coding system organised into 19 conceptual labels, six categories (giving attention; offering possibilities; participating; cultivating the relationship; caring for the self; recognising the other), grouped into two macro-categories (devoting oneself to the other and keeping the other in mind).

4.3. The second empirical phase: Teacher involvement

The third sub-articulation of the research question "How does the involvement of teachers help promote the creation of care-oriented educational contexts?" is being finalised through a participatory approach, aimed at collecting, on the basis of the care indicators identified in the first phase of the research, care practices designed and implemented by the teachers of the three schools involved in the research. The narratives recorded by the participants (Bruner, 1992) in reflexive diaries penned during the development of the experiences will be the subject of a phenomenological analysis, while the

observations made through video recordings regarding the experiences carried out will be discussed by the researcher together with the teachers through the tool of the "stimulated recall interview" (Meijer, Zanting, Verloop, 2002 cit. in Mortari, 2009). The fieldwork will continue with the collection, carried out through audio recording, and analysis of Socratic conversations between the researcher and the children, which will develop from a narrative stimulus (a fictional story) to explore the essence of the ethics of care, as care is oriented towards achieving good, or rather is animated by the desire for good (Murdoch, 2014). To conclude, thanks to the direct involvement of teachers, this last phase of the empirical research will identify forms of participation of the families serviced in the schools, through methods and tools that are currently being defined, in keeping with the evolutionary-emergential research design

5. Discussion

The studies selected highlight that an idea of education is predominant in the ECEC contexts most influenced by the neo-liberal culture, to the detriment of care. Education is understood as the process aimed at promoting the acquisition of competences and skills often strongly linked to the development of the learning content which is part of the curriculum of the subsequent school grades, and linked to an idea of performativity, often measured in terms of performance. Caring is relegated to a secondary status, marginalised or experienced as implicit in educational practices (Archer, 2017), hardly visible in the documentation produced by teachers (Löfgren, 2016; Löfdahl & Folke-Fichtelius, 2015). Care is not considered as a key component in the quality of the profession of teachers (Rentzou, 2019; Löfdahl & Folke-Fichtelius, 2015). There is a need to revisit their role and their professional identity (Rentzou 2019; Cekaite, & Bergnehr, 2018; Bussey, & Hill, 2017). By placing itself within this debate, the research aims to reposition the paradigms of care at the centre of pedagogical and educational issues, interpreting care as a "fundamental category of pedagogical discourse" (Mortari, 2013, p. 36).

6. Conclusions

If education has the task of promoting the full and integral development of all the dimensions of the person through the offer of a multiplicity of contexts of experience (Dewey, 1974), it is then necessary to imagine a philosophy of education that as an antithesis to the utilitarian or consumerist logics that often guide pedagogical and training decisions, takes care to make the potential of each subject involved in the educational process flourish from a cognitive, affective, bodily, spiritual, ethical, aesthetic, ecological and political point of view (Mortari & Ubbiali, 2021). It is therefore necessary to promote an education based on care that interprets educational practice by setting up learning contexts in which each person can find experiential situations to nourish every dimension of his or her being, through the active participation of all the subjects involved in the educational experience. Schools of care take shape through such processes.

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EARLY MARRIAGE AS A HUGE PROBLEM AGAINST EDUCATION AND CAREER DEVELOPMENT

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Abstract

Early marriage is an official or unofficial union between two people, at least one of whom has not yet reached the age of 18. It is a complex phenomenon and many factors influence it, for example: financial situation, traditions, gender inequality, sense of insecurity and others. In Georgia, early marriage reduces access to education - therefore reducing employment opportunities. In the parliamentary report of 2012, we read that in 2011-2012, approximately 7,370 girls stopped receiving education before completing the basic level, one of the reasons for which is early marriage. It should be noted that a lot of time has passed since 2012 and the results are almost the same: in 2017, one of the non-governmental, research organizations in Georgia (Safar) conducted a study on "prevention of early marriage in Kvemo Kartli". During the prevention, it was revealed that there is an information vacuum in the villages about the defense mechanisms against early marriage, moreover, within the framework of this project, it was revealed that parents and students did not have information about the age of the majority, they did not know that early marriage is punishable by law, and many did not know who to contact. in a critical situation. The target group of our research is the Georgian population. Specifically, those regions of Georgia, where the aforementioned is the most problematic. Within the framework of the study, we focus on the possibility of education and career advancement as a result of early marriage. The selection, methodology, and relevance of the issue increase the value of this research to society and inform us that it is necessary to focus on early marriage as an acute problem that opposes education and career development. The aim of our research is to study the impact of early marriage on education and career development. The research task is to determine: · What is the attitude of young Georgians who are in early marriage towards getting an education; · What attitudes, beliefs, social norms and practices exist in the community itself around early/childhood marriage and how does it affect their education? · What risks and protection factors exist in the country regarding this type of social practice?. One of the methods of qualitative sociological research - A biographical-narrative interview- will be used to obtain primary sociological data. More specifically, by using a Biographical-narrative interview, direct interaction with respondents, it will be possible to observe non-verbal communication, clarify respondents' answers and ask additional questions.

Keywords: Early marriage, education, career development, social norms, risks.

1. Introduction

Early marriage is a formal or informal union between two people, at least one of whom has not yet reached the age of 18 (UNICEF, 2017). Marriage under the age of 18 may be forced or the result of the child's immature consent. In any case, early marriage is a fundamental violation of human rights, because at this age the child does not have informed consent to the marriage.

According to psychologists and reproductive medicine specialists, early marriage violates a child's right to health, education, equality, and living in an environment free from violence and exploitation. First of all, early marriage should be considered in terms of gender. It should be noted that early marriage affects girls and boys differently.

The number of boys in early marriage is much less than that of girls. Worldwide, 1 in 5 women in the age group of 20-24 years are married before adulthood, and in the case of men - 1 in 30. (UNICEF, 2019). In addition, girls in early marriage may become victims of family violence and sexual pressure, as well as face health problems. Like boys, girls are forced to stop receiving education at school. Early

marriage is a pressing issue all over the world, as recent data from the United Nations Children's Fund makes clear.

Early marriage is a complex phenomenon influenced by many factors. Among them are: economic factors, traditions, religion, gender inequality, feelings of insecurity, and others. These factors influence the decision of adolescents to marry early. On the other hand, early marriage also affects the child's development.

It should be noted that early marriage is one of the barriers to access to education and success for children. In one of the research reports we read that, "The younger the age at the time of marriage, the lower the probability that girls will have acquired critical skills and developed their capacity to manage adverse situations that may affect their overall welfare and economic well-being" (FMRWG, 2003).

The harmful practice of early/childhood marriage is not uncommon in Georgia. According to the Civil Code of Georgia, the age of marriage is 18. According to this code, a couple cannot officially register their marriage until they reach the age of 18.

As for the principle of legal regulation of early marriage in Georgia, according to Article 140 of the Criminal Code of Georgia (sexual penetration into the body of a person under the age of 16), sexual intercourse with a person under the age of 16 is punishable by imprisonment for 7 to 9 years.

Forced marriage is also punished according to Article 150 of the Criminal Code. It should also be noted that there are exceptions and inconsistencies in the legislation of Georgia, which makes the legal regulation of early marriage more problematic, for example, if a teenager wants to start a family at the age of 16, based on the consent of the partner. Based on the existing practice of legal regulation, the person cannot be held criminally liable.

Several studies have been conducted in Georgia to study early marriage. UNICEF 2020 data reveals that 17% of women living in Georgia were married before the age of 18. With this indicator, Georgia occupies one of the leading positions in the world.

It should also be noted that the available data are not complete, because early marriages are not officially registered, therefore, accurate information about registered early marriages and their practice of continuing education is insufficient to reveal certain trends.

In Georgia, the practice of early marriage is found almost everywhere, although its causes differ according to region, where ethnic and religious minorities live, the rate of child marriage is much higher. This fact is explained by the traditions, patriarchal values, and unwritten laws here. Also, the stereotypes and social stigmas that exist here, which refer to the control of women's sexuality and the prohibition of sexual intercourse before marriage, often become provoking factors of early marriage. (UNFPA, 2014).

In addition to the fact that there are serious challenges at the legislative level of Georgia, it is important to be interested in this issue from the point of view of compliance with global goals. The issue addresses the UN Sustainable Development Goals - quality education, reduced inequality, and good health/well-being as global priorities.

Thus, appropriate policy actions should be developed around the social inequalities, developmental delays, health challenges and demographic impacts resulting from early marriage practices in Georgia. Therefore, the issue remains an actual problem for Georgia, because Georgia is actively working towards the introduction of European standards in terms of economic, human rights and sustainable development.

2. Objectives

The study aims to determine the impact of early marriage on education and career development. The following tasks were developed to realize the goal:

To investigate what is the attitude of the respondents who are in early marriage towards receiving education;

To explore what attitudes, beliefs, social norms and practices exist in the community itself about early/childhood marriage and how this affects their education.

To outline what risks and protective factors exist in the country regarding this type of social practice.

3. Design

According to the Civil Law of Georgia, early marriage is official Or an informal relationship between two people, at least one of whom is not reached the age of 18, that the person is considered a child. Accordingly, the object of our research is those individuals who created a family before adulthood.

The subject of the research is to study the life experiences of the respondents and their evaluations of early marriage.

As for the selection of the study and the description of the selection model, it involves the determination of the group participating in our study directly from the target group of the study. Since we are conducting qualitative sociological research, where research units are selected sequentially, we use the dominant form of sampling - purposive non-probability sampling.

It is based on the reflections/views/assessments, and life experiences of the purposefully selected respondents, individuals in early marriage. The selection criteria were also taken into account in the research.

1. The respondent must have been in an early marriage (one who started a family before the age of 18)

2. The respondent should have had at least 10 years of early marriage experience

4. Methods

A qualitative sociological research method - biographical-narrative interview - was used to collect research data. Through this method, we were able to investigate the existing problem in depth based on the life experiences of the respondents. As part of the biographical-narrative interview, the respondents told personal stories/narratives from their lives that played a turning role in their lives.

In this case, the interviewer focused on the narrative strategies that the respondents described in their experiences. The main reason for using this method to investigate early marriage as an important challenge to education and career development is that this problem has long been important in the experience of individuals and this issue is very sensitive for them.

At the initial stage of data analysis, data obtained based on biographical narrative interviews were grouped, then these data were coded, and later each code was combined into appropriate categories. After data coding-categorization, the categories were compared to each other and existing studies. Finally, we formulated a theoretical model of the research problem.

As part of the research, a biographical-narrative interview were conducted with 15 respondents and primary empirical data were analyzed.

5. Discussion

As a result of the study, biographical-narrative interviews were conducted with 15 respondents who were married at the age of 18 and who had at least 10 years of early marriage experience.

During the Biographical-narrative interview the majority of the respondents outlined their practices related to early marriage such as: expectations related to marriage, reasons for early marriage, the issue of integration with the new environment, challenges in cohabitation after early marriage for both men and women, social consequences of early marriage.

The majority of respondents singled out the lack of opportunity to continue education after marriage as a negative result of early marriage. Most of the respondents participating in the research did not have the opportunity to continue their education after getting married.

The reason for this was the increased responsibilities in the family, which meant taking care of the spouse and children; Lack of time, and unwillingness to continue studying. Because most of the respondents could not continue their studies, they could not arrange a career.

> "Actually, when you create a family, you don't think about getting an education and realizing it. I am a mother and it is my duty to take care of my child, raise him and give him a proper education. It turns out that you can't create your own "me" anymore and you can't establish yourself in society". (Female, 29 years old, married, Batumi, 233-236).
>
> "No, I did not continue studying." When I got married, more responsibilities were added to me. To be honest, I didn't even think about continuing my studies. I created a family, then I had children, so I didn't think about studying anymore. When I let them grow up, I realized that I needed to study, but it was too late." (Female, 33 years old, married, village, 1572-1575)

According to the respondents, early marriage brings more negative social consequences for the couple than positive ones. As negative consequences, they mentioned physical and mental health problems, premature pregnancy in girls and related risks, financial problems, violence in the family, termination of education and others. Based on the purpose of the research, the focus was mainly on the issue of the termination of education as a negative result of the practice of early marriage.

It should be noted that the majority of the respondents participating in the study created their families in the 90s of the last century. The difficult socio-economic situation at that time had a great impact on the lives of most of the respondents participating in the study. After graduation, due to the difficult social situation in the family, they could not continue their education and that is why they decided to get married.

The research also revealed that for a small part of the respondents (3 respondents) early marriage was not a barrier to their education and career creation. At the same time as they got married, they were able to continue their studies and get higher education, in which they received moral and financial support from their parents.

Some of the respondents managed to continue their studies and get higher education. One of the respondents even got a job, although according to her estimation, after getting married early, she faced barriers in her career path in the sense that what she could have achieved much earlier, she managed relatively late. Despite this, the respondent does not regret his decision to get married at an early age.

6. Conclusions

The evaluations of the majority of the respondents participating in the research are in agreement with each other regarding getting education, career development and employment after marriage. According to them, the inability to continue studying after marriage was due to the following reasons:

After getting married, with increased responsibilities in the family, difficult social and economic situation, and because of all this, the lack of desire to continue studying. According to some of the respondents, early marriage was not a barrier to getting an education or creating a career.

Despite their early marriage, they managed to graduate from university. According to their assessment, they were able to combine studies and family responsibilities through the active help of parents, which is manifested in the fact that they left their children with their parents while the respondents were studying.

The respondents' evaluations also agree in the aspect where they note that at that time employment and providing for the family independently was impossible without the help of parents. Thus, the respondents' evaluations regarding the availability of education and the possibility of employment after marriage are uniform.

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GENERATIVE ARTIFICIAL INTELLIGENCE (AI) IN EDUCATION: A CROSS-NATIONAL SURVEY ON UNIVERSITY TEACHERS' PERCEPTIONS ON THE USE OF CHATGPT

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Abstract

In November 2022, Open Artificial Intelligence (AI) launched the controversial generative AI tool named ChatGBT-plus or ChatGPT-4 (Chat Generative Pretrained Transformer) which has been available to users via the website in February 2023. Since then, its use in the classroom environment has been debated. Various scholars, especially in the field of computer sciences, provided insights into its functioning and genesis on its possible negative use and impact particularly in the education sector. Therefore, there is a need for teachers' and students' insights vis-a-vis this robot with a global perspective. This exploratory study on 236 university educators based in India revealed mixed perceptions of using ChatGPT as a learning and teaching tool. Surveyed educators are aware of it and its acceptance as teaching tool is still limited. In the conclusion, the study proposed potential research avenues about the use OpenAI in education.

Keywords: ChatGPT, India, quality education, global south, OpenAI.

1. Introduction

Information and communication technologies (ICTs) promote inclusive education (Fu, 2013; Kent & Facer, 2004; UNESCO, 2023). However, the World Bank (2023) worries that some nations in the Global South lack these resources. Therefore, the use AI powered technologies would be possible solution for bridging this gap (Kshetri (2023). However, the emergence of ChatGPT-plus or ChatGPT-4 become a debatable topic among individuals in both the Global North and South as it would hamper teaching and students' learning. Some problems are plagiarism, cheating, copyright and misinformation among many others. (Adeshola & Adepoju, 2023; Dai et al., 2023; Huallpa et al., 2023; Murris, 2023; Wu et al., 2023). ChatGPT-4 resulted from the innovation known as Artificial General Intelligence (AGI) that emerged in 2015 (Zhang et al., 2023). The model was upgraded to Open AI five, then in 2021, it changed to Codex, and in April 2022, it became Dall-E2. The latter led to the ChatGPT-4 that was released in April 2022, and since February 2023, the new version of ChatGPT, known as ChatGPT-plus, has been available to users via the websites (Zhang et al., 2023). Various individuals question the credibility of its content and use, including Sam Altman, the founder of OpenAI (Zhang et al., 2023). Scholars have mainly carried out conceptual studies about this technology, ethics, and copyright (Dai et al., 2023; Trivedi et al., 2023; Zhong et al., 2023). Scholarships about OpenAI, such as ChatGPT, should shed some light on its use among educators and students in the Global South nations as researchers claimed ChatGPT would benefit sectors like education and healthcare in developing economies (Kshetri, 2023). As computer-based technologies intercept learning, much of the debate is centered on its positive use and misuse. This study aims to find out the Global South university teachers' perceptions vis-à-vis the use of ChatGPT with a case study of India, and other three sub-Saharan nations. Such geographical locations were selected due to having English as the medium of instruction. However, this study's data are about India, as the researchers are still collecting data about the other three countries.

2. Information and Communication Technology (ICT) for education in the global south

Information and Communication Technologies (ICTs) in education refer to computer-based technology used for teaching and learning purposes (Kshetri, 2023). The effective use of ICTs helps in both formal and informal education, with the use of computers, the Internet, and other electronic tools such as phones, radio, and television. These tools are paramount in promoting inclusive education as they help create the e-learning environment. The computer-based technologies help students practice their courses at

school and home 24 hours a day and "learning can occur anytime and anywhere" (Fu, 2013, p. 112). Despite these benefits of using ICT in education, the global south still lags behind due to lack of adequate resources (Alharbi, 2023; Department for International Development, 2005). The Internet is yet to reach the grassroots for information and education. The COVID-19 pandemic showed the need for Internet for education in urban and remote areas. The COVID–19 pandemic also ushered in teaching learning technologies that were never thought of before. Students worldwide were connected to various ICT tools such as tablets, and many on mobile phones. Social media also became a mode of delivery of education, interaction, and entertainment (Suárez-Lantarón et al., 2022). Internet is also a tool for human empowerment and promoting inclusive ideas and education. However, World Bank found that there is a huge gap between developing nations and industrialized nations when it comes to internet access. One-third of the world's population "remains offline in 2023" (para.3). The findings showed that only one in four individuals in low-income countries use the Internet (World Bank, 2023). This is an alarming finding because accessing ICT, such as the Internet, can help address various issues, including illiteracy among the inhabitants of developing nations (Karan, 2008; Selmi, 2023). However, a large portion of the population is disconnected from the rest of the world and many people in developing nations are under 30 years old (World Economic Forum, 2022). The nations are urged "to prepare young people to participate in the global knowledge economy" (Samarakoon et al., 2017, p. 646).

3. ChatGPT use in education: Benefits and challenges

ChatGPT, an OpenAI robot, has attracted several researchers' attention in the last two years (Dai et al., 2023; Wu et al., 2023). This OpenAI technology has had four main generations (Wu et al., 2023). The GPT-1 was launched in June 2018, and its main data sources were BooksCorpus and Wikipedia. In February 2019, the system was upgraded to GPT-2 with 40GB of pre-training data, and the webText was its main data source. A year and three months later, the GPT-3 emerged with the Common Crawl as the main source of its data. The current GPT-4 started in March 2023 with the "unpublished" data source (Wu et al., 2023, p. 1123). This technology is powered by artificial intelligence-generated content (AIGC), which enables users to create content such as images, texts, and videos (Wu et al., 2023). The ChatGPT provides prompt responses. It remains a powerful and trustworthy tool due to generating content in various languages, but generated content is problematic because of containing numerous mistakes. (Wu et al., 2023). Despite this advancement, which it timely executes multitasks, ChatGPT has become a debatable topic. There are mixed feelings and feedback about its use in education. According to Adeshola and Adepoju (2023), the emergence of the ChatGPT posed many challenges, such as the violation of academic integrity and honesty. Therefore, Adeshola and Adepoju (2023) recommended that academic institutions work out guidelines about AI-generated text. There are also mixed opinions towards the use of ChatGPT among higher education users. The findings of a recent study showed multiple ethical issues posed by ChatGPT use (Huallpa et al., 2023; Stahl & Eke, 2024). For example, Stahl and Eke (2024) realized that there are issues related to this language-generative AI, such as the concerns about "responsibility, inclusion, social cohesion, autonomy, safety, bias, accountability, and environmental impacts" (Stahl, & Eke, 2024, p. 1). The authors argued that finding the sources to attribute responsibility and authorship would be challenging. Moreover, its specific sources of information sometimes remain unknown to the users It can also promote Western culture because of the under-representation of data about developing nations (Kshetri, 2023; Wu et al., 2023). Despite these criticisms, other studies findings also showed that the effective use of ChatGPT can be beneficial for various sectors such as health, tourism, agriculture, transportation and serving as a resource hub for developing nations (Dwivedi et al., 2021; Javaid et al., 2023; Kshetri, 2023). Therefore, there is a need to conduct an empirical study to determine the use of ChatGPT. This study aims to address four research questions:

RQ1. What computer-based resources do teachers in higher education access in India?
RQ2. What are teachers' existing knowledge of using ChatGPT in higher education in India?
RQ3. To what extent are the faculty prepared to use ChatGPT when teaching in India?
RQ4. What are the teachers' perceptions about using ChatGPT in learning and teaching activities in India?

4. Method

The researchers conducted an online survey of seventeen questions to address the research questions. Surveys allow researchers to collect large numbers of data across various variables (Wimmer & Dominick, 2014). Southern Illinois University-Carbondale's Institutional Review Board (IRB) approved this cross-national study. Questions aimed to test teachers' understanding of using ChatGPT in education, teachers' habit in ICTs, and teachers' readiness and appreciation vis-a-vis the role of ChatGPT in education. The online survey opened on February 15, 2024, and closed on March 11, 2024, at midnight central standard

time (CST), U.S. These respondents were selected using the nonprobability method with purposive sampling to reach out to the faculty and the snowball approach to increase the chances of increasing the number of participants (Wimmer, & Dominick, 2014). In the data analysis, the researchers primarily used descriptive statistics and inferential statistics to test any possibility of differences among the respondents' age, gender, and academic disciplines when using ChatGPT.

5. Findings & discussion

5.1. Socio-economic profile of respondents and internet access

Of the 240 respondents who opened the survey link, 98.3% (i.e., 236) have completed the survey. Of these 236 respondents, 60.6% (M=1.39, SD =0.49) were female. The researchers considered responses marked as 100%. A majority of the respondents were 36-45 years (44.4%), followed by 25.4% of 46-55 years, 23.3%, were aged between 25 and 35 years, while only 6.8% were 56 years or older. Most of the respondents (67.4%), work for private colleges, while 16.1% work for public universities, and 13.6% teach at semi-public colleges. Further, almost as a quarter, 22.9% (the highest number) have 11-15 years of teaching experience, 21.2% have 16-20 years, 19.1% have 21 years or more years, while 16.9% have 6-10 years and 6.8% stated that they have less than two years of teaching experience. About 44.5% mainly teach undergraduate courses followed by 26.3% who teach master's courses. Only 5.1% of the respondents mainly teach doctoral courses. Regarding the academic programs, 60.6% affiliate with STEM programs, 25.8% for Social Sciences, and 12.7% work for humanities, and 0.8% (i.e., two respondents) did not specify their affiliated programs. Interestingly, 50% have intermediate computer skills, 31% believe their computer literacy is advanced, 19% consider themselves experts, and 9.7% are beginners.

5.2. The computer-based resources teachers use

The first research question addressed the computer resources used by teachers. The findings showed that the highest number of participants (19.9%) used their personal computers. The second most used tool is mobile phones (12.7%). About 6.8% of respondents use school computers or tablets, and 5.9% used their other school electronic tools. Further, when asked about the frequency of using computers when teaching, preparing for courses, and grading students' activities, 35.6% of respondents often use computers when teaching, while 22.9% use computer-based technologies when grading students' work and only 26.3% use computers when checking for students' work authenticity or for plagiarism. Even if this finding cannot be generalized to the entire country in India, it reflects the claims about the lack of computer resources. Therefore, there is a need for teachers to have access to computers in the education sector.

5.3. Teachers' knowledge about ChatGPT and readiness to use

In this exploratory study the next questions related to the awareness of ChatGPT and its uses in their work. The questions about ChatGPT use were restricted to the respondents who did not know what ChatGPT is. In this context, the findings showed that most of them (i.e., 85.2%) knew or heard of ChatGPT. Of this number, 62.7% of respondents heard of it a lot, 58.7% heard of it in 2023 for the first time, and 5.1% heard of ChatGPT 3 to 5 years ago. Interestingly, 50% stated that they used ChatGPT. When asked, the purpose of their use, the respondents stated that they used it for personal and academic purposes. Precisely, some respondents wrote: "Research purpose and to acquire and search new information"; "random, make pictures, write poetry"; "edit, translation and rewrite a copy. "Sometimes, look for better ways to use the platform for a positive outcome"; "to have different lines and words"; "content for making presentations"; the online material which is not available in [G]oogle search or sometimes to know the validity of material"; "computer programming language purpose". These responses support Kshetri's (2023) argument about the use of ChatGPT as a source of data. However, it must be clear that it is not yet the source to which the information can be attributed. When asked about their perceptions of using ChatGPT as a teaching tool, it was found that the teachers had mixed feelings. Only 47.3% agreed with the statement about the assumption that ChatGPT would improve students' research abilities. The study also showed that more than a third 36.3% neither agreed nor disagreed with the assumption that ChatGPT will negatively affect students' academic performance. Further, 38.3% do not trust ChatGPT content. About allowing the students to use ChatGPT, 65.2% indicated that they would (somewhat) likely allow their students to use AI-powered tools in the future, even if its use might be normalized. Moreover, 59.7% of the respondents are somewhat agreeable to using ChatGPT in the classes, if they get an opportunity to be trained. Considering this finding, the educators remain undecided or skeptical about using generative AI in the classroom environment (Table 1)

Table 1. Teacher's perception about the use of ChatGPT.

S/N	Statement	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1	ChatGPT and research skills	31(15.4%)	95(47.3%)	48(23.9%)	20(10%)	4(2.0%)
2	ChatGPT and academic performance	19(9.5%)	61(30.3%)	73(36.3%)	28(13.9%)	4(2.0%)
3	Training on ChatGPT	28(13.9%)	107(53.2%)	31(15.4%)	15(7.5%)	1(0.5%)
4	Trusting ChatGPT content	9(4.5%)	27(13.4%)	77(38.3%)	61(30.3%)	5(2.5%)
5	ChatGPT and prelimanary research	18(9.0%)	98(48.8%)	42(20.9%)	16(8.0%)	7(3.5%)
6	Advising students to use ChatGPT	31(15.4%)	85(42.3%)	32(15.9%)	22(10.9%)	10(5.0%)
7	Students' cheating, plagiarizing	23(11.4%)	74(36.8%)	59(29.4%)	21(10.4%)	2(1.0%)

The researchers further tested whether there was any significance between some variables such as academic discipline, years of experience, gender and perceptions. On the academic discipline variable, one-way ANOVA was conducted because there were more than two factors (i.e., Humanities, Arts and Social sciences, and STEM) to determine whether the perceptions about ChatGPT use are statistically significant. The findings showed that the p-values were not statistically different, as the p-value was above 0.05. Therefore, it was found that teachers tend to have similar attitudes toward ChatGPT. An independent t-test was also conducted to test whether the perceptions toward ChatGPT depend on gender. Findings showed the t-scores for two variables (i.e., fifth and sixth statements). There was a significant difference in females' perceptions (M=2.52, SD=0.98 and male's perceptions (M=2.26, SD=.81); t(181)=1.85, p= 0.033) and on statement six, female's perceptions (M=2.59, SD=1.14 and male's perceptions (M=2.12, SD=.0.94); t(180)=2.87, p= 0.002). However, it would be too simplistic to argue that gender plays a role in perceptions about ChatGPT.

6. Conclusions

The findings from the survey addressed the four research questions. A few respondents stated that they use computers when teaching. The findings also showed that the teachers are aware of ChatGPT, but had mixed feelings toward using ChatGPT as teaching or learning material. For example, 59.7% are somewhat agreeable on using ChatGPT in the classes if they get an opportunity of being better informed and trained. Despite this tendency to rejecting ChatGPT as a legitimate tool for education, respondents expressed interest in being trained about its use. Surveyed teachers also consider ChatGPT a research resource and not as a threat to their work. This is unlike past studies (Adeshola and Adepoju, 2023; Stahl and Eke,2024; Zhang et al., 2023) where ChatGPT is being considered as a concern to educational institution on issues of plagiarism and cheating. This exploratory study's findings fill the gap in the use of ChatGPT among educators in Global South nations. This study also brings another major finding with reference to Kshetri's (2023) study where the findings showed that ChatGPT would benefit sectors like education and healthcare in developing economies. The findings from this study can serve as a point of reference for expanding to other nations located in Southern Asia or Sub-Saharan Africa. Future researchers can explore the influence of people's academic discipline on accepting or rejecting this fast-growing OpenAI tool in education, but it would be used with caution and its better understanding could be a solution. Therefore, in-depth studies about the teachers' and learners' points of view would help understand the users' assessments of technologies, such as OpenAI in education. Given possible negative consequences associated with ChatGPT, there is a need for building a comprehensive teaching framework about the use of OpenAI by focusing on its benefits and mitigating possible challenges.

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WHICH IS MORE DIFFICULT, LISTENING OR READING?

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Abstract

In today's world, there are many texts we read or listen to. Regardless of how texts are presented, listening, and reading skills are equally important in everyday life. More attention is paid to developing reading skills, less to listening skills. There has been little comparative research on reading and listening comprehension of L1 texts. Children's listening skills in L1 develop before school, but reading skills are mainly developed at school. Previous studies shows that listening comprehension is better until the age of 13-14, and only then do both skills reach the same level. Therefore, special education teachers recommend that children with reading difficulties should listen to long texts rather than read them. In any case, teachers must pay attention to the development of both skills at school. The objective of our study was to find out whether 4th-graders understand the meaning of texts better by reading or listening to it, and if one skill is better or worse developed, what is the level of the other.

Keywords: Text comprehension, listening skills, reading skills.

1. Introduction

The modern information society has created an overabundance of both spoken and written texts. The ability to understand different texts is important for navigating social interactions and achieving personal goals (OECD, 2019). The text comprehension problems can contribute to learning barriers and academic failure (Cain, 2010). The concept of text has expanded: texts are no longer only traditional printed texts, but also various other materials that require reading, listening, and viewing skills (Castek, 2016). If people talk about understanding the text, most often they mean understanding the printed text (e.g., Oakhill et al., 2015; Reutzel, 2016) and excluding much of the text that is received by listening instead. Even the school is more concerned with developing the understanding of printed texts, especially in older classes, while the conscious development of listening skills is given less attention (Aruvee, 2022; Diakidoy et al., 2005). It is crucial to promote the student's ability to understand texts, emphasizing both listening and reading skills to prevent learning difficulties.

2. Text comprehension

The acquisition of the mother tongue is based on listening. This, in turn, is a prerequisite for other language skills: speaking, reading, writing. The child learns to listen from birth by himself, but reading skills must be taught to children. The ability to understand oral texts provides the basis for both reading and understanding what they read in the future (Fisher & Frey, 2014). However, understanding oral and written text is not the same – understanding oral text does not guarantee understanding of written text, even if it is the same language (Cain, 2010).

Lund (1999), Diakidoy et al. (2005), and Brown & Brown (2011) have found that listening tasks yield the best results in terms of explaining the overall comprehension and synthesis of a text. Readers perform better on tasks requiring factual knowledge and they can recall more details because the text is fixed and they can go back to the text, whereas listeners must construct the text while listening and find help from other sources, but they are better able to grasp the gist of the text (Diakidoy et al., 2005). Listening comprehension outperforms reading comprehension up to age 13-14; later, reading comprehension outperform listening comprehension (Fisher & Frey, 2014).

The objective of our study was to find out whether 4th-graders understand the meaning of texts better by reading or listening to it, and if one skill is better or worse developed, what is the level of the other. The article seeks an answer to the question of whether students in 4th grade have equally developed the reading and listening skills needed to understand the text and if one skill is better or worse, what their relationship is.

3. Methodology

We conducted tests to get answers to our research questions. We tested 4th-grade pupils who were 10-11 years old. They studied in two different classes. There were 46 pupils in total, 25 boys and 21 girls.

To find out whether pupils understand the text in the same way when they read and listen, two texts were chosen that were as similar as possible. To exclude the possibility that students are already familiar with the texts, which could affect their comprehension, the two texts were selected from the non-fiction book "No way", written by Peter Ernits (2014). The book contains stories about little-known animals; therefore, it could be assumed that 4th-grade students would have no prior knowledge of the topic. We assessed the difficulty of the texts with the readability index Lix (Björnsson, 1968; Puksand, 2004). The texts selected for the study were of similar difficulty (see Table 1). One class read the text 1 and listen to the text 2 and the other class read the text 2 and listen to the text 1.

Table 1. Comparison of texts.

Texts	Number of words	Number of sentences	Mean length of sentences	Percent of long words	Readability index Lix
Text 1	438	42	10.4	37.2%	48
Text 2	417	43	9.7	39.6%	49

To assess text comprehension, 7 questions were compiled for both texts according to Bloom's taxonomy (Bloom et al., 1956; Krathwohl, 2002). Questions 1 and 2 corresponded to the remembering level of Bloom's taxonomy, questions 3 and 4 to the understanding level, and questions 5, 6, and 7 to the analysis level. Questions 1 to 6 were multiple-choice questions. The student had to choose one correct answer from four options, question 7 was open-ended. In total, the student was able to get a maximum of 15 points.

4. Results

In the results, we compare students reading and listening skills and look at the reading and listening skills of students with low and high text comprehension results.

4.1. Results of reading and listening tasks

Students understood the text better by listening to it. The reading task scored an average of 9.65 points (64.35%), while the listening task scored an average of 11.46 points (76.38%). The minimum text comprehension score was 1 point for reading and 6 points for listening, a maximum of 15 points for both. The standard deviation (4.15 vs 2.53) suggests that there is a larger difference between the reading scores than listening scores.

Figure 1 summarises the points obtained in each respondent's reading and listening task. The maximum score was achieved by 3 students (2 girls and 1 boy). 7 students, including 3 boys and 4 girls, scored below 15 points – they had low results in both the reading and listening tasks. Most students performed better on the listening test than on the reading test.

Figure 1. Reading and listening scores by pupils.
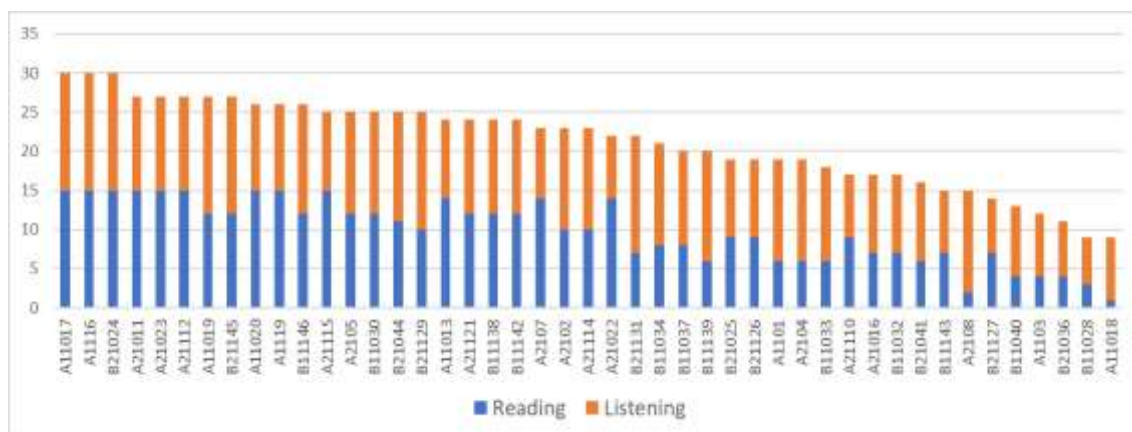
Both boys and girls understood the text better by listening (see Table 2).

Table 2. Comparison of girls' and boys' results.

	Reading score (%)	Listening score (%)
Girls	61.59	76.51
Boys	66.67	76.27

When text comprehension on listening were relatively similar in both genders, while reading revealed differences. The girls' performance on the reading task was lower than the boys' performance. Different previous studies (e.g. OECD, 2023) show that girls read better than boys, so in our study, we can justify the superiority of boys with a small sample size.

4.2. The reading and listening skills of students with low and high text comprehension

In our study, we also wanted to find out the relationship between listening and reading skills among students with low and high text comprehension. Figure 2 shows the results of the student reading and listening test by percentage range.

Figure 2. Distribution of the results of reading and listening tasks between 10-percent performance ranges.
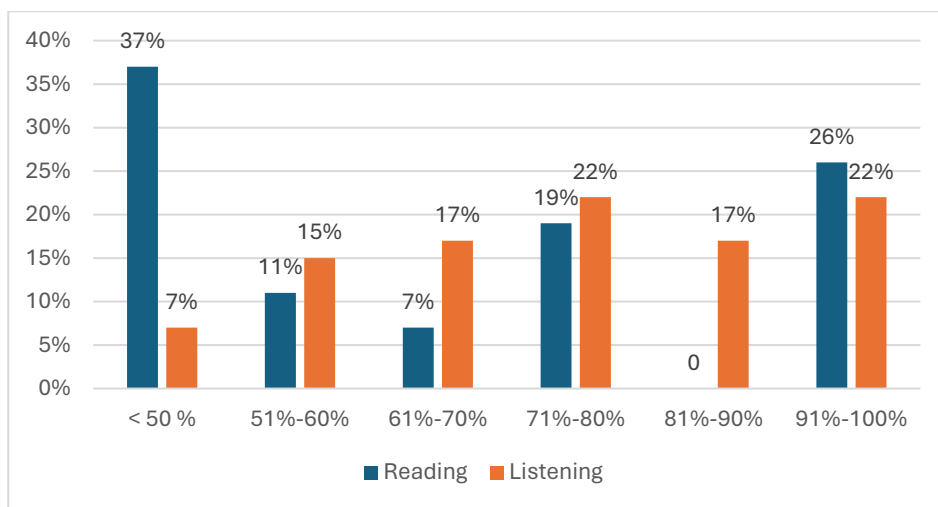
In the reading task, 37% of the students had a reading score below 50% and 26% of the students scored above 90%. In the listening task, 3 (7%) students scored below 50% and 10 (22%) respondents scored above 90%.

Pupils with a reading score below 50 percent were defined as low achievers (see Figure 3). There were 17 (37%) poor readers. Only one poor reader scored the same on the listening task, while all the others had a better listening score. 6 poor readers scored 80% or more on the listening task, indicating good listening skills. Among the weak readers, there were 9 girls and 8 boys.

Figure 3. Comparison of reading and listening test results of low achievers.
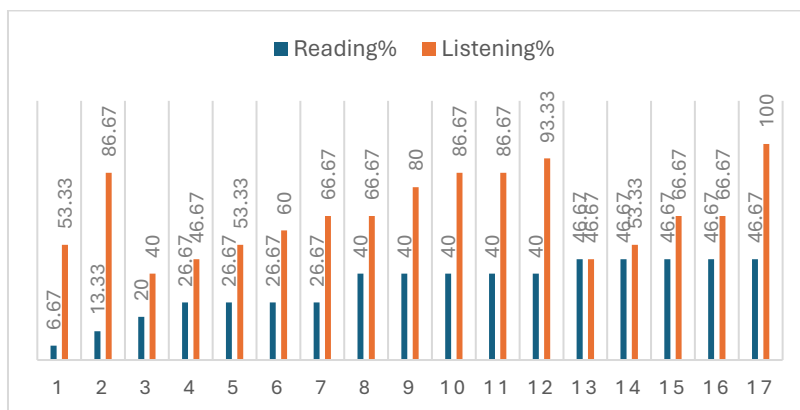
Pupils who scored below 50 percent on a listening task were counted as having poor listening skills. There were only 3 students with low listening skills (students 3, 4, and 13 in Figure 2), but their reading scores were also low. Among the students with low listening skills, there were 1 girl and 2 boys.

Students with a score of more than 90 percent were designated as good readers (see Figure 4). There were 12 good readers based on the results. 3 good readers also performed a listening task on the maximum points. 3 good readers had a listening task score of 80%, while others had a listening task score of less than 80%. One good reader had a listening task score of just over 50%, but no one had a reading score of less than 50%. Among the good readers of the sample, there were more boys: 5 girls and 7 boys.

Figure 4. Comparison of good readers' reading and listening scores.
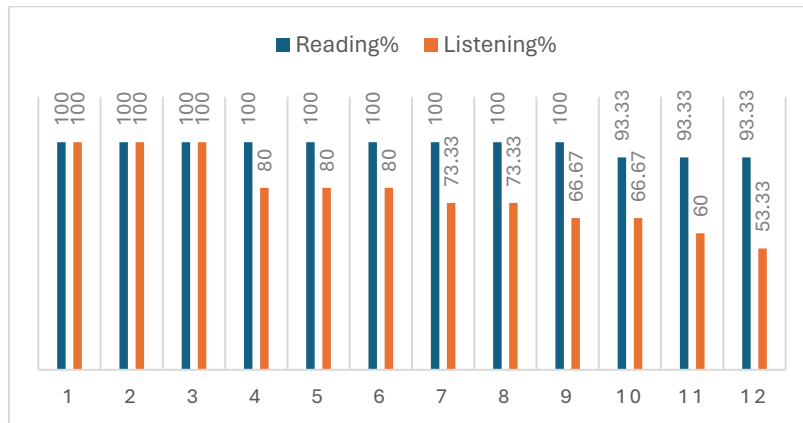
Students with good listening skills included students with a listening score of more than 90% – there were 10 such students (see Figure 5). Among students with good listening skills, there were 5 students with average reading results and as many as 2 students with reading scores below 50%. Among students with very good listening skills, boys and girls were equal.

Figure 5. Comparison of good listeners' reading and listening scores.
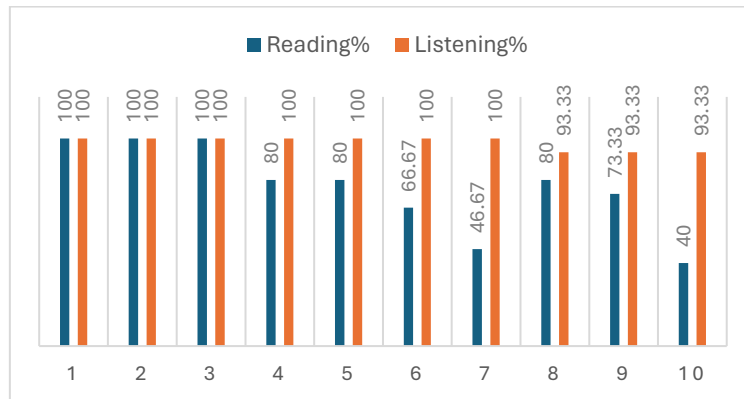
Among students with good listening skills, there were 5 students with average reading results and 2 students with reading scores below 50%. Among students with very good listening skills, boys and girls were equal.

5. Conclusions

We can conclude that for 4th graders, listening is easier than reading. More students found listening to tasks more pleasant. Students who liked listening more received significantly fewer points for reading tasks than for listening tasks. The listening task was considered more difficult by 43% of students, while for 57% of children, reading was more difficult. Students who found listening more difficult received the same number of points for both assignments.

The individuals who struggle with reading proficiency are not necessarily lacking in listening skills. The findings revealed that those with challenges in reading demonstrated notably higher scores in listening tests, with some even achieving excellent results. While a small number of students exhibited poor

performance in listening tests, their reading test scores were even lower, suggesting the possibility of more severe learning difficulties for this subgroup.

Analysis of the reading test responses revealed that students did not use the opportunity to go back to the text and look for the correct answers in the text, and therefore they chose answers that seemed logical, chose only partially correct answers, or wrote answers that had no connection with the text. Reasons for this kind of performance include poor inferencing and linking skills, inadequate comprehension tracking skills, lack of awareness of reading strategies, and the ability to use these strategies. Therefore, pupils also need more teaching of reading and listening strategies.

4th-grade students who demonstrate a good comprehension of listening texts, emphasizing the need to prioritize the instruction of reading strategies. Teachers must remember that a student struggling in reading may be good at listening. Consequently, teachers should develop reading and listening skills in all classes, not just primary classes.

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A DIGITAL TOOL TO HELP WORK-ORIENTED PROJECT STUDIES IN HIGHER EDUCATION INSTITUTIONS

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Abstract

Development-oriented learning combines many things, such as project learning, problem-based learning, learning by development, learning by doing, experiential learning, and research. One perspective behind developing the Learning by Developing (LbD) Action Model has been the development of higher education students' future working life skills during their studies and the opportunity to network with companies. Through business cooperation, students can more easily find a job after graduation. The LbD was developed at Laurea University of Applied Sciences (Laurea) in the early 2000s and has been used as a pedagogical method for almost 20 years. The LbD pedagogy must be constantly developed and renewed to stay up-to-date and as a valid pedagogical method in a changing society. This article describes a digital tool in the design phase that would facilitate working-life-oriented project studies in higher education institutions. The starting point for the tool's design has been research conducted in three higher education institutions between 2019 and 2022 and practical teaching and learning experiences at Laurea according to the LbD model.

Keywords: Learning by developing, higher education studies, students' experiences, project-based studies.

1. Introduction

This article describes a planned project, the background of which is the need to develop a new digital tool to help lecturers, students, and project clients work on work-life-oriented student projects in higher education institutions. One starting point has been the pedagogical method of Learning by Developing (LbD) Action Model used at Laurea University of Applied Sciences. The LbD has been used as the primary pedagogical method at Laurea for almost 20 years. Through research and experience, information has been obtained that it would be good to use LbD as a tool that primarily helps lecturers plan, implement, and evaluate their work-oriented project courses. Information has also been collected from the students, and the students would also like more detailed guidance or a concrete tool to help them use LbD, which would help them better understand the development of their skills. The project clients are the third and most important in working on work-life-oriented student projects. Project clients are often only one time in various work-oriented student projects as principals, and they also need concrete instructions on how to operate in the projects and what their role is in them. This article describes what has already been planned and the background thoughts and theories behind the design of the new digital tool. The article also contains background information about the research conducted for computer science students, lecturers, project clients, and other practical experiences using LbD.

The starting point for the design of the new digital tool is firmly LbD, but the prerequisite for using the tool is not LbD pedagogy as such, but it is suitable for any work-oriented student project implemented in a higher education context. The subject of a work-oriented student project can be almost anything, i.e., it does not have to be related only to IT projects, even if the research behind it was related to IT projects of computer science students.

2. Learning by developing (LbD) action model

The creation of the Learning by Developing (LbD) Action Model is based on the University of Applied Sciences Act (2003/351) (Finnish Law, Act351/2003), which influenced the recognition of pedagogical change at Laurea. In the University of Applied Sciences Act, the tasks of universities of applied sciences were defined as pedagogy, regional development, and research and development work. These tasks

have been integrated into the new pedagogical LbD model at Laurea. The LbD was developed to support teaching and learning, regional development tasks based on the University of Applied Sciences Act, and creating innovations for companies as enablers of a new competency-based curriculum. (Raij, 2007).

The LbD includes research, authenticity, partnership, experience, and creativity as part of competence development (Raij, 2014). An essential part of LbD pedagogy is the importance of lifelong learning and its importance for students' future (Ojasalo, 2019). What is essential in LbD pedagogy is the jointly agreed roles of lecturers, students, and project clients, competence-based, and the perspective of working life development.

The LbD Action Model has been used extensively at Laurea since 2006, and it is a valuable way to teach higher education students new skills needed in working life (Raij, 2012). The LbD must be constantly developed and improved to keep up with the constant change. Using LbD as a pedagogical teaching and learning method requires careful familiarization and good instructions for all stakeholders.

3. Lecturers' and students' practical experiences and results from research

At the beginning of the LbD project, students familiarize themselves with the competence goals defined in the project. The competence goals are described in the higher education organization's study plan and the customers' definition of their goals. The client's goals support and deepen the goals set in the study plan, bring personal perspectives to the student's work and clarify the differences between development projects in different operating environments. In connection with several LbD projects implemented with students, it has become clear that students constantly reflect on their level of competence and why it should be developed in the subject area. Reviewing one's competence can be recognized by a quick thought: "This is easy; I already know everything related to this." or "Oh no, I do not understand any of this; how am I going to get through this." or "Well, I have to do this." At the beginning of the LbD project, the students should think about their current competence versus the desired competence as part of the curriculum to be completed. At competence development, students learn to think about how new competence can be used more widely, for example, in future career choices. The modified Binkley model presented in this article is suitable for identifying this process and supporting the setting of competence development goals (Binkley et al., 2012).

At Laurea, individual projects are implemented for business customers in the P2P (peer-to-peer) model of LbD projects. In these working life development projects, students form a team of 4-7 people, led by a project manager who is a student. The development of competence, therefore, extends to, for example, group dynamics, external and internal communication, teamwork, theoretical information processing, project expertise, method choices, problem-solving, presentation methods, and consideration of the unique needs of the operating environment and the actual subject.

The new digital tool would strengthen the students' understanding of competence development and its related factors. When implementing projects and assignments, the development of competence brought by failures and challenges and their effect on meta-competence and problem-solving skills can sometimes be wholly forgotten. The new tool would help students better recognize the development of skills other than those related to the substance itself.

As the students' competence develops and they participate in various LbD projects, they get a real-time perspective on the real competence needs of working life and can relate their competence to these. By examining these, students can plan their own goals for their future professional development and consider future potential employers based on cooperation. Clients get the same perspective on their future employees and their level of competence. Based on this, they can agilely highlight the factors needed for their studies on both sides. At best, the student can develop their competence systematically through various projects and find employment with one of the clients of the cooperation project. The client gets an employee who is familiar with the operating methods and gets an employee to fill the required competence gap.

One of the background factors for this article was a study carried out at Laurea, Robert Gordon University (RGU), and Haaga-Helia University of Applied Sciences (Haaga-Helia), which targeted computer science students, lecturers, and project clients. One of the goals of this research was to get information from different parties, pedagogy staff, lecturers, students, and project clients about what kind of development needs LbD has, in their opinion. One research question was used to collect information and suggestions on improving the LbD Action Model. The answers to this question were compiled from the answers of all the participants in the study. (Lintilä, 2023).

The lecturers had many suggestions for improving LbD, especially its use and familiarization. As suggestions for improvement, the lecturers hoped for clear and reasonable instructions for each party, i.e., lecturers, students, and project clients. The instructions must be very concrete, practical, and easy to use. Instructions were requested for different situations because client projects often differ, and study modules and subjects vary. Examples of good practices and best practices were also requested. The students hoped

for a deeper familiarization with the LbD model in order to better understand the ideology of LbD. The research also yielded many ideas from the project clients for improving the LbD model and better familiarizing the project clients. The most central finding of the research was that a clear and practical guide and tool is needed to implement and use LbD, which helps the understanding of the role of all stakeholders in pedagogy according to the LbD model. With the help of the research, many things have been found that still need development in the LbD model. However, most improvement needs are related to more precise and concrete instructions and a new practical tool with instructions for lecturers, students, and project clients. Developing a new practical tool has already started, but it is still in the planning phase.

4. Objectives

The new digital tool aims to help lecturers, students, and project clients. The tool is designed to have sections for each of these three stakeholders, which helps them better plan and implement their parts of the project's tasks from their perspective. Lecturers' tasks start before other parties because they are responsible for developing students' skills according to the curriculum. Lecturers have many tasks related to planning, study module implementation, and competence assessment. These tasks are not always the same in every project, but they are linked to the substance that the students are studying. Implementation methods also vary, which is essential to planning and implementing the study module. In addition to the customer project, the study module can include many other learning tasks, which must be planned, and what will be learned in the projects. In addition, the lecturers' task is to plan which assessment methods are included in the study module. The evaluation can consist of the lecturer's evaluation, an exam, assignments, project implementation, self-evaluation, peer evaluation, and customer evaluation. Before starting the study module, students must know how the study module will be evaluated. When designing the tool, many issues related to the lecturers' needs must be considered so that the tool facilitates the lecturer in working on a life-oriented project teaching.

From the students' point of view, the new digital tool must be such that the students can easily understand the process of developing their skills. Binkley's model has been taken as one of the background theories from the point of view of the development of students' skills, which has been supplemented (Table 1). To expand students' understanding, the model has different areas they look at and thus better understand what they should learn and how their skills develop. Concerning the different sub-areas, the table also has a division into the development of student personal competence, the development of team skills, the development of project work skills, and the development of competence made with working life. The tool also aims to help students understand better their learning during the study module and the work-life project. Competence objectives are defined in the curriculum, but students' competence often develops in many other subjects besides the competence objectives defined in the curriculum. The tool, therefore, helps students recognize the development of their skills in a broader area.

The role of project clients in work-oriented study projects varies a lot. The purpose of the new tool for project clients is to identify the client's role in each project well before committing to the project. In some projects, the client's role can be the typical role of the client, to whom the students regularly report on the project's progress, and the client guides the project's progress and tasks. In some projects, the client's role can be a mentor; in others, the client can be more of a teacher. However, the customer is always the one who tells the project's goals and related schedules. However, it is good for the customer to know the students' schedules in advance so that the project can be adjusted accordingly. It is usually also crucial for the customer to know what the students already know and what they are learning in the study module, i.e., the lecturer must also be able to tell the clients the competence objectives related to the study module and which of them are intended to be learned during the project.

Table 1. An outline of the learning process of a work-oriented project (Lintilä and Marstio, 2022, modified from Binkley's model).

Stages of the learning process	ME (What do I learn and what is critical at each stage)	My Team (teamworking skills)	Project (project working skills)	Working life context (working life skills)
Project kick-off and team grouping	Interaction with different actors. Define your own learning goals. How will you reach them as well as the results the working life partner expects?	You get to know your team members and define together the learning objectives for the project	With your team, you will create a thorough project implementation plan. You agree on roles and responsibilities within your team. Critical: commitment	You get to know the working life partner and investigate backgrounds of the project and the expectations of the project partner
Building the knowledge base and framing the challenge	You learn about information search. Remember source criticism	Leveraging the strengths of different group members Critical: Even division of labour	Skills in project work and project management Critical: Coordination of the teamwork	You improve critical thinking skills
Problem solving and formation of solution(s)	Your problem-solving skills will evolve. You can enhance your creativity	Critical: Reconciliation of different perspectives and aspirations	Your skills in co-development and innovation will develop	You gain ability to apply theoretical knowledge to the working environment of the project partner
Presenting solutions and reflection on the lessons learnt	You reflect your and your team's activities and learning in light of the learning goals. You develop your presentation skills	Critical evaluation of the solution to be presented. Practicing the presentation	Elaboration of the project report	You are able to speak expertly in questions related to your field of education
Skills and competencies to be developed at all stages	You are able to identify your own competence. Your trust in your competence is strengthened	Development of teamworking skills	Project management skills in practice: how to have meetings, schedule work and agree on things	You gain ability and confidence to work with people from different backgrounds

5. Development methods

The new digital tool development project will be implemented in three phases. In the first stage, definition and planning are done using service design. Three universities of applied sciences from Finland have signed up for the project cooperation: Laurea University of Applied Sciences (Laurea), Haaga-Helia University of Applied Sciences (Haaga-Helia), and Southeast Finland University of Applied Sciences (XAMK). Based on the specifications and designs, a digital tool is implemented using agile methods in the second phase. After the implementation phase, the tool is tested and piloted in various project study implementations.

The division of work between the three universities of applied sciences is agreed upon during the project's planning phase. In the planning phase, issues related to the ownership and licensing policy of the new digital tool are also considered. Agreeing on ownership during the project's planning phase is essential because digital tools must be maintained and further developed. The rights to use the digital tool should be agreed upon at the very beginning of the project so that all parties know their rights to use the tool after publication. In the future, it is possible that the new digital tool can be expanded, and a commercial product can be created from it, which can be widely marketed worldwide.

6. Discussion

When applying a working-life-related project, the lecturer needs to articulate the student's role and the kind of competence that will be developed in the project concerning the content goals of the course without forgetting generic skills. A structured methodology requires all parties to have the ability to cooperate and tolerate uncertainty and incompleteness; there are no ready-made answers. A practical guide to being produced because of the proposed development project will surely be in demand.

Online courses containing large groups of students challenge the ways of implementing working-life-related projects. Along with lecturers' skills development, modern online teaching tools and collaborative learning methods have offered solutions for managing big groups. The next challenge and opportunity is the development of artificial intelligence and its utilization in learning. There are no ready-made answers in learning based on authentic working-life cases, and the assessment focuses on the learning goals and the development of competence in the learning process. Hence, using such tools as ChatGPT cannot replace a student's thinking and efforts in an authentic working-life project.

7. Conclusions

An authentic learning environment is a very up-to-date phenomenon in higher education, and technology provides tools to make it available online. Online degree programs require new skills in both learning and supervision. Competences acquired through working on life-related projects live in time and adapt to the challenges of a changing world. Learning is not oriented only to the substance of the studied subject but also to the generic skills needed in working life. The student accumulates, as if unnoticed, various meta-skills as a working-life project progresses: time management, organization, data management networking, group working, and creative problem-solving. These kinds of skills are in high demand in today's workplaces.

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INTEGRATING THE ARTS INTO KINDERGARTEN CURRICULUM: A CASE STUDY WITH CHILDREN IN CROATIA

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Abstract

Art in general and various art forms are woven into the everyday lives of children in kindergartens. Arts education contributes to activating brain areas associated with cognitive, social, and observational skills, motivation, empathy, and attitudes related to non-artistic learning (Ishiguro, Ishihara, & Morita, 2023; Russel & Zembylas, 2007). Artistic expression is an important form of communication for preschool children, while verbal expression is not yet (sufficiently) developed. Croatian kindergartens cultivate the artistic fields of music, dance, theater, literature and visual arts, which are complementary and intertwined in an integrated approach to preschool children's learning. As two distinct art forms, music and visual arts share many structural elements and processes and allow for meaningful integration opportunities that create natural synergies. When working with children, however, it is not enough to listen to music, sing, or paint, i.e. to use art only for entertainment, for the free development of the child, or the development of artistic skills. Preschool teachers should know what they want to achieve with these activities and be aware of contemporary approaches to learning and teaching to create the necessary conditions for children to acquire knowledge and skills through their experiences. This type of learning finds strong support in constructivist learning theories, which emphasize that children need to be actively involved in restructuring their prior cognitive concepts by questioning their thought processes and beliefs, asking new questions and reconstructing their existing understanding, The article presents a part of the project carried out in the kindergarten "Lišnjak" in Pićan, Croatia, in 2024. Using empirical examples, the innovative methods of using art to create new knowledge and skills based on the children's experiences are presented. The part of the project that included integrated artistic research activities in the field of music and visual arts is described, with a special focus on the concept of sound sculpture (sound art). The children were confronted with situations that challenged their way of experiencing, thinking, feeling, and expressing themselves. The process of carrying out the activities is described and examples of the children's learning are given. The results of the study show the positive effect of the activities carried out on the children's motivation, creative thinking, and artistic expression.

Keywords: Constructivist learning theories, early and preschool education, music, project approach, visual arts.

1. Introduction

Art in general and various art forms are woven into the everyday lives of children in kindergartens. Arts education contributes activating brain areas associated with cognitive, emotional, social and observational skills, motivation, empathy, self-identity and attitudes related to non-arts learning (Ishiguro, Ishihara, & Morita, 2023; Russel & Zembylas, 2007). Artistic expression is an important form of communication for preschool children, while verbal expression is not yet (sufficiently) developed. Arts education develops children's ability to communicate ideas and feelings in different forms and through different media (Bautista, Tan, Ponnusamy, & Yau, 2016). Croatian kindergartens cultivate the artistic fields of music, dance, theater, literature and visual arts, which are complementary and intertwined in an integrated approach to preschool children's learning (National Curriculum for Early Childhood and Preschool Education, 2015). Integrating the arts into the curriculum provides children with learning experiences that are intellectually and emotionally stimulating and based on making connections between new information and everyday life (Russell & Zembylas, 2007). The effects of integrated arts education are also transferable to other artistic and non-artistic domains (Samuelsson, Carlsson, Olsson, Pramling, & Wallerstedt, 2009). The topic of this study is the integration of music and visual art – two different art areas and forms with the common feature of expression in non-verbal language. Musical and artistic

language share many structural elements, principles and processes. There are numerous studies that have demonstrated the benefits and positive outcomes of integrating visual arts and music in education, particularly with early childhood and preschool children (Estrada & Nixon May, 2019; Hanna, 2014; Krogh & Morehouse, 2020). However, when working with children, it is not enough to just listen to music, sing or paint, i.e. to use art only for entertainment, for children's free expression or to develop artistic skills. Educators should understand the principles of arts education and know *why* they are creating a learning activity (learning objectives), *what* learners will gain from participating in a learning activity (learning outcomes) and *how* to create a stimulating learning environment. This type of learning finds strong support in constructivist learning theories, which emphasize that children need to be actively involved in restructuring their prior cognitive concepts by questioning their thought processes and beliefs, asking new questions and reconstructing their existing understanding (Tomljenović & Tatalović Vorkapić, 2020). In the constructivist approach, the traditional role of the teacher as a transmitter of knowledge is transformed into the role of designer of activities; teachers become facilitators of children's learning by finding ways to involve children in exploring and solving problems in an interdisciplinary way and making their own experiences by creating meaningful connections through interesting and challenging learning activities (Bautista & Ho, 2021; Ferrero, Vadillo, & León, 2021). One of the best learning models that promotes active learning is project-based learning (PjBL) and related problem-based learning (PBL). They represent active, child-centred teaching models that encourage learners to work in collaborative groups on real-world challenges to promote the acquisition of higher-order thinking skills through interdisciplinary learning (Ferrero et al., 2021). In both approaches, the emphasis is on personal research, group work and interactive conversations where children's independent expression of their own ideas, thoughts and actions is encouraged

With this paper, we wanted to point out the importance of understanding the purpose and goal of art education in the context of constructivist theories, using methods that encourage children's exploration and creation in meaningful artistic processes. Although the main topic of the described project is the integration of visual and musical arts, it is important to emphasize that the learning content of all activities also included learning about nature, science, language, sustainability and other areas of children's life, as they were based on real life situations and took place not only inside but also outside the kindergarten. In this way, the activities contributed to the children acquiring deeper knowledge and skills not only on an artistic level, but also in a broader sense.

2. Method

2.1. The problem and the goal of the research

The aim of this study was to investigate the possibilities of integrating visual arts and music in teaching children aged 3 to 6.5 years. The research aimed to explore innovative methods and activities based on the constructivist pedagogical approach, and to investigate their effects on children's performance in terms of motivation, social interaction and creativity. The integration of artistic activities is not uncommon in kindergarten, but the way in which these activities are carried out is important. There is still a perception among some educators that artistic activities are for entertainment, children's free expression or the development of artistic skills. However, through arts activities, children can develop cognitive skills, explore, problem solve and develop creative and critical thinking in the same way as in other areas. The entire project was carried out in two cycles in the kindergarten „Lišnjak" in Pićan, Croatia. This article presents the second part of the project, which was carried out in 2024 and included artistic research activities in the field of music and visual arts in a multimodal environment, focusing on the concept of sound sculpture (sound art). The study also aims to answer the following research question: *Does arts integration based on constructivist principles help to improve children's motivation and social and creative skills?*

2.2. Participants

There are two pedagogical groups in the "Lišnjak" kindergarten. The study was conducted with both groups, in which there are children aged 3 to 6.5 years (24 children in total). The groups are led by two kindergarten teachers who conducted research activities. Before and during the study, all necessary procedures were carried out to ensure that the ethical principles for protecting the privacy of the participants were observed.

2.3. Data collection

The research was based on a qualitative case study design. For the purpose of this research, data were collected by observing the activities carried out, taking notes, photographing and recording the activities, analysing the notes and recordings and drawing conclusions based on the material collected,

and interviewing the kindergarten teachers in a semi-structured form. The questions were open-ended and included information about the kindergarten teachers' work experience, observations during and after the study in relation to the research question, and opinions on the advantages and disadvantages of the activities carried out with children. The notes were audiotaped and transcribed. The research indicator checklists were created to help the kindergarten teachers assess the degree of change in children's motivation, social interaction and creativity. The checklist for motivation included items such as children's retention in the activity, concentration and level of involvement in the process. The social environment checklist included items on the level of interaction with peers, willingness to participate, self-expression, self-confidence and attention regulation. The creativity checklist included items on the expression of specific creative skills such as unusual imagination and unusual visualisation of emotions and experiences through verbal and artistic expression, unusual ideas, humour, richness of artistic expression (through use of colours, shapes, lines, composition, use of voice, singing), synthesis of experiences, reflections, thinking

2.4. Description of activities and discussion

At the beginning of the project, two online meetings were organized with the director and the kindergarten teachers, during which the idea, purpose, objectives, methods for conducting the research and the activities to be carried out with the children were presented to them. The research in the second cycle consisted of three sets of activities. Integrated artistic activities were carried out according to the interests and abilities of the children and teachers. Each activity began with open-ended questions that encouraged the children to reflect, express and connect with their environment and past experiences and feelings. The first set of activities revolved around the question Can we see/feel/show sounds? The experiment was carried out with a "device" consisting of a metal pot into which a loudspeaker was inserted. The pot was covered with hard aluminum foil on which various loose materials (seeds, plastic balls) were placed. The sound was transmitted using the "Frequency Generator" mobile application. At different frequencies, the loose material behaved differently on the aluminum surface and formed different shapes. The next art activity began with questions such as – Can sound have color and shape? The children were shown the abstract artwork of some artists who painted their experiences with music (Kandinsky, Klee). After that, the children themselves tried to depict music through painting, using tempera and collage techniques. The next activity was making a joint sound sculpture called Rain, of connected pieces aluminum foil joined together on which they had previously drawn a drawing of the sound of rain and wind (Figure 1). The second set of activities began in the outdoor area of the kindergarten. By guiding communication through questions and encouraging inference, the children became aware of objects in nature and the environment that produce sounds (e. g. the sound of trees, streams, rattling wires, etc.), the feeling that sounds evoke, and the interdependence of the structure of objects and the sounds they produce. The next activity took place in the kindergarten and involved looking at examples of sound sculptures on You Tube. The children were shown video clips of the artists Zimoun and Pinnucio Sciolo as well as some other examples such as a wave organ and a wind harp. The children tried to work out for themselves how the sound was created in the examples shown and the conversation also turned to the visual features of the sculptures. The children then began to make a sound sculpture together. The process involved a collaborative 'painting' of music by creating a free-standing installation on a wooden structure previously made with with vertically stretched strings of ropes. The children added strips of coloured paper and small musical objects made from beads, pieces of metal, etc (Figure 2). The third set of activities related to rhythm research. The children listened to music, verbalized their observations of changes in rhythms and demonstrated them with movement in space. The next activity was to create a picture using wooden sticks with absorbent cotton covered in fabric attached to the ends. Pieces of music with different rhythms served as a sound stimulus. The children dipped the sticks in the paint and 'drummed' them rhythmically on the paper, transferring their own experiences with music into an artistic interpretation of what they had experienced. In the next activity, the children played with cardboard tubes made from recycled paper, which they used to create their own rhyming combinations. After a discussion about possible ways to create a sound sculpture, the children and their teachers realized the final version of the interactive mobile sculpture (Figure 3).

The above activities encouraged the children to develop associative thinking, creative expression and the ability to transfer experiences from one medium to another. The children became aware that sound does not necessarily have to be experienced only through the ear and that the experience of music can be multidimensional, even synaesthetic. With the artistic and exploratory activities carried out, we wanted to emphasize the importance and benefits of integrated activities that promote the development of children's cognitive, social and creative potential. The children were confronted with situations that challenged their way of experiencing, thinking, and expressing themselves. The activities are presented in the form of cooperative play, as play is the most natural way for children to learn. In the research we

focused not only on the product but also on the process of work, i. e. the process outcome - the way children and educators participate in the activities and their interaction, originality of ideas, imagination, motivation, exploration of materials and environment, problem solving, purposeful action and meaningful learning. The activities were based on constructivist pedagogical principles that promote the acquisition of new knowledge and skills through hands-on teaching, working with open-ended materials, collaboration, exploration and self-directed learning. Providing a constructivist learning environment enables internalization and a deeper understanding of the learning content (Richardson, 2005).

The results of the study showed that the activities carried out had a positive effect on the majority of the children who took part in the study. The conclusions were drawn on the basis of the teachers' statements during the interviews. The children's increased motivation was reflected in their commitment and concentration on the activities, in their anticipation of the next activities and in their communication with teachers and peers. „Listening to appropriate music while carrying out activities contributed to greater motivation, as the children calmed down more quickly and concentrated on the actual work. However, it is interesting to note that the three-year-olds returned to the same stimuli after abandoning certain activities, usually carrying different toys with them. They supplemented the artistic stimuli offered, observed what older children had done with the stimuli in the meantime and helped them to finish what they had started." (teacher K.S.). Increased attention and concentration was mainly observed in older children, while interest waned more quickly in three-year-olds, taking 15-20 minutes for each activity, which is to be expected. Progress was also observed in the socio-emotional area: Teachers reported children's increased desire to participate in the activities, positive attitude, increased social engagement, verbal communication and interaction with peers, mutual cooperation, higher self-confidence, attention regulation and general satisfaction due to new experiences. Most of the children showed more courage and confidence in expressing their own thoughts and feelings than in the usual kindergarten activities. After completing activities, the older children were happy to participate in a conversation about the experiences they had had and to express their own ideas and thoughts. This is an important segment as knowledge, especially at a child's early age, is not only the result of cognitive processes, but also of emotions experienced. The positive effect of the activities carried out was also reflected in the children's creative thinking and expression, visible in the richness of imagination, unusual visualisations and sound formations, different approaches to the expression of lines and shapes, richer expression with colours and unusual combinations of materials. In some children, a complete concentration on the creative act, the *flow*, was observed (Cseh, Phillips, & Pearson, 2015). Considering all these results, we can conclude that the answer to the research question: *Does arts integration based on constructivist principles help to improve children's motivation, social and creative skills*? is positive.

Finally, the role of educators should be emphasized once again, whose professional approach to working with children is a key factor in the quality of the educational process. The use of appropriate learning methods can significantly improve children's engagement and enjoyment of the work and thus the effectiveness of the teaching-learning process (Li, Zhou, & Chen, 2018). In general, educators often feel that they are not sufficiently competent to teach effective practices when it comes to applying more complex work models such as interdisciplinary learning, integration of activities, problem-based and project-based learning. However, these problems can be mitigated or overcome through better curriculum design and the provision of professional teacher training and support (Zhang, 2019).

| *Figure 1. Sound sculpture I.* | *Figure 2. Sound sculpture II.* | *Figure 3. Sound sculpture III.* |
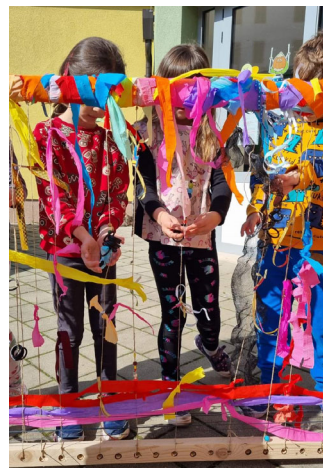
3. Conclusion

Many authors have emphasised the importance of the arts in children's education for their cognitive, affective and social development (Eisner, 2002; Ishiguro, Ishihara, & Morita, 2023; Mazepa-Domagala, 2021). The purpose of this study was to contribute to the field of art integration in the kindergarten curriculum by describing empirical examples and innovative methods based on constructivist pedagogical approaches to using arts to build children's knowledge and skills and to promote meaningful, in-depth learning. Their use contributed to the children's better understanding of the characteristics of musical and visual language and the possibility of translating music and sound into visual experiences and vice versa. The results show a positive impact on children's motivation, social engagement and creative thinking and expression. The research findings can help educators better understand the effect of project- and problem-based learning and design their integrated activities according to these principles to improve children's learning outcomes. The limitation of the study is that it was only conducted in one kindergarten with a small number of participants. It is certain that a longer study is necessary for a significant change in the children's development, also taking into account the use of additional measuring instruments. A longer research period could also include the development and application of more systematic and specialised teacher training in the integration of arts with other disciplines

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ZOONYM PHRASEOLOGICAL UNITS AS HATE SPEECH
IN YOUTH VOCABULARY

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Abstract

Phrasemes with a zoonymic component represent a very significant segment in the phraseological fund of a language. The term zoonym is actually a general noun that is used to name an animal. However, zoonyms as lexical components have the ability to connect with another lexeme within the phraseme. When such linking takes place, the zoonym loses its basic lexical meaning. With that, the zoonym no longer denotes a specific animal, but acquires a new function. The zoonym becomes a metaphor, the breakdown of which leads to the discovery of certain character traits, mental characteristics, external characteristics, or emotional states that relate to man. Such properties of zoonyms speak of their high productivity in the formation of phraseological units. Zoonyms very easily become an integral part of young people's speech, especially in everyday colloquial communication. Following these, we detected several phraseological compositions in which a zoonym is used, with the aim of indicating some characteristic of the one to whom the phraseological unit is addressed. The use of zoonyms in phrasemes often initiates direct or indirect speech in which hate can be recognized. Being aware that hate speech is becoming a common occurrence in language communication (oral or written), we did research involving students. The research gave solid results that in the future can be an impetus for deeper research on this topic.

Keywords: Zoonyms, phraseological units, young people, hate speech.

1. Introduction

The human world and the animal world have always been in a direct and inextricable relationship. Animals are the first and closest neighbors of man since ancient times. Fearing them, man respected them and elevated them to the level of a cult. Ancient religions created lasting cults built on the images of animals, and remnants of them still exist today. In contemporary context, remnants of such cults remain and they function in their symbolic form. Man's closeness with animals left a mark in the language system, that is, in its lexical structure. Various historical, social, and cultural influences have contributed to the creation of lexical units in the language of a culture that are recognizable only for that culture, but also those that have a universal meaning. Due to different language images of the world and different literary sources, many zoonyms contain a certain element of meaning that is understandable only to the bearers of that particular language culture (Мирчевска-Бошева, 2021, p. 305) or that reason, the language structures that function within the framework of phraseological units carry cultural characteristics of the environment in which they were created and represent a kind of linguistic cultural heritage. As an example, we point to the phraseological unit *strong as a lion*, which essentially represents a universal phrase the meaning of which is the same in almost all languages, as opposed to the phraseological unit *boring as a louse/fly*, which is only known for certain language environments, such as Macedonian, for example.

Considering different definitions and interpretations of the term zoonym, we observe it exclusively as a general noun that names an animal regardless of which group it belongs to (reptiles, amphibians, invertebrates, fish, birds, mammals and insects). The research of phraseological units with a zoonymic component in Macedonian, English and German showed that it is a question of expressions with a comparative component. Although we are talking about languages that do not belong to the same language family, as well as the fact that they are languages with incomparable spatial representation and continuity, still, in terms of the symbolic meaning of the zoonyms, they show great similarities. The creation of phraseological units with a zoonymic component is conditioned by the creation of associative links of the human-animal relationship. Namely, drawing parallels means a comparative approach to the behavior of man and his approach, compared to the behavior of animals, their appearance, and their natural predispositions.

Table 1.

	English	**German**	**Macedonian**
1.	fat as a pig	fressen wie ein Schwein	Дебел како свиња/Свиња
2.	fight like a lion	kämpfen wie ein Löwe	Се бори како лав/Лав
3.	bad as a bitch	/	Лоша како кучка/Кучка
4.	work like a horse	wie ein Pferd arbeiten	Работи како коњ/ Коњ
5.	snake in the Grass	eine falsche Schlange	Лоша како змија/Змија
6.	repeat like a parrot	wie ein Papagei nachplappern	Повторува како папагал/Папагал
7.	sly as a fox	so schlau wie ein Fuchs	Итар како лисица/Лисица
8.	stubborn as a donkey	stur wie ein Esel	Тврдоглав како магаре/Магаре
9.	/	/	Здодевен како вошка/ Вошка

During the structural breakdown of phraseological units, it is noticed that the zoonym used within the framework of a given phraseme loses its primary meaning and becomes a symbol. The zoonymic component becomes a metaphor for that human characteristic that is associated with a certain animal: external appearance, way of moving, facial expression, sound expression, etc. Focusing on naming, we have actually come to the conclusion that in many phraseological units with a zoonymic component one can sense hate speech towards the person to whom the phrase is addressed. To insult the other, to humiliate or devalue means to choose a word that will actually be addressed to the other person. Considering animals as his rivals, man often uses them as symbols in speech communication with which he will cause negative feelings in the other person. *Fat as a pig/cow; Bad as a bitch; Legs like a giraffe/stork; Stubborn as a donkey/goat* are only some of the phrases with a zoonymic component used with a pejorative function. In fact, zoonyms within phraseology show great potential for forming a linguistic structure with a tendency to be used as hate speech, depending on the context. The negative connotation in which the phraseological units with a zoonymic component are used brings everyday referential speech to the border of hate speech. The external appearance is the most frequently affected.

Table 2.

The zoonym refers to:	Phraseological units with zoonyms*
External appearance of a person	*strong like a lion, strong like a horse, fat like a pig, fat like a cow, fat like a bear, walks like a mare, big like an elephant, tall like a giraffe, legs like a stork, black like a raven, beautiful like a swan, a short rooster, beautiful like a gazelle, donkey ears*
Mental characteristics	*calm as a lamb, stubborn as a donkey, stubborn as a goat, slow as a snail, boring as a louse, bad as a dragon, bad as a snake, faithful as a dog, sly as a fox, sly as a monkey.*
Behavior, habits, skills	*repeat like a parrot, mute like a fish, creeps like a leech, boring like a fly, grabs like an eagle, works like a horse, creeps like a tick*
Intellectual capacity	*birdbrain, chicken brain, magpie brain, buffalo nerves, ox hide.*

*The translation of these phraseological units to English is literal.

The basic characteristics of phrasemes are solid structure, reproducibility, formal organization, idiomaticity, imagery, expressiveness, and connotative meaning. The meaning of the phrase is indicated by an image in the semantic sediment, which can be concrete and complete, part of a story, a parable, but it can also be a person, trait, symbol, toponym, etc. The semantic sediment reveals a motivational signal, that is, a visual message that helps to determine phraseological meaningful units. (Vidović, 2007, p. 405). It is precisely that visual message in phraseological units with a zoonymic component that makes them amenable to analysis in terms of whether or not they emit hate speech.

2. Research methodology

Motivated by the knowledge that zoonyms open opportunities for associative connection with man, his appearance, traits, and behavior, we did this research. The aim of the research was, firstly, to detect from the given language corpus the phraseological units with a zoonymic component and to perceive their frequency, and secondly, to isolate the phraseological units used as hate speech and their representation in the speech of young people. The team of researchers includes a group of professors at the Faculty of Philology from the Departments of Macedonian, English, and German as well as students in the first (first, second, third and fourth year) and second cycle of studies. The research was done on three groups of students studying: Macedonian, English and German. Namely, the students had a specific task to answer a questionnaire on the recognition and use of zoonyms in colloquial speech; in the second questionnaire, the most frequently used phrases according to the results of the first questionnaire were indicated and they were to be detected as hate speech or not. At the end of the research, in the last phase, a register of zoonyms was made that the students use most often both in their mother tongue and in the foreign language they study. *Strong as a lion; works like a horse; fat as a pig; stubborn as a donkey; mute like a fish, repeat like a parrot*, are just some of the phraseological compositions that we detected in students' speech. However, not all of them are used with the intention of directing hate speech towards another person. The conducted research showed that only part of the phrasemes containing zoonyms are used with the intention of directing hate speech towards the other person. The rest are used unconsciously, that is, with an undertone of metaphorical and metonymic meaning.

3. Results and interpretation

A total of 45 students from the first and second cycle of studies at the Departments of Macedonian language and literature, English language and literature and German language and literature were included in the research. From the corpus that was at our disposal, which contained texts where the referential function of the language is dominant, we singled out a total of 37 phraseological units with a zoonymic component (See Table no. 2). These are expressions that are most often used when giving a physical description of a person or an assessment of his/her psychological traits, habits, skills, or intellectual capacity. It should be noted that, in each of the mentioned languages (Macedonian, English and German), the phraseological units are with a different percentage of use, which of course depends on the cultural factors of the environment.

In the first phase of the research, the students had the task of answering a questionnaire about the recognition and use of zoonyms with a negative connotation that are represented in colloquial speech. From the results obtained, we prepared a register of phraseological units with a zoonymic component that are most often used in a negative context. The results showed that the largest number of students (12) recognized the phraseological unit *1. M. дебел како свиња, 1.E.* **fat like a pig**, *1. D.* **fressen wie ein Schwein** as the most frequent in the given language, used in a negative context. (Макаријоска, Л., & Павлеска -Георгиевска Б. 2020, p.190). This phraseological unit, whose zoonymic component indicates the external appearance of a person, is used in Macedonian, German and English with the same meaning, to describe an overweight person.

Phraseological units: 3. M. *лош како кучка*, (9 students, with the exception of German language students for whom this phraseological unit is unknown), 5. M. *лоша како змија/Змија*; 5. G. **eine falsche Schlange;** 5. E. **Snake in the grass** and 8. M. *тврдоглав како магаре* (7 students); 8. E. **stubborn as a mule; 8. G. stur wie ein Esel** refer to the psychological traits of man and his bad behavior.

Figure 1.
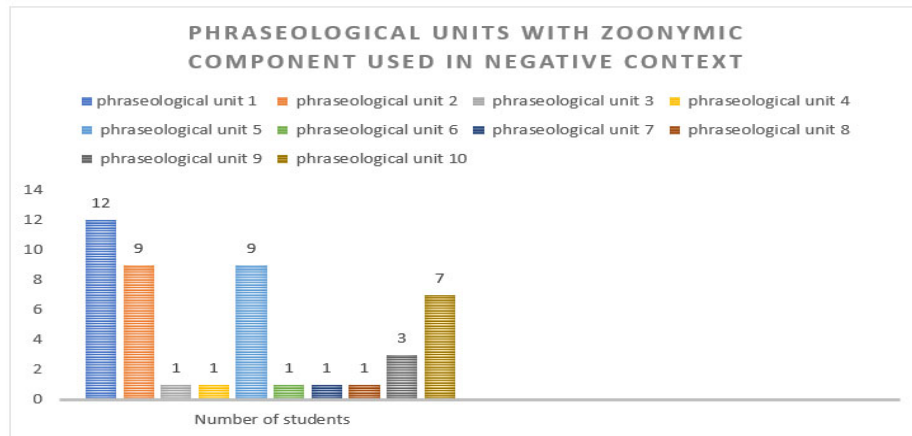
In the second part of the research, the students had the task of pointing out, from the phraseological units with a zoonymic component, those that, according to their conviction and experience, indicate hate speech. The results showed that from the extracted linguistic material, the phraseological units: *fat as a pig, stubborn as a donkey, bad as a bitch, snake in the grass* are those that mostly refer to hate speech directed at the interlocutor (regardless of whether it is a conversation face-to-face or with an intermediary). To the question: "Do these phraseological units indicate hate speech", we got the following results:

Figure 2.
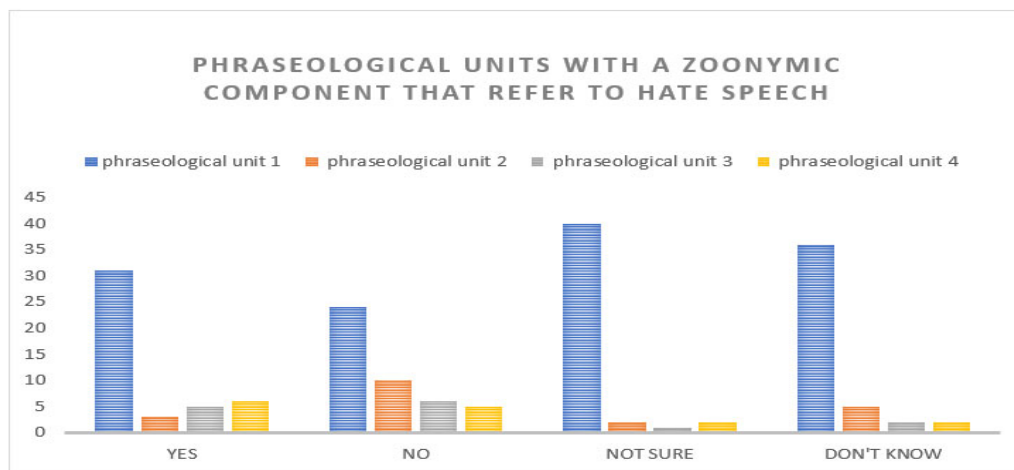
According to the results of the research, out of the total number of students who were included in the research (45), 31 students answered that the zoonymic component in the phraseological unit **1. *fat as a pig*** refers to the use of hate speech, 3 answered NO, 5 answered NOT SURE and 6 DON'T KNOW. As for the phraseological unit **2. *stubborn as a donkey***, 24 students recognized it as hate speech, 10 answered NO, 6 with NOT SURE, and 5 with DON'T KNOW. The phraseological unit **3. *snake in the grass***, was recognized as hate speech by 40 students, 2 answered NO, 1 was NOT SURE and 2 said DON'T KNOW, while **4. *bad as a bitch*** for 36 respondents was hate speech, 5 answered NO, 2 with NOT SURE, and 2 with DON'T KNOW.

From the above, we can see that the phraseological units with the zoonym snake mostly refer to hate speech, especially directed towards the female gender. This is directly related to the snake as an archetype with high frequency in almost all cultures. Snake as a metaphor for the curse, evil, cunning, greed as a biblical symbol has an uninterrupted continuity in the literary-linguistic tradition of almost all nations. As per the claim that cultural fact is very influential when it comes to language structures and their resistance, the positioning of this zoonym is understandable.

4. Conclusion

From ancient times until today, animals are the closest companions of man. They are part of his environment. Man lived with them, observed them, tried to understand them and learn to live near them. That alone led to the emergence of a large number of similarities in human behavior, in the way humas behave, gesture, articulate, etc. Such similarities are reflected in the language, especially in its lexical layer. Phraseological units with a zoonymic component are strongly expressive, emotional, and deeply metaphorical structures that are very common in referential speech. Man's need to use a word or a phrase that will hurt, humiliate, or delegitimize the interlocutor, prompted the use of zoonyms as the strongest weapon for this. Hence the conclusion that phraseological units with zoonyms in their composition have a strong associative power, but also the potential to motivate hate speech. A person in an affective state, rage or anger very often refers to the linguistic constructions that exist in his language, which contain a zoonym, with the intention of causing negative emotions in the object to which the speech is addressed. The speech of young people is burdened with the use of zoonyms with a pejorative function. Such usage associates hate speech which is becoming more and more prevalent in oral and written communication, especially today in the era of social networks and easy access to space for expression.

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VERNACULAR AND DOMINANT LITERATE PRACTICES IN LATIN AMERICAN SCIENTIFIC LITERATURE

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Abstract

This text focus on the results of a documentary, qualitative, and hermeneutical-comprehensive research whose objective was the categorization of the theoretical and conceptual repertoires that support the proposals for understanding and textual production in social spheres, cultural, and school. Initially, the search parameters for articles in Scopus were defined. The formula focused on publications that had the descriptors "practical", "literary" and their plurals, initially obtaining 79 documents in three languages (Spanish, English and Portuguese). In addition, only research articles published in Latin American open access journals between 2018 and 2023 were selected. The unit of analysis was delimited through Rayyan (https://www.rayyan.ai/), a free-to-use collaborative web application, which allowed automated duplicate elimination processes to be carried out. Two of the researchers carried out the review of the titles and abstracts of the 79 documents, independently and blindly evaluating compliance with the inclusion criteria. Subsequently, the selected articles were read in full. Any discrepancies that arose during this process were resolved by consensus, with a third researcher. Once this sequence was completed, a unit of 36 articles was obtained. Subsequently, the rubric and the completion protocol were designed, which were validated by experts (two thematic and one methodological). The rubric allowed each article to be reviewed in three aspects: bibliometric, conceptual, and discursive. The completion protocol allowed the 36 articles to be distributed among the researchers, standardizing the evaluation process and the collection of information. As a conclusion, theoretical trends and conceptual constructions were diversified geographically and epistemologically centered, with some political influence on the academicians.

Keywords: Legitimate publications, literate practices, state of art, text production fields.

1. Introduction

Reading and writing are linked to training processes, particularly in school settings, where students interact with texts constructed with a training purpose, especially in primary and secondary school (Pérez and La Cruz, 2014). and are characterized by specific communicative structures and purposes, within some disciplines, predominantly in university studies (Zamora and Venegas, 2013). Hence, textual comprehension and production, in the school environment, not only require linguistic and rhetorical-discursive skills, but also situational and disciplinary contexts, becoming, at the same time, evidence of discernment. of information and conceptual assimilation (Irvin, 2010).

However, upon arriving at the university, students present some difficulties in relation to the processes of disciplinary textual comprehension and production; since appropriating predominant discursive structures requires an approach to knowledge, genres and specialized lexicon; and, on multiple occasions, the epistemic potential that writing carries with it is wasted (Carlino, 2006); given that, it is assumed that students, by knowing the linguistic codes, are able to interact autonomously with genres, whose structures may be novel in their training processes and, therefore, are not explicitly taught to them (Cassany and Morales, 2008). Furthermore, those students who cannot overcome their writing difficulties in the university environment are prone to face academic problems, obtain low averages or drop out of the training program (Olave et al., 2013).

Therefore, within the current social and cultural dynamics and the constant efforts of the school environment to strengthen the levels of reading and writing, it is pertinent to review the reconfigurations of literacy in Latin American scientific literature, revealing the predominant traditional bets that continue emphasizing reading and writing from the perspective of literacy as a process of (de)coding and semiological construction, as well as those more sociocultural and multimodal bets that have allowed the conceptualization of textual understanding and production in terms of literacy and literacy practices.

2. Method

It is documentary, qualitative, hermeneutical-comprehensive research (Latorre et al., 2021) derived from the research Vernacular and dominant literate practices in master's students in Social Sciences from the University Institution of Envigado in 2023-I, corresponding to the categorization of the theoretical and conceptual repertoires that support the proposals for understanding and textual production in social, cultural, and school environments.

Initially, the search parameters for paper-type articles in Scopus were defined. The formula focused on publications that had the descriptors "practical", "literate" and their plurals. In addition, only research articles developed in Latin America, published in open access journals indexed in Scopus, between 2018 and 2023, were selected, initially obtaining 79 documents in three languages (Spanish, English and Portuguese).

The unit of analysis was delimited through Rayyan (https://www.rayyan.ai/), a free-to-use collaborative web application, which allowed automated duplicate elimination processes to be carried out. Two of the researchers carried out the review of the titles and abstracts of the 79 documents, independently and blindly evaluating compliance with the inclusion criteria. Subsequently, the selected articles were read in full. Any discrepancies that arose during this process were resolved by consensus, with a third researcher. Once this sequence was completed, a unit of 36 articles was obtained. Subsequently, the rubric and the completion protocol were designed, which were validated by experts (two thematic and one methodological). The rubric allowed each article to be reviewed in two aspects: conceptual and discursive. The completion protocol allowed the 36 articles to be distributed among the researchers, standardizing the evaluation process and the collection of information (Londoño et al., 2018).

The systematization of the 36 rubrics was done based on a multiple-entry matrix, designed in Excel, which facilitated the identification of the keywords of the articles and their duplicity to compare them with the concepts recognized in the rubrics, allowing analysis categories to be consolidated by grouping (Fusch, et al., 2018). In this way, two theoretical categories were obtained:

1. From traditional literacy to literacies in context

2. The role of literacy and literate practices in the formation of a critical, autonomous, and democratic citizenship.

3. Discussion

Next, discussion is presented in two theoretical categories built from the methodology previously stated:

3.1. From traditional literacy to literacies in context

Literacy has become a social practice that refers to a process related to the encoding and decoding of linguistic signs in the specific contexts generated by the user communities of a certain language (Sousa, 2019; Nemirovsky & Menendez, 2023). Likewise, what is related to literacy has been observed as one of the forms of social inclusion and the exercise of citizenship, which can be observed with the introduction of the concept of "reading citizenship":

In this sense, reading is considered a political-cultural practice, which is not outside the forms of agency of citizen action and participation from culture and ways of understanding the world. This criticism shows that, to a large extent, literacy can result in a form of imposition on the ways of seeing the world and representing it. That is why the importance of creative writing and reading and writing literature is highlighted (Sousa, 2019) in the processes related to literacy, mainly in the school years.

On the other hand, the variety of specific contexts in which literacy processes take place has allowed us to talk about family literacy (Campos and Marco, 2021), initial (Campos and Marco, 2021), academic literacy (Villabona and Villalón, 2022), scientific (Queiruga, et al., 2020) and informational (García, 2021). However, in the different contexts linked to literacy, such as workspaces and professional performance, ICT has led to the opening of new scenarios for human action that, in addition, are considered to contribute to the processes of social integration (Sunkel and Trucco, 2010).

These implications, derived from what ICTs have brought about, generate new conditions for the treatment of matters related to literacy, textual production and comprehension practices, and their formalization. In this sense, to the spaces that give rise to processes related to literacy generated in everyday and academic contexts, it is pertinent to add virtual contexts (Buendía, et al., 2009).

Literacy as a process that involves the (de)coding of signs used in "literate" contexts makes children think that they do not know how to read and write if they have not gone through school (Nemirovsky and Menendez, 2023). On the other hand, in the literacy practices present in school, perspectives are proposed that allow the child's possibilities to be enhanced with pedagogical practices

that consider what children know how to do and not focus on what they do not know. This invites us to take into account children's understanding of the world in the processes that take place in the classroom, and that pedagogical practice must take into account the perspective of the child and not only that of the adult, and that linguistic awareness is not become a prerequisite for reading and writing, but rather what is achieved through the different significant activities of interactions between teachers and students (Goulart and Corais, 2020).

3.2. The role of literacy and literate practices in the formation of a critical, autonomous, and democratic citizenship

As evidenced in the previous section, historically, literacy has been understood as the ability to (de)code linguistic signs within a specific language and, from this perspective, different training programs have been designed in Latin America (Druker, 2021), allowing substantial indicators to be achieved regarding people's ability to identify these linguistic signs, associate them with phonemes and graph them (Gélvez et al., 2022). However, being able to interact with the language, from this more traditional perspective, does not necessarily represent having the elements to understand and produce a text (Taboada, 2022). And, especially, when this text is expected to fulfill the communicative, social, and epistemic function demanded by some environments such as study, employment, community participation, social interaction, emancipation, among others (Queiruga et al. 2020).

Hence, the term literacy has emerged to describe a new way of understanding reading and writing, representing a conceptual change that goes from psychological ability to a set of social practices with a predetermined function (Hernández, 2019). Furthermore, this shift led to the rethinking of some basic questions that had focused particularly on linguistic and metacognitive aspects to concerns about people's relationship with texts and the development of their literacy practices (Navarro, 2019). In other words, literacy goes beyond mere (de)coding and focuses on the ability to understand, produce, and evaluate discursive genres of various types, formats, and platforms (Lorenzatti et al., 2019). In other words, from functionally interacting with a variety of discursive genres, both print and digital and multimodal, such as articles, laboratory reports or letters of recommendation, on the one hand, to emails, blogs, fan fiction, podcasts, videos, WhatsApp, on the other (León et al., 2022).

Regarding the topics of interest, four possible initiatives emerge: school and training, new literacy practices, literacy in higher education and citizen training for emancipation. In the first, the reading and writing practices of children are analyzed based on the uses and meanings assigned in the alphabet and it is observed how, based on the story, the relationships with the written culture at school are configured (Guerrero, et al., 2022). The training process can also benefit from the role of parents and their sociocultural conditions, which positively or negatively affect the process of internalization of reading and writing of first grade students of an educational institution (Ardila and Fernández, 2022). However, another aspect to keep in mind are the tensions and challenges that some situated practices of teaching writing in secondary education educational institutions go through, where a schooled conception continues between the objectives of advanced literacy and didactic decisions assumed from a traditional perspective (Taboada, 2022).

Concerning the literacy in higher education, this begins with a description of the context of higher education in Latin America, through three lenses: the study skills model, the academic socialization model, and the critical sociocultural model (Trigos, 2019), which is complemented with a critical overview of the study traditions and the features of a didactics based on discursive genres for the teaching of academic writing in higher education, defined as significant, articulated, socio-constructivist, critical and explicit (Navarro, 2019).

4. Conclusions

Literacy has become a social activity that, although it initially involves the process of (de)coding language signs in the specific environments created by communities that use a particular language, also demands a series of elements. extralinguistic that draw the message with greater precision in the communicative act, a situation that is not necessarily present in the traditional approach of this concept.

There it is where literacy emerges with greater force to propose a contextualized, localized and situated act of communication, where the appropriation of linguistic signs is demanded, the recognition of the interlocutors and the sections that make up the textual genre, the visibility of the powers and forces present in the context in which said communicative act is constructed and the possibility of building, participating, proposing and contributing to the construction of a more just and democratic society. Therefore, it is evident how the reviewed publications delve, mainly, into literate practices as a sociocultural option that understands the significance of revealing not only the linguistic, but also the elements that constitute this communicative act, in the different scenarios, where the actions of the

participants are materialized through the texts. The approach to this situation can be from the hermeneutical-comprehensive or the critical-social perspective, ratifying the interest in the social implications contained in these reconfiguration processes.

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DISCOVERING STATISTICAL MISCONCEPTIONS AS STUDENTS CREATE NOTES FOR TESTS!

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Abstract

Educators are often left guessing how, when, and where misconceptions develop in mathematics and statistics. Students will leave many blank spaces on test papers, which is little or no help to educators as to why they could not complete the question. Stress and nervousness play a part in assessments, and students will not remember why they wrote a particular solution or why they left a blank space. Educators have tried to alleviate this situation by allowing students to create their own notes to use during tests and examinations. As educators, do we ever provide specific instructions on how to create useful notes to help in assessments? This question was posed to students attending Curtin College, who responded with an overwhelming "no." Curtin College is an alternative pathway college that provides courses for students who have not obtained enough points for university entrance or overseas qualifications that are not recognised in Australia. A new format has been adopted for the revision class in the hope that it will improve their skills in creating notes for tests. Students arrive at the classroom expecting to complete questions on the whiteboards about probability, specifically Venn and Tree Diagrams, Tables, and Symbolic Formulae. Most classes during trimester are interactive, but this week, unlike other weeks, students will drive the content seeking to generate the perfect set of notes for the assessment. Students working in small groups will write on the whiteboards information they believe will help solve the problems in the assessment. This simple practice has the ability to reveal misconceptions that are hidden from both students and educators. In the relaxed atmosphere of the classroom, students embark on a journey of "saying, listening, and writing" that hopefully will create new memories of correct concepts. Combining these three language modalities, such as saying information aloud while listening and writing it down, can further enhance memory encoding and retention. The educator is provided with the opportunity to observe, correct, and settle arguments between students, when necessary, through questioning the notes, removing the spotlight from individuals by concentrating on the written notes thus reducing academic pressure. Misconceptions are revealed by the combination of curiosity, openness to new experiences, and being in the right place at the right time. There are many benefits for both students and educators. Not only can you see how time-consuming writing notes can be for the student, but for the educator, you can see the origin of misunderstandings and failure to recognise key points. It is hoped that this simple experience may help students provide better notes in all disciplines. The qualitative paper will elaborate on this experience in the classroom setting and how it has evolved.

Keywords: Misconceptions, notes creation, collaboration.

1. Introduction

There is very little literature available on using notes in assessments such as tests and final examinations. According to Charles P. Corcoran, the use of notes had no significant effect on the learning outcomes in 2020, and this is the emphasis many educators will put on the preparation of the notes for an assessment. Perhaps, taking a different perspective on the development of notes rather than focusing on improving a grade, educators could redirect the aim to developing an insight to the students' comprehension of the topic and concepts. This qualitative paper will describe the classroom experience.

2. Background

Curtin College offers students the opportunity to finish the last 2 years of secondary education or complete the necessary units to enter the second year at Curtin University. The class sizes are smaller than at university usually no more than 25 students, this means that a relaxed atmosphere is easily created between students and educators. The classes are a mixture of explicit teacher-led instruction and interactive

whiteboard student collaboration work. Some students may be reluctant at first to take part using the whiteboard instead of the usual pen and paper but after a few lessons their shyness has faded. These students have always taken mathematical and statistical assessments with notes (often referred to as cheat sheets), but many have never had any advice on what constitutes a good set of notes nor how to use the notes as a learning tool. The students described in this paper are studying Health Sciences and are required to pass a basic unit in mathematics and statistics.

3. Classroom setting

The classroom will need whiteboards, they can be walled, mobile on wheels or smaller versions used at desks. If possible, from the first lesson have a whiteboard activity as some (or all) students may need to become accustomed to collaborating in this new fashion.

This experience may be daunting to both tackle new material in a changed interactive environment and deciding on your role within the group! The roles within the group change each lesson, within a lesson and even within a topic, this accommodates all learners. One moment a student may be a creator of ideas, then change to a director then become an editor or just be an observer. It is always thrilling to witness the progress of students in each role and all the interactions and discussions that pursue. This is how you can hear misconceptions without directly approaching students, thereby avoiding any embarrassment or drop in confidence from the student.

4. The lesson

The minor twist for students in this lesson will be as an alternative to teacher-led instruction and solving examples, students will create notes for the upcoming assessment on whiteboards without the usual prompts. Students will be asked to write notes on the whiteboards that they believe will help them answer the test questions and are allowed to use lecture notes, etc. Students have been solving questions in this manner since week one but now the task is to write notes that will give them hints on how to solve any question on a particular topic.

The challenges that face the student are which facts and strategies are important and will be useful, and the description of the hints in a manner that helps solve the problem. This is the similar experience that writers have when starting a new project and researchers when writing a paper, just where and what is the starting point? The topic of probability is chosen as it has the possibility to contain diagrams rather than just written formulae which may make the task easier to begin. The students may require one or two extra words of encouragement and may take several minutes before the whiteboard starts to be used.

5. The observations of misconceptions

The educator becomes the facilitator and stops regularly to ask questions on the material students have written on the whiteboards. This activity's emphasis is solely about the notes, not the individual student, so any student can answer the question not just the author of the notes.

"An inclusive classroom promotes a positive emotional environment for students, thus enhancing students' emotional development by making them feel comfortable, happy and more confident. This, in turn, allows students to take risks and achieve their full potential" as mentioned by Leatherman and Niemeyer (Leatherman & Niemeyer, 2005).

Students working in small groups, in the relaxed atmosphere of the classroom, students embark on a journey of "saying, listening, and writing" that hopefully will create new memories of correct concepts. Combining these three language modalities, such as saying information aloud while listening and writing the information, can further enhance memory encoding, retention and ultimately understanding of the topic. The educator will use the same strategy "saying, listening, and writing" though the order may be different, the information about misconceptions is obtained unobtrusively.

"Listening":
Conversations may be heard by the educator as students debate on the composition of the notes and here is the opportunity to hear thoughts and reason from the students' point of view. Students are usually unaware of the educator so there is no added stress on students.

"Saying":
The educator may be stopped to clarify certain aspects of the notes on the whiteboard and ask questions such as "how will we use in a question?", "what do you mean by these words?" and so on.

"Writing"

Students are encouraged to walk around the classroom and see the methods other students are employing. The most common mistake for students is trying to put too much information, adding words they do not fully understand and confining all in a restricted space. In a test situation, these notes become more confusing than helpful in answering the questions. Students are encouraged to be creative and think outside of the box in the writing part of the notes.

The educator will travel with students through each group's set of notes and ask a few questions to the "why" these words and visuals are chosen. There will be a brief summary and any corrections will be explained here if they have not been dealt with previously in the class.

Once the students have completed the notes then each group is given a question to answer using the notes. This is the real "test" of the notes as to whether they are serving the purpose they are created to do.

Misunderstandings here can be three-fold either the notes were misleading (or maybe incorrect as some notes may be missed on the walk around) or students did not understand the notes, or the vital part of information is missing or finally they could not link the notes to the question.

The educator will start to solve the question and link the lines of the solution to the notes created by the different groups. Here, both educator and students can discuss the merits of the notes and edit and improve where necessary. These class discussions will bring to light any misunderstandings in the notes and between the notes and question. Many discussions will have students experiencing a "AHA!" moment as the concept or solution now appears to make sense after many days of being hidden.

6. Conclusion

In this qualitative paper, the focus has been to redirect the attention away from notes just for use in an assessment but as a learning opportunity for both educator and student. The aim is to produce critical thinking and meaningful discussions in a relaxed atmosphere, where solving a question is not directly involved but in the background. Misconceptions may be found seamlessly as opposed to direct questioning of a student about a solution.

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EFFECTIVE TEAMS WORKSHOP: A CASE STUDY IN HIGHER EDUCATION TO TEACH TEAMWORK COMPETENCY

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Abstract

The needs of the globalized world and the transformations that different organizations undergo make being competent in teamwork a necessity. Therefore, the educational sector must give it the appropriate relevance and concern itself with how to develop this particular competence in higher education. In a Colombian university, particularly in its administration faculty, some steps have been taken in this direction. This text presents a case study that seeks to identify the learning outcomes related to teamwork in the course Effective Teams Workshop. To achieve this, six months after the course was conducted, qualitative information was collected through surveys with students, semi-structured interviews with professors, and the products created during the course. This information was analyzed through predetermined categories based on the course objectives, allowing for the emergence of additional categories. The information analysis reveals a pedagogical design with an experiential methodology for the course, where teams are formed to carry out assignments, facing challenges in each class session. This approach enables students to practice what is intended to be taught, aligning with what is learned and assessed. Students who participated in this course acknowledge learning that commitment and effective communication are fundamental parts of a successful team. This result aligns with the professors' proposal to understand and apply strategies for configuring effective teams. Still, it does not demonstrate the achievement of the second objective regarding the identification of team members' roles and their importance for team performance.

Keywords: Teamwork, collaborative learning, university education, teamwork competency, qualitative research.

1. Introduction

It is essential to understand teamwork to differentiate a team from a group. A group working together is not necessarily a team. One difference lies in the performance results. Such an outcome should reflect a joint contribution of the team members and not a compendium of individual contributions. In a team, responsibilities and decisions are group-based, so commitment must be shared. Thus, Katzenbach and Smith, in the first definition of what a team is, postulate that it is "a small number of people with complementary skills, who are committed to a purpose, a set of performance goals and a common approach, for which they hold each other accountable" (Katzenbach & Smith, 2005, p. 3).

When analyzing team management, team members' leadership emerges, facilitating the team's mobilization. In this regard, Bernstein (2016) states that a team's construction, management, and commitment are the levers the leader can use to improve team performance. Therefore, an essential element for the development of teamwork competency is leadership.

Amid the urgency that has begun to be recognized globally about the importance of teamwork, the education sector, particularly in higher education, must give it the appropriate relevance and concern itself with how to train in this competence. However, despite its great value, interest, and importance, a great deal of research in the field has shown a phenomenon that has been commonly repeated in the development of this and other competencies: the use of lectures and passive interactions among students is not enough to be able to foster the development of such a complex competency as teamwork (Passow & Passow, 2017). On the contrary, developing competencies requires active learning, described as a set of activities designed to ensure student engagement and motivation (Felder & Brent, 2016).

In addition, there is a lack of accuracy and explicit elements when developing teamwork in a higher education classroom is the issue. On the one hand, teachers commonly understand teamwork as any activity developed in groups of students within an educational context. This action creates a misunderstanding and

an underestimation among teachers and students about what competence really represents. On the other hand, many teachers believe that exposing students to different work activities with their peers can implicitly lead them to develop teamwork. However, research in the field has shown that the absence of explicit theorization about teamwork and its characteristics can inevitably lead to an impoverished understanding of the topic, with subsequent unfavorable performance of the competency (Pinard et al., 2018; Therrien et al., 2017).

In a Colombian university and particularly in its faculty of administration, some steps have been taken on a path that seeks to generate an active learning experience in which participants also conceptualize what teamwork is and what characterizes it. This course belongs to a master's degree of the administration faculty and is offered under the name *Effective Teams Workshop*. The course lasted three weeks, and the work was focused on the participants learning how to build and manage teams that want to achieve high performance. There was one face-to-face session each week of four hours and approximately nine hours per week of extra-class dedication in work teams.

The keys to building effective teams are a good team atmosphere, clear rules of the game, and well-defined roles (Katzenbach & Smith, 2005). For students to learn how to build effective teams, the course design included challenging activities that tested communication skills, problem-solving, and joint decision-making. After the activities, best practices for top performers are recognized through reflection. The other activity consisted of a video project in which teams analyzed a conflict situation in a team and related it to their own process of building an effective team.

In the first session, the groups were organized and given the project evaluation rubric presented in the last session and the guidelines of the team contract defining the roles required for the project. The practical activity consisted of the team building a tower with wooden tokens, and there were three roles to play in each team: builders, leader, and observer. The activity consisted of three rounds; in one, the builder was blindfolded, and in another, the team leader could not speak while the builders were building the tower. The winning team was the one that could build the tallest tower. With this activity, we worked on leadership within a team and identifying what promotes good team performance and what does not.

The second session focused on team decision-making and internal problems, and a simulation activity on survival in a desert was conducted. A situation is posed in which a flight falls in the middle of the desert, and only five people (number of team members) and fifteen objects survive. First, individually, they must rank the objects from 1 to 15 according to their importance, with one being the most important and 15 the least. Then, as a team, they reach a consensus and propose a new order. Afterward, they must compare their new order with the order shown to them made by an expert. The team that comes closest to the expert wins.

In the third session, oriented towards communication and management within the team, a simulation activity was carried out to identify the culprit of a murder. Each member has a fragment of all the information necessary to find the culprit in this activity. The team that best reconstructs the facts and identifies the murderer wins the challenge. At the end of this last session, the video results from the final project are shown.

This document aims to identify what learnings about teamwork occurred in the course Effective Teams Workshop to guide how to design activities in academic environments to help students develop this competency.

2. Methodology of the study

This is a case study in which qualitative data was collected six months after the implementation of the course. Ethical considerations concerning the respectively informed consents, the care of anonymity, and the socialization of the results to benefit subsequent groups taking the course were considered. The learning outcomes were analyzed using the students' reflections in the course, semi-structured interviews with the two professors, and a student survey, which was answered by 70% of those who participated in the course. Thus, we identified the results that persisted around this competency and were enhanced in the course.

To do the results' analysis, a triangulation of instruments and actors was carried out in the categories of analysis predetermined based on the course objectives and giving space to emerging categories. The following section presents the results.

3. Results and analysis

The information analysis shows how an experiential design for the course, where teams are formed to act in front of some challenges, allows what is taught to be in harmony with what is learned and what is evaluated. In the survey, when we asked about "any valuable experience you had during the teamwork for

this course", two people stated that the activity of the towers was valuable for the recognition of skills. One spoke of the second activity, the desert activity, for learning about consensus building. Another referred to the third one: the murder case. One spoke about the final project and the leadership she experienced in that experience. Four people felt that meeting new people and working on soft skills was the most valuable thing. Three referred to communication, highlighting listening as a valuable experience, and one person talked about understanding synergy as a valuable experience throughout the course.

A more detailed analysis is presented in three categories: 1. Conforming a team, 2. The management of team members and their interaction, 3. No emerging categories were identified.

3.1. Conforming of a team

We interviewed the professor who directed the course when we asked him, "Beyond what is written and what you want to achieve with the course, what do you see in practice that the students take away from the course? When you create a team, there is a big difference between a team and a group. That is one of the main conclusions, and they differentiate it. When there is a demarcated interdependence and when there is a challenge, a team is formed; if not, no, with a group is enough." In this sense, the assistant professor says: "There is a topic that enters the clash and remains as learning, and it is the difference between a group and a team. They come from their work areas as if they were in teams; however, from the readings and the conformation of high-performance teams where each has a different participation role and contributes so that everyone can achieve the objective, they begin to understand that first definition of teamwork".

In line with this idea, a student writes in her reflection after the first activity that "it has been striking for me to understand that teams are made up of interdependent people, that is, that the work of each one is indispensable to reach a common goal" and "that it is necessary to be genuinely motivated to achieve commitment to the team and to take ownership of the role we play".

The results of this category, which agree with Felder and Brent (2016), show that students can conceptualize that a team is different from a group of people working together. This result is essential to validate the course design both in its experiential and active bet and in the student's reflection importance so that they appropriate the concepts exposed in the reading material.

3.2. Management of team members and their interaction

The teacher seeks with the activities that the students "really realize how a team that is interdependent acts" so that they identify "what things promote good team performance and what things do not promote it" and about leadership, "the good thing is that they realize how is the leader (guide) role within the team". In a reflection, a student expresses that: "many times leadership does not always fall on the same person; it will depend on the skills of each team member, in what phase of the project they are in and if an adjustment in roles is needed." Another student recognizes an essential characteristic of leadership: "The leaders who stood out the most were those who were able to put themselves in the shoes of their team members".

The teacher describes that, in the first activity, in the last round, the leader cannot speak but previously gives a confidence boost to his teammates, "the best results are achieved." "What I want is to generate the leaders achieve the ability to convince others and learn how to transmit a good message to their team when they face of a difficulty, how to approach things so as not to demoralize the team". In one of the students' reflections, characteristics of the leader are highlighted from the experience, the choice was "Julian, the leader because of his voice and good management of people" and she says that "with Julian's good guidance we were able to properly carry out the proposed structure and we stuck to the letter of what we were going to do" and that "when we started the construction part, Alba was nervous, Julian managed to calm her down at the right moments so that she could finish the activities properly and not feel alone, achieving the objective again in the second round" and which coincides with the teacher's wish: "In this phase we could not be with our leader, but it gave us the confidence that we already knew the strategy". This evidences Brestein's statement that "small differences in team leadership can have big consequences for the success of team efforts" (Bernstein, 2016) and that the internal management of a team, which has to do with trust among team members, makes good leadership possible.

To the question: "How were your communication and relationship skills with your peers tested during the course?" in the survey, of the fourteen people surveyed, only one referred to the information provided, and all referred to the practical activities. Four people referred explicitly to the towers' activity, where they had to communicate while blindfolded, and communication was tested even without speaking.

Leadership as a critical component in a team was put to the test in the course. 72% of the students surveyed considered that the course contributed significantly to developing their leadership skills, while 7.2% considered that it contributed little.

Concerning the commitment and the assignment of roles for a common purpose, another student wrote in her reflection: "I consider that it was of great importance to take advantage of the time given at the beginning to get to know each other better so that we could later focus on the planning of the tower design, the construction strategy and assign each member their work", a different student acknowledged that: "During the activity, we were able to experience how confidence in the skills and abilities of our teammates allowed us to work more efficiently and effectively".

In the survey regarding the characteristics of an effective team, to the question: "Mention three characteristics that a team must have to achieve high performance", it was found that the most named was *assertive communication* with twelve answers, the next with more repetitions was *commitment* and *enhancing individual skills* with four answers, followed by three answers: *trust and having a clear common goal.* With two repetitions: *empathy and leadership,* and named once: *analysis for continuous improvement, respect, relationship, teamwork, resilience, role clarity, flexibility, and discipline*.

These results show that students understand that "teamwork represents a set of values that encourages listening and responding constructively to the views expressed by others, giving them the benefit of the doubt, supporting them and recognizing their interests and achievements," as stated by (Katzenbach & Smith, 2005, p. 4), the most remembered characteristic is that of assertive communication.

3.3. Causes that slow down equipment and how to remedy them

One student acknowledged that one of the obstacles during the first activity was: "We were confident because we already knew each other and did not take the time to analyze each other's skills and define roles," causing: "us not to stop to think about what we were doing wrong as a team, and we focused only on changing the chosen design as if the mistake was all on this" This shows that one of the lessons learned in practice that the students had was regarding the adaptability and flexibility needed within a high-performance team, he concludes that: "yes it was evident that it helped us a lot in that last round to take the time to analyze what we were doing as a team, what was not working, what we could apply from the processes that other teams were doing, what was the design that was best for us to follow and who had the best disposition and skills to carry out the task."

To the survey question: "What did you have to fix in your team to advance with the goal you had to achieve as a team?" Four people recognized time as a constraint, and organizing schedules was challenging. Nine people talked about communication, and to fix it, they recognized that it is good not to assume and to listen actively. Moreover, one person talked about defining opportunities for improvement and proposing action plans.

An obstacle recognized by one of the students described it as follows: "When forming a team, people's skills are used as criteria to form the team and in many occasions in my personal experience this is not managed in this way, due to the availability of people in the projects or simply because they do not have the necessary equipment for such activities".

4. Conclusions

The contribution of the student mentioned above says that in his work, it is not always possible to know the team members' skills "due to the availability of people in the projects or simply because they do not have the necessary equipment for such activities." This answer shows us that in educational environments, we must always be aware of the distance between the academic and job worlds. This is the reason why in the surveys conducted six months after the end of the course, the relevance, which, in a first reflection, the students gave to the understanding of the importance of defining roles, did not prevail as much as that of assertive communication and the joint commitment that a high-performance team must have.

At the pedagogical level, a conclusion regarding the design of the activities that foster the development of teamwork competence is based on the fact that in order to analyze the learning generated in the course, attention was not focused on the final product of the project (the video itself), but on the learning and reflection processes that occurred at the collective and individual levels for its elaboration. This fact shows that in the designs for meaningful learning, the richness of the process in which learning is constructed is much more important than the content or the topics addressed.

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GAMES AND CALCULUS

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Abstract

Every 1st semester of an academic year we have around 500 engineering students enrolled in a Calculus 1 course. Involving students in the learning process is a concern for any teacher, thus making us think of strategies to achieve this goal. This academic year we decided to introduce board games in some classes, to encourage mathematical communication and teamwork. In addition, the four weekly contact hours were divided into blocks, and one hour each week was dedicated to solving group tasks which, at the end of the lesson, were submitted on the Moodle platform and made available to all the students in the class. Each group had a different task, so that a wide range of solutions was available to everyone. The performance in these tasks was considered in the course's final grade. Moodle's peer assessment tool was also used, making students actively participate in the curricular unit's assessment process. The groups were randomly created (each student participated in three different groups along the semester) and the students evaluated their performance, as well as their peers' contribution in the group work, twice. Although the percentage of successful students did not improve significantly compared to previous years, the number of students who underwent assessment increased considerably and the attendance rate was also higher. Our university has a quality assurance system and, at the end of the semester, the students evaluate the courses they have taken and the teachers who have taught them. In their perspective, this methodology was useful, with minor corrections. In this paper we'll illustrate some of the games used, describe in more detail how the course worked and reflect on the learning results obtained.

Keywords: Calculus, games, peer assessment.

1. Introduction

At the University of Aveiro Calculus I is a compulsory subject for 1st year science and engineering programmes. In our case we have 507 students, from eight different degrees, spread over 10 classes and 5 teachers. As (Iannella, Morando, & Spreafico, 2022) say "The main purpose of general scientific degrees' Calculus courses is to introduce students to the scientific method of analysis, providing a suitable language and useful skills in order to effectively face other disciplinary courses. Unfortunately, this does not happen frequently." Every academic year we have to deal with different profiles and backgrounds of students from a variety of degrees, and often not motivated for the study of mathematics. "Designing actions to promote motivation and increase students' engagement becomes an essential challenge" (Morando & Torconi, 2022) for any teacher.

(Vankúš, 2021) recalls that "The idea of games as an educational tool is not a new one, it was originally devised by Hellenic philosophers, Plato and Aristotle", and he also states that "In the area of mathematics, educational games were identified as suitable to promote mathematic achievements in various domains".

After many years teaching Calculus using different strategies to engage students on their learning process, namely, flipped classroom and team-based learning, I decided to use, in some classes along the semester, board games, following the suggestions of P. Morando and G. Torconi (2022) and using the experience I had in a workshop on Mathematics Games in Vercelli in 2023.

2. Methods

Calculus I has 4 weekly contact hours, in 2 blocks of 2 hours each, and an extra hour which students can use to clear some doubts arose on their study, although they don't use them seldom, except when there is an exam in that particular week. In the 1st semester 2023/24, each block was divided in two different

moments: in the first block some time was used to clarify doubts from the previous classes and the rest of the time was a traditional class, exposing the concepts, giving examples and solving one or two exercises, discussing with the students the possible ways to solve them; the other block started with the traditional class, leaving one hour for the students to work in groups solving different tasks assigned to each group. It was in this last block that some games, involving the concepts taught previously, were played.

The groups were randomly formed, using Moodle, and they changed group three times. This procedure was used because I believe it is important that students get used to working with different colleagues, but also, as they had to assess their own performance, as well as their peers', the grades were not biased, as each student would be assessed by different classmates.

2.1. The games

The classes started with the game "Guess who" played with the whole class. I chose one graph, amongst 20 that were projected (see Figure 1), and the students had to guess the graph chosen asking questions of yes/no answer. The first student to guess won the game, but if it wasn't the correct choice, the student was out of the game.

This game acted as an icebreaker, allowing the whole class to interact and, at the same time, to remember some of the fundamental concepts for a Calculus course.

Figure 1. Graphs used in the game "Guess who" and in "The mysterious rule".
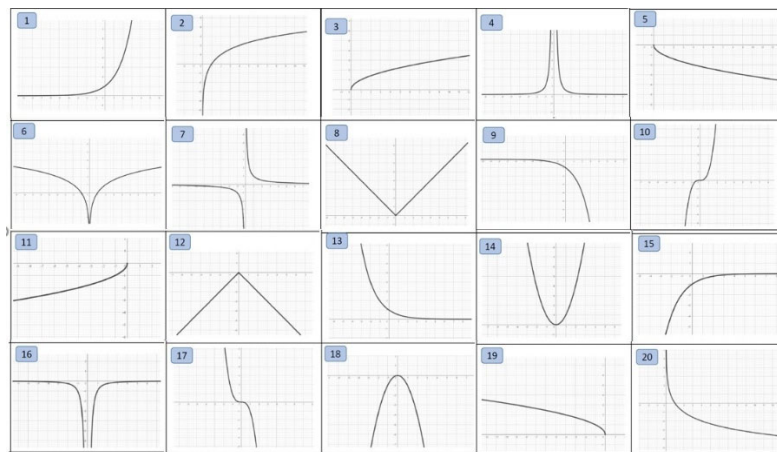
These same graphs were used in the second part of the class in the game "The mysterious rule". In each table there were two teams (of 6/7 students each) that received 2 decks of 20 cards by team, one with characteristics, like $f(x)$ doesn't have points in the second quadrant, or the range of f is a subset of $[0,+\infty[$, and the other with the 20 graphs presented in Figure 1, and also a board like the one in Figure 1.

The characteristics cards are shuffled and each team draws a card. Within 3 minutes they have to pick all the functions that satisfy the characteristic withdrawn. After this the teams exchange the cards with the graphics that fulfil the characteristic and the opposing teams have 3 minutes to guess the characteristic (the mysterious rule). It is important to remark that no graph can be left outside the set satisfying the characteristic, because if that happens and the opposing team realizes that there is one or more functions missing, the team loses one point. The points are distributed like this: if the team chose all the graphs satisfying the rule they get 1 point, if the opposing team finds the rule gets 1 point, but if they find another characteristic that is satisfied only by the graphs selected, among the 20 available, they get 2 points.

Watching the students warmly defend their points of view was very rewarding. And like any good game, at the end there were prizes for the winning teams (chocolates).

Another game used in the study of inverse trigonometric functions was "Math Twins". Each team received a deck with 24 cards: 12 with a graph numbered 1, 2,…12 and 12 labelled A, B, …,M with the analytical expression of a function (see figure 2). They had 10 minutes to form corresponding pairs (graph number, label analytical expression) and write down the pairs in a piece of paper they handed to an opposing team to correct. For each correct pair the team has +1 point and for each wrong pair -1 point. The winner is the team that got more points. The functions chosen were composed of inverse trigonometric functions, so the students had to take into account the domains and range of the composite, which is usually difficult for them.

Figure 2. Cards used in the game "Math Twins".
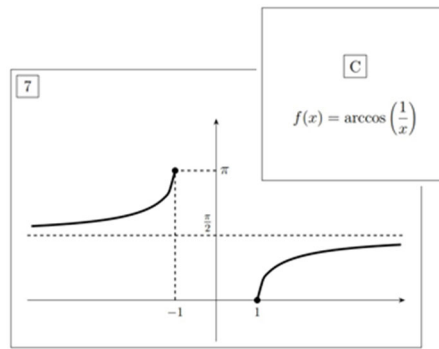
After the game, each team had to do the complete study of one of the functions used to play and submit the detailed resolution in Moodle.

The last game used was "The antiderivatives boxes". Each team was given a set of 25 colored cards (a color for each team) with antiderivatives and 8 "rule" boxes were placed on a table in the middle of the room. The aim of the game was to put the cards with the antiderivatives in the right rule box. For instance, in figure 3, the antiderivative 2 should be put in box A and the antiderivative 15 should go to box H.

Figure 3. Examples used in "The antiderivatives boxes".
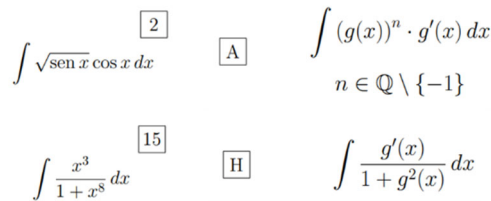
Students feel confused when starting the study of antiderivatives, specially on understanding the rules, and playing this game made them discuss with their classmates which rule to use. After the game, each team and a set of 3 antiderivatives to evaluate, and that was the task they had to submit on that class.

The games used within lectures improve the participation and motivation of students, and develop communication skills in mathematics, as well as promoting the use of mathematics language, fundamental to succeed in a Calculus course.

2.2. Team work

The tasks were proposed in the second part of the second block, after introducing the related topics, illustrated with some examples. Our goal was to have students to immediately reflect on what they have learnt in the last two lessons through peer discussion. Students feel more comfortable when sharing their doubts in a small group rather in front of all class and discussing how to solve a task is important to consolidate learning.

Each group picked a task from a *hat* (I used it to put the sheets of paper with the exercises to be solved) and had to solve it during the remaining time of the class and submit the detailed solution in a Forum available for all the students of the class (see figure 4). I corrected the tasks and gave the feedback before the next class, in order to discuss the difficulties that had arisen when solving them.

Figure 4. The submission and correction of the task.
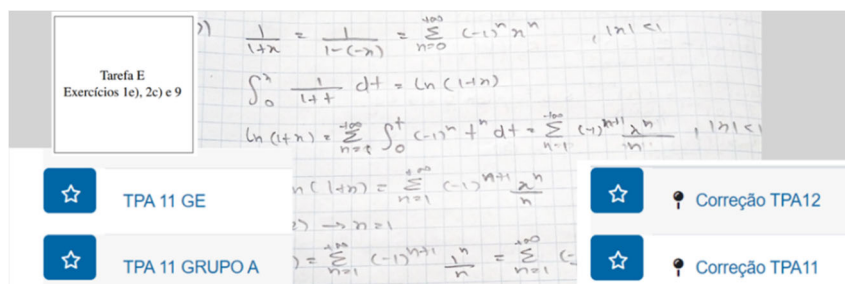
The first groups were created in the first lesson to play the "Mysterious rule", but in the beginning of the semester there are always class changes, new students who are placed in the second and third stages of higher education applications, so peer assessment was not applied on these groups. Using Moodle, random groups were created twice along the semester, and it was applied the peer assessment tool so that each student could evaluate their performance and that of their peers, and there was a penalty if a student didn't answer to the peer assessment quiz. In a scale of 0 to 4, the students had to evaluate their peers in the following items: attendance to classes, relevance of ideas given for group work, quality and quantity of the work done, fulfilment of assigned tasks, contribution to the organisation, cohesion and progression of the group work, ability to listen to other's ideas, encouragement given to others to participate in the work. Although not all the students used this tool responsibly, evaluating all their colleagues with the highest mark - even those who contributed little to teamwork, many were conscious even in their self-evaluation.

3. Discussion

The pass rate hasn't improved when compared to previous academic years, however class attendance was higher along all the semester (usually, there is a drop in the attendance after the first test), and students were active, specially in the teamwork block.

This methodology had several goals to hit. One of them is a common request that students ask: having solved exercises. Passing responsibility for this request on to the students themselves should force them to commit to their learning, providing detailed and carefully written solutions to their peers. Although this wasn't always achieved, I believe it was worth it, and the students recognized this fact.

The university has an internal quality assurance system (IQAS) established and the students are invited to answer a survey regarding their self-assessment, the functioning of the course and their teacher. Overall, the students are not particularly motivated by the Calculus I course nor satisfied with their own performance, with an average of 5.89 and a median of 6, on a scale of 1 to 9. Regarding the functioning of the course the students consider that it is appropriate, as well as the study materials provided and the assessment method used. The average teacher evaluation was 7.85 in 9, with 41% of the students grading it with the maximum grade. In the reports produced as part of the IQAS, group work carried out in class is mentioned as an added value because it generates cooperation between peers and facilitates learning.

Using these strategies, allowed me, as a teacher, to perceive the difficulties students had in solving the proposed tasks, but, the large number of students per class (45-50 students) hindered a more personalized attention to all of them.

4. Conclusions

In the 21st century the teacher's role must adapt to the reality of a global world, where the internet knows it all. It's important that we endow our students with critical thinking and communication skills, teamwork and self-confidence, and not so much with routine procedures that they can easily find on the internet.

Along the years I have been adapting my way of teaching to the audience I had and realized that, even if my effort on solving and explaining in the board was huge, only a few students would profit. I believe that when they try to solve problems/exercises by themselves, with the help of their peers, is the best way to learn. Working in small groups also encourages students to ask questions to their classmates, they wouldn't feel at ease in front of the all class. It's also known that one of most efficient techniques to learn is to teach, and this can happen when students are grouped and they have to explain to the others the strategies used to solve the task they have to do.

The use of games seems to be an appropriate strategy to learn some concepts, and to promote the interaction between students. Despite some dissenting voices, in particular because they take up a lot of class time, the learning results are worth the effort.

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A WEB AND SIMPLE CLICKS TO UNDERSTAND CHEMICAL CONCEPTS

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Abstract

In the new era of machine learning and artificial intelligence, the project is designed to impart knowledge about ligands, substituents, and elements bonded to or surrounding a metal in a catalytic context. Leveraging successful web servers in the research field, the project enables researchers, irrespective of their computer chemistry expertise, to access pertinent information effortlessly. The methodology involves using a steric index, $\%V_{Bur}$, which gauges the occupancy in the metal's first sphere to reveal the catalytic performance of the corresponding catalyst. The web server, available at *https://www.aocdweb.com/OMtools/sambvca2.1/index.html*, facilitates the calculation of steric hindrance for any ligand (Poater et al., 2009; Falivene, 2016; Falivene et al., 2019; Liu, Montgomery, & Houk, 2011). For students in the Master in Advanced Catalysis and Molecular Modeling (MACMoM) program at the University of Girona, the project becomes an inspiring exercise. Through experimental and computational approaches, students correlate catalytic reaction pathway yields with the $\%V_{Bur}$ steric index. The exercise entails delving into past experimental results, manipulating xyz coordinates from X-Ray data, and employing linear and multilinear regressions. Importantly, each student in the class tackles a unique problem, fostering collaboration as solutions are shared within the group. This collaborative aspect not only aids in unraveling complex systems but also enhances the collective understanding of the intricacies involved. Emphasizing self-directed learning, the project encourages students to connect theory with results, promoting a deeper comprehension of the impact of specific groups.

Keywords: Chemistry, educational exercise, ligand, steric hindrance, project-based learning.

1. Introduction

In the new era of machine learning and artificial intelligence, the project is tailored to impart knowledge about ligands, substituents, and elements bound to or surrounding a metal in a catalytic context. Leveraging successful web servers in the research field, the project aims to enable researchers, regardless of their expertise in computational chemistry, to effortlessly access relevant information.

A straightforward steric index like $\%V_{Bur}$ reveals how much space is occupied around the metal, indicating the effectiveness of the catalyst it belongs to (Poater et al., 2009). These web servers have been successful in research, where researchers, even those with limited knowledge of computational chemistry, can easily access relevant information with just a few clicks (Falivene, 2016; Falivene et al., 2019),

Choosing the best catalyst from a vast array of transition metal complexes is often done without a clear protocol (Liu et al., 2011). It is not due to negligence, but rather because there isn't a well-established understanding of what constitutes the best catalyst for each scenario. This decision is often based more on intuition than rationality. However, molecular descriptors offer a solution by organizing the catalyst space, similar to how enzymes work around their active sites (Wu et al., 2012). These descriptors quantitatively correlate the properties of the catalytic pocket with its experimental behavior. Understanding the interaction between the metal and the ligand is crucial in determining the stability, activity, and selectivity of the resulting catalyst (Poater et al., 2010).

Developing an effective catalyst involves shaping the catalytic pocket correctly. Achieving selectivity greater than 95% requires finding a catalyst that can differentiate between desired and undesired reactions by at least 2 kcal/mol. To increase certainty towards 100% selectivity, this difference should ideally be above 5 kcal/mol (Dehghani et al, 2019; Tabrizi et al., 2021). The challenge lies in developing descriptors capable of capturing subtle structural differences in the catalytic pocket, leading to more significant differences in energetic pathways. This strategy aims to pave the way for the in silico

design of new catalysts (Harper, Vilardi, & Sigman, 2013; Monreal-Corona, Pla-Quintana, & Poater, 2023; Fey, 2010).

The initial articles on $\%V_{Bur}$ and steric maps (Shams et al., 2022; Tomasini et al., 2021; Luque-Urrutia et al., 2017), along with their corresponding web servers, have garnered significant attention and citations since their publication, with thousands of citations worldwide (Escayola, Bahri-Laleh, & Poater, 2024). However, the lack of educational resources has motivated the redesign and simplification of discussions on organometallic reaction performance using web servers, with the aim of involving students in the process (Czerwinski et al., 2016).

The project focuses on indirectly teaching about ligands, substituents, and their interactions with metals. The selected reaction, the NHC–copper(I) halide-catalyzed direct alkynylation of trifluoromethyl ketones on water, was chosen not because it's perfect but because it provides ample data for analysis. In summary, the goal of this exercise is to use the SambVca 2.1 web application to calculate the $\%V_{Bur}$ index and steric maps of various complexes. By comparing different NHC complexes and others from the literature, the aim is to establish a linear relationship between $\%V_{Bur}$ and reaction yield or another relevant metric.

2. Methodology

The methodology involves the use of a steric index, $\%V_{Bur}$, which measures the occupancy in the metal's first coordination sphere to reveal the catalytic performance of the corresponding catalyst. The following website hosted the tool that allows anyone to calculate the steric hindrance of any ligand: https://www.molnac.unisa.it/OMtools/sambvca.php (Falivene et al., 2016; Falivene et al., 2019), that has been recently moved to https://www.aocdweb.com/OMtools/sambvca2.1/index.html. Changing the web server was not a whim, but rather to ensure that these servers are successful in their use, whether by researchers or undergraduate or master's students. It is necessary that they are not only easily accessible but also consistently accessible without suffering from connection interruptions from the institution they are associated with. In this sense, in 2023, the use of a professional web service that avoids such contingencies was considered.

The SambVca 2.1 web application was used to conduct calculations and obtain $\%V_{Bur}$ indexes and steric maps for the ligands under study. Essentially, $\%V_{Bur}$ serves as a descriptor to quantify the steric hindrance of ligands, particularly focusing on N-heterocyclic carbenes (NHCs), by considering the fraction of the first coordination sphere occupied by a ligand.

The use of a spherical section is because catalysis and substrate recognition typically occur within the first coordination sphere around the metal. However, the need for more comprehensive treatment of asymmetric ligands led to the development of steric maps. These maps depict the available surface area that ligands offer to substrates, defining the catalyst-substrate interaction and explaining the origin of enantioselectivity. Similar to physical maps depicting land and water features on Earth, steric maps use different colors and shading to represent elevations and differentiate between areas where ligands protrude towards reacting groups (brown areas) and areas where ligands withdraw from reacting groups (blue areas).

3. Results and discussion

For students in the Master's program in Advanced Catalysis and Molecular Modeling (MACMoM) at the University of Girona, the project serves as an inspiring exercise. Through experimental and computational approaches, students correlate the yields of catalytic reaction pathways with the $\%V_{Bur}$ steric index. The exercise involves delving into previous experimental results, manipulating xyz coordinates from X-ray data, and employing linear and multilinear regressions. It is noteworthy that each student in the class tackles a unique problem, fostering collaboration as solutions are shared within the group. This collaborative aspect not only aids in unraveling complex systems but also enhances the collective understanding of the involved intricacies. By emphasizing self-directed learning, the project encourages students to connect theory with results, promoting a deeper understanding of the impact of specific groups.

A comprehensive 4-hour laboratory exercise is proposed for, actually, any Master's program focusing on catalysis, tailored for classes comprising up to 20 students. The exercise aims to inspire students to grasp the intricate influence of 3D ligands on the metal's first coordination sphere. Moreover, it seeks to establish correlations between catalytic reaction yields and the $\%V_{Bur}$ steric index, calculated using the web server. So, it is not just about calculating the steric index; the goal is for students to find practical applications for it, making it a useful tool rather than just a calculation exercise. It is important for students to spend time thinking and reflecting on why a catalyst with ligands of varying steric hindrance might have a significant impact on a particular reaction (Bosson et al., 2009). This approach

promotes a deeper understanding of key concepts in catalytic chemistry and encourages critical thinking skills.

Overall, this exercise encompasses various components, including searching for past experimental results, manipulating xyz coordinates primarily sourced from X-ray data, and conducting linear regressions. Before delving into the exercise, students are provided with a brief overview of the fundamentals and theoretical background, drawing from the introduction and methodology sections of relevant literature. The exercise is structured around three sections: 1) Calculate the $\%V_{Bur}$ index and corresponding steric maps of NHC ligands for catalysts of Michalak and coworkers' work ((Czerwinski et al., 2016), with the chance to exclude some catalysts for the sake of simplification. Utilize xyz coordinates extracted from the Supporting Information file, ensuring accessibility for all students. 2) Analyze and comment on the symmetry of the steric maps' four quadrants. Justify your selection criteria. 3) Establish a correlation between the yield of alkynylation of trifluoromethyl ketones and the $\%V_{Bur}$ index. Initially, students focus on assessing the NHC ligands of a selected list of 15 catalysts. The necessary xyz coordinates are retrieved from the Supporting Information file, ensuring students have the requisite data for analysis.

Take for instance, Figure 1 depicts the step-by-step process for utilizing the $\%V_{Bur}$ server.

Figure 1. Sequence of screens to generate the $\%V_{Bur}$ and the steric map.
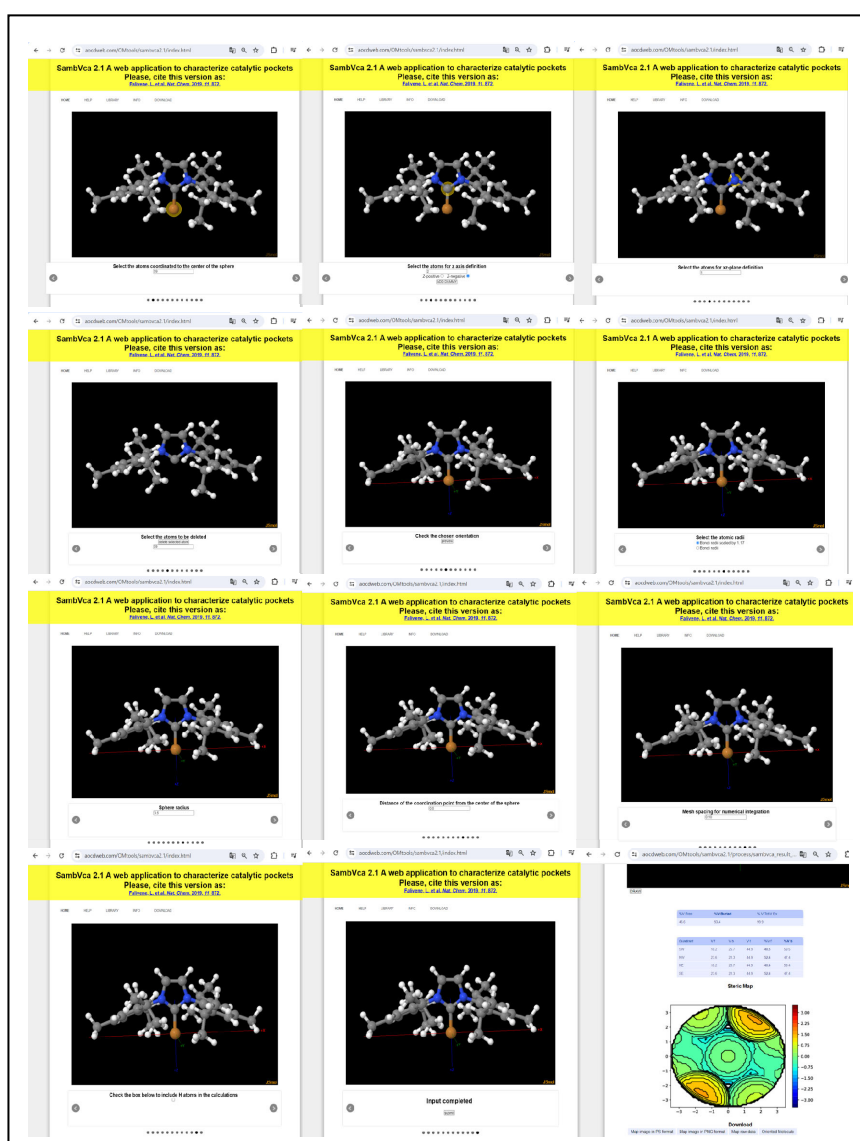
Initially, in Figure 1 the user selects the relevant section of the file and then designates the center, typically the metal atom. Subsequently, the z-axis is defined by the carbon atom of the N-heterocyclic carbene (NHC) ligand bonded to the metal, followed by the selection of the xz plane by clicking on either of the N atoms of the NHC ligand. Since the primary objective of this exercise is to

elucidate the influence of NHC ligands on the metal, the metal atom is then removed from the analysis. To ensure consistency and minimize errors, the orientation of the axes can be examined at this stage. Subsequent windows allow for the customization of various parameters. By default, Bondi Radii are used, and although the metal atom is removed, its contribution is still considered in the calculation of the plane. The level of integration is set to 0.1, and there is an option to include hydrogen atoms in the analysis, which is particularly relevant for experimentalists utilizing X-ray crystallography data, where hydrogen atoms are included through parametrization. The final output provides both total and quadrant-specific $\%V_{Bur}$ values, along with a steric map that can be saved in a high-quality format if desired.

Once the analysis of $\%V_{Bur}$ indices is complete, they are plotted against the experimental yield. Figure 2 illustrates that the most sterically hindered NHC ligands yield higher reaction yields, contrary to conventional expectations. In fact, the transition state defining the rate-determining step (rds) worsens as the steric hindrance of the NHC ligand increases. However, this is offset by the relative stability of the rate-determining intermediate (rdi), resulting in a lower overall energy barrier.

Figure 2. Graph depicting the relationship between the yield of phenylacetylene addition to trifluoroacetophenone and the steric bulkiness of the N-heterocyclic carbene (NHC) represented by the percent of buried volume (%V_{Bur}), including selected steric maps.
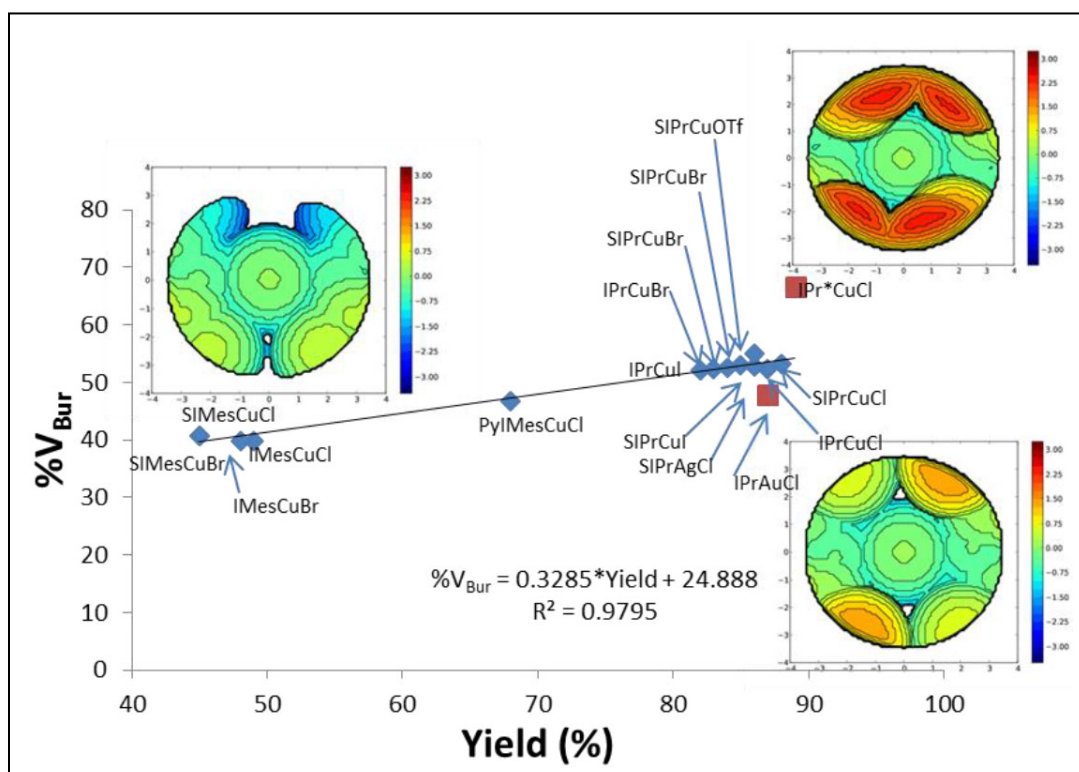
The evaluation of the exercise is done on an individual level, with particular emphasis on the reasoning behind the results. Furthermore, the positive reception of this proposal by students, as indicated by surveys, highlights the integration of professors' basic research within the Master's teaching framework. This is seen not only by experimentalists but also by others, as a valuable tool that can be utilized without the need for computational calculations, simply by examining X-ray structures.

4. Conclusions

A web server is the tool that a group of students, who have so far been at the Master's level but could also be at the undergraduate level, can use to understand the steric effect of ligands linked to their role in catalysis, without needing to grasp the theory beforehand or be experts in computing. It can be accessed from any computer, including tablets or mobile devices, making education flow seamlessly, which can then be quantified in correlations and even linked to artificial intelligence.

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INTERACTIVE PROJECT-BASED TEACHING – MEETING THE CHALLENGES OF THE COMING GENERATIONS OF STUDENTS

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Abstract

Experiences from the authors' teaching indicate that students are becoming less focused on educational exploration and critical thinking. In parallel, Broo, Kaynak, and Sait (2022) highlight that future engineers must be fluent in different technologies, methods, and methodologies. Hence, the fast changes that take place require a highly dynamic capability among the workforce of tomorrow, which is opposite to many students' behavior in teaching and courses. This sheds light on Project Based Learning, in its essence, student-centred and with a dynamic approach to teaching where students study real-world problems and challenges (Kokotsaki, Menzies, et al. 2016). Similarities exist with Problem-based learning, where complex real-world problems are also at the centre to promote student learning. Both these concepts can promote the development of critical thinking skills, problem-solving abilities, communication skills, and the possibility of working in groups (see, for example, De Graaf and Kolmos, 2003). This research report documented experiences involved in moving from a more traditional teaching approach into a more project-based approach regarding a course in construction management, undertaken four times with a new structure in which a problem-based approach was developed. One of the key issues at hand with the course was to develop it and stimulate students interest in the course subject, i.e., intrinsic motivation (Entwistle, 2009), motivation that comes from "*interest in what is being learned and feelings of pleasure derived from it*" (pp 20), and not from external rewards (extrinsic motivation). Based on previous experiences from project-based learning, course material has been developed in four rounds, where each course provided feedback to develop the course further. The course focused on an already conducted construction project, which was modified for each round so the students could create new frames for the project. Feedback was received during the course, and individually, students at the end of the course provided feedback to coming rounds. The results from this development show interesting challenges in teaching regarding the balance between showing results from the actual project vs. stimulation of creativity among students, with a clear conclusion that age, and work experience positively affect how the students execute the projects. It also directly shows the significance of the course framing and the variation of project set-ups in the course. Our findings also show values in PBL for students' ability to handle changes in a world with many insecure influences.

Keywords: Problem-based learning, project-based learning, intrinsic motivation, flexible learning.

1. Introduction, motivation, and objectives for the paper

The authors of this paper have extensive experience in teaching over the years. Altogether, the authors' teaching experiences include different subjects at different university levels. These experiences and discussions with colleagues indicate that students are becoming less focused on educational exploration and critical thinking. The focus here is construction engineering, and Broo, Kaynak, and Sait. (2022) highlight that future engineers must be fluent in different technologies, methods, and methodologies. Regarding this, the Architecture, Engineering and Construction sector is no exception, where climate impact pressures and technological advancements sets demands on broad skills among its professions (Chacón, 2021). Hence, the surrounding world is going through fast shifts which cannot always be foreseen but puts emphasis on a high dynamic capability, i.e., to adapt to upcoming circumstances to be competitive (see for example Meier et al, 2023) among the workforce of tomorrow. In this setting and under these circumstances, Project Based Learning can be a valuable teaching

approach. This is, in its essence, student-centred with a dynamic teaching approach, where students study real-world problems and challenges (Kokotsaki, Menzies, et al. 2016). A similar approach is Problem based learning, in which complex real-world problems are in focus to promote student learning, i.e., both concepts can promote the development of critical thinking skills, problem-solving abilities, and communication skills and possibilities to work in groups (see for example De Graaf and Kolmos, 2003). Perrenet et al. (2000) states that a similarity between the concepts is that they both emphasize self-direction, collaboration, have a multidisciplinary orientation and are founded in real-world problems. Hence, both approaches can be valuable in addressing challenges with students and their learning focus, as stated above.

This paper presents documented experiences involved in moving from a more traditional teaching approach into a more project-based approach regarding a course in construction management, undertaken four times with a new structure in which a problem-based approach and project-based approach were developed. The paper aims to provide learnings for other types of education aiming to transform into this type of education.

2. Method

Relating to the aim of this paper, the background, and motives for the change of the course, as well as changes and feedback from the students, are described. In addition, the mean age and experience of the student groups are described. One of the authors has actively been involved in developing the course set-up and documented the progress and student feedback.

For Higher Vocational Education (HVE, see below under 2.1), the students had, as a part of the course assignments, to describe their learning process over the course, write a diary, and evaluate the execution of how the project group had been working together. In this, there was feedback on the course set-up and development. In addition, an evaluation was made by the program director, and the students filled out a formal survey. For Halmstad University (HU, see below under 2.1), the students were given an assignment to write a diary and an evaluation of the project and the project group. In addition, the students did a course evaluation at the end. Besides that, a structured evaluation was made in class to discuss the course and its execution in the final class. Altogether, these activities are used to identify areas of improvement for the next round and is on an aggregated level which the students know that it is used for and it is this aggregated information that is used in this extended abstract.

Since one of the authors has been active in the development, this influences the interpretation of the development and the information presented in this paper. Therefore, the second author takes on an important role as critical reviewer besides giving the perspective of an outside view. This is a major part of creating credibility in the results, including reflection of the methods weaknesses and risks (Maxwell, 2012). The critical awareness of the method is also important to create trustworthiness, and here, the outside view of the second author is of central importance (Merriam, 1994).

3. Development of the course(s) in Construction management

In this section, the background of the course is described, as well as changes made over the different course rounds. The course has been given at two schools in different rounds, where the content differs due to level and overall education objectives.

3.1. Background and changes to the course

Several years ago, one of the authors worked heavily with transforming different engineering education programs from mostly so-called traditional teaching into a teaching approach based on project-based and problem-based learning. This covered only part of the education programs, i.e. half the teaching over one semester in each year of education. The experiences from this were overall sound, and students already in the first semester produced impressive results in their projects and abilities to bring unexpected ideas and solutions (not all students, though). This positive experience has, from then on, been more or less a key ingredient in one of the author's teachings.

Within the Department of Construction and Energy Engineering, specifically regarding the Construction Engineering program, there has been a discussion about how the development of teaching can be developed into a more problem-based approach and project-based approach, stemming from a discussion about the student's attitude toward their studies. Teachers have experienced students often seeming narrow in their views and often expressing a need for clarity in what to do and achieve. This is important in any education, but patience, the ability to grasp what is expected, and taking one's own initiative for learning have been seen as an area of development potential. Therefore, a change in the design of the studies has been seen as vital to stimulating explorative learning. In particular, teachers were

experiencing a student attitude aimed at having very precise instructions that could provide answers, which in many cases is typical for courses in design that include dimensioning/calculations. The course in question for this paper is a course in construction management, basically covering the steps of building design and all activities needed to hand over a finished building. The course provides an overview of the construction process but does not go into depth in sub-areas since this is covered in other courses. Hence, since the students had been complaining about it being hard to grasp and seeing the practical benefits of the course, this provided a good opportunity to redesign the course.

In parallel, some of the teachers in the department, including one of the authors, had a similar but shorter course at a 2-year education program, a Higher Vocational Education (HVE). HVE was a two-year education with a more practical orientation and included work practice. This course was given once a year but proved helpful as a first test of a revised course set-up, emphasizing project and problem-based learning. The student population was different concerning both age, no of students and experiences. HVE round one (HVE1) had an average age of slightly over 30 yrs and almost half were women and round 2 just under 30 yrs (HVE4) and around a sixth women. HVE was mainly consisting of students that had worked and came from many different backgrounds, including the construction industry. HU2 had an average age of slightly under 25 yrs and nearly half of the class were women. while HU3 had an average of slightly over 20 yrs with about a third of the class women.

The original courses, called HU, took place at Halmstad University and are part of two types of bachelor-level education programs, and HVE, taking place at the two-year education program mentioned above, depending on their location, were basically structured as follows. HU consisted of lectures and exercises, and the exercises were 1 ECTS, a project assignment of 3 ECTS, and an exam of 3,5 ECTS credits. The project assignment was, in short, to create a document for procurement of a building project; the exercises revolved around using different types of projects and the exam about the course aims. The project covered time-planning and costs associated with the building project, and the course mainly had one day a week dedicated to teaching, while the rest of the time was dedicated to the student's studies. HVE had a bit of another set-up, with three days of classroom activities consisting of lectures and exercises. The whole course was then examined through a written exam.

When changing the courses, the basic idea was the same. The main objective was to go through the steps of building an industrial facility, including a warehouse, office, and social spaces. The students had project assignments relating to start-up activities and then had to conduct project activities related to a construction project from start to finish for each week. By doing this, the students should also be trained in visualizing and understanding systems and structures, which is essential in the construction sector (Mastrolembo Ventura et al., 2022). In HVE, the students worked with the project, its assignments, and documentation in a PowerPoint presentation, with ongoing presentations of the project activities and feedback provided regarding the assignments. In parallel, the students had individual assignments to hand in each week, which were about answering reflective questions about that week's themes. For the HU course, the basic set-up was the same, but the students had to conduct a report for the project, including a final presentation of the project, which was supposed to have a selling approach. Since the HU course was more significant to its extent, the assignments were also more extensive.

3.1.1. Feedback and changes over the rounds.
Each time the course has been executed, there have been changes. The first time the course took place was, as stated above, the HVE1. The second time was at Halmstad University (HU2), the third time at Halmstad University (HU3), and the fourth time at HVE (HVE4).

HVE1: The first time the course took place, it was deemed successful overall as it was considered interesting, but also with many areas the students wished to go deeper into. The course evaluation survey had a response rate of about a third of the class answering and a mean satisfaction value of 4,25 (out of 6). Main comments were that the structure of the learning platform was messy, and to many teachers involved and at times messy with the individual assignments and the communication between the teachers. On the positive side, though, it was good with the individual assignments and the projects. In addition, the course was considered interesting and valuable, and the teacher's knowledge was considered good with many new subjects. Judging from the learning process descriptions, the course was deemed successful overall, with about a sixth of the students disappointed but the rest satisfied (or more). A main issue that the teachers reflected on was that the students were not challenged in different types of designs regarding the facility. It was much the same, and it was also concluded that they should be provided costs at an early stage to enable an assessment of the design.

HU2: With a basis from HVE1, different groups were provided with different demand specifications and a more thorough review of different building systems and costs. To the demand specification it was added that the students should choose a possible customer to adapt the building towards. In this course, they were also given more frames to change the design and evaluate their design

regarding cost and climate impact. Many of the student groups made a 3D model of the building in the software Revit, which was a good addition to the projects. A main complaint from the students was that they thought they had too much information and sources and that it was hard to assess how much the report should contain. Otherwise, the groups presented buildings with different designs/architecture. In the oral evaluation, students raised the point that they thought there was too much material, which was discussed, with the point being that the students need to learn how to find facts. The course evaluation had a response rate of about a third of the students answering and a general satisfaction index of 67 % (out of 100 %) On the positive side, the students found that the project and the exam were good and interesting, including the set-up with weekly assignments. Once again, the students complained about the learning platform's structure, and some thought the amount of work was too much, although a majority assessed it as fair.

HU3: This time, a demand specification was added to broaden the scope of buildings. In addition, a template with headlines and additional instructions was added to clarify the content of the report and the project. It also became mandatory to make a 3D model using the software Revit. In the oral evaluation, students again raised that they thought there was too much material, which was discussed, with the point being once again that the students need to learn how to find facts. The course evaluation had a response rate of about a fifth and a general satisfaction index of 61 %. Once again, the students found that the project and the exam provided an understanding of all the parts of a project and that the high amount of practical work was good and interesting, including the set-up with weekly assignments. Also, the students complained about the structure of the learning platform and that the students found that the teachers were not synced, which had to do with a new teacher coming in to the course previously unused to the course and its set-up.

HVE4: The added changes were used again, this time in the project. In addition, due to previous criticism, the main author took over more of the course to manage a more significant part of the course. Since these students studied a limited version of the project, the visualization in Revit was not part of the project, and some of the parts were smaller in the project. Again, the course was deemed successful overall as it provided good basic competence and many good learning areas, but more depth in some areas was stated as helpful. The course evaluation survey had a response rate of around 70 % and a mean satisfaction value of 4,7 (of 6). Some individual comments were that some parts could have a higher pace, and some students still felt that too many teachers were involved. However, judging from the learning process descriptions, all course participants expressed satisfaction with the course.

Planned for next round was that the students were given a real area to plan the building project on. The area was under planning within a municipality, where the buildings in the projects can be built. This addition was made to further enable different types of designs and projects and possibly also add possibilities for different types of architecture.

4. Discussion

One of the key issues at hand with the course was to develop it and stimulate students' interest in the course subject, intrinsic motivation (Entwistle, 2009), i.e., motivation that comes from "*interest in what is being learned and feelings of pleasure derived from it*" (pp 20), and not from external rewards (extrinsic motivation). As seen from the evaluation summaries, there is a variance regarding students' satisfaction. An indication is, however, that older and more experienced students seem to cope with the approach better than younger students. However, there is still a dilemma with several issues in the approach. Firstly, the structure of information can constantly be improved. However, the balance between providing very clear instructions and letting the students set the frames themselves seems to be an ongoing development route where more clarity can be improved, but the level of innovativeness in the projects must also be supported and encouraged.

An example is that the students initially think the project is unclear, but it becomes more apparent as they go ahead. This phenomenon seems to be more stressful for younger students than older ones, and younger students ask more questions regarding what to do. In contrast, older students ask more questions about knowledge and its application. The students experience the setup differently depending on personal attributes and experience. At large, the HVE students generally, although being a smaller group, seem to have a greater interest in learning. In addition, the impression is also that they can manage undefined issues better than university students, which most likely can be related to their experience in managing issues in real life.

There is also a challenge in how many teachers should be involved, and an easy conclusion seems to be that one teacher should have a majority of the course, validated by HU2 and HVE4. However, there is also a learning process among teachers to get into the approach, which is also valuable.

5. Conclusions

Based on previous experiences from project-based learning, course material has been developed in four rounds, where each course provided feedback to develop the course further. A main driver has been to increase creativity and variation in the projects but also to meet the students' wishes to improve the course. Working with problem-based and project-based learning is a learning skill, and handling undefined activities is a competence that also needs to be developed to manage changes in a real-life work environment.

The course focused on an already conducted construction project, which was modified for each round so the students could create new frames for the project. Feedback was received during the course, and individually, students at the end of the course provided feedback to coming rounds. The results from this development show interesting challenges in teaching regarding the balance between showing results from the real project vs stimulation of creativity among students, with a clear conclusion that age, and work experience have a positive effect on how the students execute the projects. It also directly shows the significance of the course framing and the variation of project set-ups in the course. Our findings also show values in PBL for students' ability to handle changes in a world with many insecure influences. It should also be acknowledged that learning among teachers is also a significant part of the development process. Finally, the wide frames of the set-up seem to stimulate creativity but also need to be balanced with good enough instructions.

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CO-CONSTRUCTING AND EVALUATING AN ENDOCRINE DISRUPTOR EDUCATION PROGRAM FOR TEENAGERS IN SCHOOLS: THE COPE-ADOS PROGRAM

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Abstract

Some Endocrine Disruptors (EDs) are suspected to cause deleterious effects on the reproductive system, developmental abnormalities and hormone-dependent cancers (breast, uterus, prostate, testis). The public's perceptions of these chemicals are poorly understood. The period of adolescence is a critical time when exposure to ED could have long-term health consequences. As part of the third axis of France's second national strategy on endocrine disruptors (SNPE 2) 2019-2022, the COPE ADOS project aims to offer an education and information program on endocrine disruptors for teenagers in schools. The COPE ADOS project is divided into 4 steps: 1) documenting the knowledge, representations and skills of high school students on the subject of endocrine disruptors; 2) co-constructing with teachers an educational device aimed at students and their educational supervisors; 3) building a specific tool to evaluate the program; 4) implementing the program and carrying out its evaluation. The communication will describe the implementation of the project and the results associated to its different steps: **1-** A qualitative study (23 focus groups – N=275) has been carried out among high school students in order to collect knowledge and social representations. The sample includes general and professional high schools, including hairdressing and automobile, whose professions are more exposed to ED. **2-** Based on the results of this qualitative survey, the consortium of researchers - (public health, education sciences) and teachers jointly developed 6 educational objectives. The objectives were then declined into 14 educational tools made available to teachers on a digital platform. **3-** The project has been supported by academic authorities, and 10 schools are currently involved in the program trial. The first intervention phase will involve 218 high school students; 493 high school students have been included in the control group. **4-** An evaluation questionnaire was drawn up in line with the objectives. The questionnaire measures high-school students' skills and knowledge relating to endocrine disruptors, using a 60-point score. Data were collected for all high school students (intervention and control) in September 2023 (T0) and after 4 months of intervention in January 2024 (T1). These questionnaires are currently being entered into the EPIDATA software for statistical analysis. At the same time, a process evaluation will be carried out by interviewing teachers. This will provide data on the program's acceptability and the use of the tools offered on the digital platform.

Keywords: Health education, endocrine disruptors, co-creation, evaluation.

1. Introduction

Endocrine-disrupting chemicals are "*natural or human-made chemicals that may mimic, block, or interfere with the body's hormones, which are part of the endocrine system.*"[1]

Characterizing the risk associated with endocrine disruptors in humans is difficult, however, the report on the state of scientific knowledge concerning these chemical substances (Gore et al., 2015) highlights their impact on the reproductive health of women and men, including an overall deterioration in reproductive health in men since the 1990s (reduced sperm quality, increased incidence of testicular cancer, etc.). EPs are also suspected of increasing the incidence of hormone-dependent cancers (breast and prostate cancer) as well as other pathologies (obesity, diabetes, thyroid and metabolic disorders), having an effect on immune function and increasing neurobehavioral disorders (Fini & Demeneix 2019) (dyslexia, mental retardation, autism, attention deficit disorder).

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[1] National Institute of Environmental Health Sciences: *https://www.niehs.nih.gov/health/topics/agents/endocrine*

Because endocrine disruptors come from many different sources, people are exposed to them in many ways, including in the air we breathe, the food we eat and the water we drink. EDCs can also enter the body through the skin. The characteristics of occupational exposure (dose, frequency and duration) entail greatly increased risks for certain professionals in contact with drugs, solvents, pesticides, the metallurgical, pharmaceutical, cosmetics and plastics industries, as well as in the agricultural sector. Endocrine disruptors act on the hormonal system. As the quantity of hormones required for the functioning of the endocrine system is extremely small, disruption of this system can result from very low concentrations of substance. What's more, PEs call into question the principles of classical toxicology: substances that do not individually cause measurable endocrine disruption nevertheless have a significant effect when mixed together, the so-called cocktail effect (Delfosse et al., 2015).

In France, the public authorities are paying particular attention to EDCs. The second French national strategy SNPE 2: 2019-2022 has been published, with the aim of better protecting the population and reducing environmental contamination by EDCs. This national strategy focuses on three key areas: "improving knowledge; preventing environmental contamination and protecting the population; educating and informing".

Early childhood and pregnancy, recognized as vulnerable periods, have given rise to numerous interventions aimed at treating and preventing exposure during these critical periods. Adolescence, marked by pubertal sexual activation, is emerging as a crucial period, underlining the need to examine and reduce the impact of endocrine-disrupting substances during this stage of development.

Public policy initiatives aimed at moderating individual or family behavior do not affect the entire population in the same way. For example, eating organic food is more common among the higher socio-economic classes. Preventing the population's exposure to endocrine disruptors must therefore be achieved more generally through health education programs to provide all individuals with the necessary skills to make their own health choices.

Several initiatives have been developed to reduce exposure to endocrine disruptors in pregnant women (Rouillon et al., 2017). Overall, there are very few initiatives aimed at teenagers.

2. Objectives

Our research team specializing in cancer prevention (Chaire HYGEE, Institut PRESAGE) decided to develop a program aimed at teenagers in schools. The COPE ADOS project brings together a consortium of 3 research teams, including an academic team specialized in educational sciences to co-construct with teachers a program that could be feasible and acceptable, and that has real pedagogical qualities. The challenge was also to define a research design to measure the program's implementation in the classroom and its impact on pupils' knowledge, representations and know-how in terms of preventing exposure to endocrine disruptors.

3. Design

The COPE ADOS project is divided into 4 steps: 1) documenting the knowledge, representations and skills of high school students on the subject of endocrine disruptors; 2) co-constructing with teachers an educational device aimed at students and their educational supervisors; 3) building a specific tool to evaluate the program; 4) implementing the program and carrying out its evaluation.

4. Qualitative study

4.1. Data collection and methodology

In order to collect knowledge and social representations among teenagers, a qualitative study has been carried out among high school students. The sample includes general and professional high schools, including hairdressing and automobile, whose professions are more exposed to EDCs. The schools were contacted by telephone or e-mail. We wanted to have a great diversity of profiles, in general and vocational school sections, and especially in professions impacted by EDCs. The choice to call upon students in the second and final year of high school was made in order to investigate the potential evolution of their knowledge between the beginning and the end of their studies. in fact, elements of EDC education could already be present in school curriculum. After several tests, we decided to structure the focus groups following a framework of questions in two parts, before and after viewing a small video a short video presenting PEs, their harmful effects on health and preventive attitudes.

6 high schools participated in the study and 23 focus groups were conducted by 2 researchers together, involving 275 students. The focus groups were recorded and transcribed for analysis.

Two researchers independently coded the same randomly selected transcripts and discussed the codes for reliability and validity in their application to the data. (Kidd & Parshall, 2000). Qualitative coding was conducted in NVivo 13, and one-third of the focus group interviews were double coded by an independent researcher.

4.2. Main results of the qualitative study

As for the notion of "endocrine disruptors", the term was mostly unknown. For them, "endocrine disruptors" are assimilated to the various pathogenic agents studied in their biology courses: viruses, bacteria, etc. They are considered bad for health, invisible and transmissible. These elements are close to the representations of COVID and we can think that there may be an assimilation given the period of the survey.

The link between EDC with the hormonal system is rarely made by itself. However, most high school students know about hormones, are able to name several of them and explain their use in the body. None of the majors endocrine disrupting molecules are identified. But students indicate some associations with health controversies.

About the perception of risks and consequences on health; we can see that the professional situations are better documented than everyday situation. Plastics, which are a very common source of endocrine disruptors in everyday life- were rarely identified. Several professions are qualified as higher risks: specific to endocrine disruptors like farmers using pesticides, or beauty care professionals handling cosmetics. We noted the influence of career paths in the knowledge of the sources of EDC.

After the video, the consequences of EDC are well described at the individual level and at the environmental level. We also noted a confusion with other types of risks for health such as exposure to screens or exposure to pathogenic agents. Exposure to endocrine disruptors also associated with risky behaviors among the adolescents: drugs, tobacco, alcohol and unprotected sexual relations are mentioned.

The web is the main source of information cited by students. The social and academic level of the students determines the web search strategies. There is also a strong exposure to information on social networks. Prevention behaviors are more influenced by the family environment.

In term of prevention strategies, adolescent said us that avoiding these molecules seems complicated, but it seems possible to limit them and to protect oneself from them. Several preventive behaviors regarding endocrine disruptors are known by high school students: for example, they are washing clothes before wearing them, they are airing and cleaning their homes regularly. But these attitudes are not connected with EDCs prevention.

Nevertheless, regarding their actual behaviors, vigilance regarding the composition of food and cosmetic products in particular, and the attention paid to labels or to plastic are weak. However, considering their actual behavior, many things can be improved. The priority is due to the vigilance on the composition of food and cosmetic products, the misuses of plastics.

5. Co-create an educational device

Based on the results of this qualitative survey, the consortium of researchers - (public health, education sciences) and teachers jointly developed 6 educational objectives.

The performance (educational) objectives were determined in partnership with the co-construction team following the analysis of focus groups. The identification and selection of theoretical methods that are believed to influence changes for the determinants associated with each educational objective. This broad goal was subsequently dissected into six distinct performance objectives, as identified by the co-creation team and termed as educational objectives by the researchers engaged in the COPEADOS project. These performance objectives include:

1. Increase knowledge levels about EDs.

2. Increase the sense of control over environmental risks.

3. Be able to assess risks related to EDs in everyday life and/or professional situations.

4. Be able to implement appropriate prevention strategies.

5. Know how to identify reliable sources of information on EDs.

6. Reduce anxiety related to EDs and their exposure.

To progress with the program logic model, steps 3 and 4 required a series of 3 meetings with the co-creation team to reach consensus on the model. The co-creation team established a framework for the program, defining three sessions, each with a specific objective. Session 1 was devoted to assessing students' knowledge and perceptions. The co-creation team emphasized the need for tools that would enable

a comprehensive assessment of students' specific needs, in order to tailor the program accordingly. Session 2 aimed to foster the acquisition of EDC knowledge and exposure prevention skills, while session 3 was designed to consolidate contributions.

It was also stressed that each session should be limited to a duration of 50 minutes to align with the typical pace of high school activities. The program should be adaptable for use in both whole classes and small groups. Furthermore, all tools should be easily downloadable from a shared platform accessible to facilitators, complete with technical guidelines that would enable facilitators to use them independently without requiring assistance from researchers. The tools should be delivered by members of the high school, and people in the high school should be self-sufficient in delivering the program without the need for additional support.

Initially, the co-construction team proposed tools to achieve the various objectives. The co-creation team proposed tools based on models they had already used. The objectives were then declined into 14 educational tools made available to teachers on a digital platform.

6. Build an assessment tool

An evaluation questionnaire was drawn up in line with the objectives. Its comprehensibility and clarity were tested with 177 high-school students in general and vocational second-year classes, at 3 schools, to ensure that it met the needs of the target audience. Modifications were made, including changes to vocabulary, the addition of questions and rewording. The final version of the questionnaire will measure the impact of the program on the skills and knowledge of participating high school students concerning endocrine disruptors, using a 60-point score. The questionnaire will be administered at T0 in September 2023 and at T1 in January 2024, i.e. before and after the implementation of the program. It is hoped that this score will evolve over time.

7. Implementing the program and its evaluation

The project has been supported by academic authorities, and 10 schools are currently involved in the program trial. The first intervention phase will involve 218 high school students; 493 high school students have been included in the control group Data were collected for all high school students (intervention and control) in September 2023 (T0) and after 4 months of intervention in January 2024 (T1). These questionnaires are currently being entered into the EPIDATA software for statistical analysis.

At the same time, a process evaluation will be carried out by interviewing teachers. This will provide data on the program's acceptability and the use of the tools offered on the digital platform. The interview guide will be used to investigate obstacles and facilitators to implementation, and adaptations made to the program since its launch. The RE-AIM evaluation framework (Glasgow, Vogt, & Boles, 1999) will be used to assess the program. This model was chosen because it proposes criteria that cover both the evaluation of the results obtained on knowledge and representations of endocrine disruptors and, on the other hand, the evaluation of the processes that led to these results, thus enabling them to be reproduced. Through its 5 investigative items (Recruitment, Effectiveness, Adoption, Implementation, Maintenance), it will enable us to observe potential discrepancies between the planned intervention and the intervention carried out, to take account of the effects of setting up the program, to qualify the participation of the players and the influence of the context on the progress of the program. Interviews will be conducted in person or by telephone, depending on the interviewees' preferences. Interviews will be recorded, transcribed and anonymized. Qualitative coding will be carried out using NVivo 13.

8. Conclusion

If the program is shown to be effective in terms of improving pupils' knowledge and skills in preventing exposure to endocrine disruptors, and if the qualitative study confirms the possibility of teacher autonomy based on the availability of the tools, we will be faced with the challenge of implementing this program. We have established a partnership with the Ligue Against Cancer to provide them the co-created tools and enable them to become active in this specific phase.

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POSTERS

FACTORIAL STRUCTURE VALIDATION OF THE ENTREPRENEURSHIP QUALITIES QUESTIONNAIRE 2.0

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Abstract

Entrepreneurs are more than ever very important economic actors in all societies. In many countries such as Canada, governments are mobilizing school curricula to include activities aimed to develop entrepreneurship competencies in high school students. However, there is no clear data on the actual level of these competencies among high school students and adults as well (Yergeau & Gingras, 2023). Accordingly, there is also few instruments intended to evaluate dimensions of entrepreneurship. This study examines the factorial solution of a modified version of an open online instrument aiming at measuring entrepreneurship qualities. The original Entrepreneurship Qualities Questionnaire (EQQ, L'Heureux et al., 2000) contains 59 items grouped in 6 continuous scales (Commitment, Motivation, Result-oriented, Creativity, Self-competition, Leadership) and a Total score. The EQQ 2.0 is an updated version based on previous work showing some items factor loadings were problematic in the original factorial solution (Yergeau, Busque-Carrier, Gingras & Lépine, 2023). A sample of 5527 high school students and n=5309 adults from the province of Québec have answered the EQQ between 2013 and 2023. An exploratory structural equation modeling within confirmatory factor analysis (EwC) was used to assess the second-order factor structure used by the EQQ 2.0. EwC mostly replicated the novel four first-order and one second-order factor structure. Results were validated with a subsample. Overall, these findings support the utility of the EQQ 2.0 to assess entrepreneurship qualities.

Keywords: Entrepreneurship, factorial structure, construct validity, quantitative measure.

1. Introduction

Entrepreneurship competencies refer to the skills, knowledge, and abilities that individuals need to successfully start, manage, and grow a business venture. These competencies have been widely studied in the academic literature, and several frameworks have been proposed to categorize them. One commonly referenced framework, proposed by Audretsch and Lehmann (2005), identifies eight core entrepreneurship competencies: opportunity identification, innovation, proactiveness, autonomy, risk-taking, self-efficacy, networking, and learning. Another framework, proposed by Stevenson (1985), identifies four key competencies for entrepreneurs: conceptual, human, network, and financial. Additionally, a more recent study by Edelman, Watson, and others (2015) defines the following 8 entrepreneurship competencies: 1) Opportunity recognition, 2) business acumen, 3) creativity and innovation, 4) interpersonal and communication skills, 5) strategic thinking and planning, 6) resilience and persistence, 7) networking and relationship-building and 8) financial management. All these frameworks, however, have in common the emphasis that it is a combination of various abilities and traits that make an entrepreneur successful. These models have inspired some high schools to offer some basic training in entrepreneurship to students. However, questions remain regarding the objective measure of entrepreneurship competencies. This study aims to examine and validate the factorial structure of the revised version of the Entrepreneurship Qualities Questionnaire (EQQ 2.0), an open online instrument aiming at measuring entrepreneurship qualities.

2. Methodology

The participants have answered voluntarily and anonymously to the online version of the EQQ between 2016 and 2023. The EQQ is available free online to the general population and is often suggested by teachers and guidance counselors. All scores are computed electronically. There has been no

subject solicitation, so this is a convenience sample of 9182 persons who answered the online questionnaire on entrepreneurship. 4945 were youth, 1921 are young adults (18-30 y/o) and 2316 persons are over 30 years old. There are 5384 women and 3798 men. For validation purposes, two random subsamples of equal size were created.

The original Entrepreneurship Qualities Questionnaire (EQQ; L'Heureux et al., 2016) is a self-reported instrument including 59 items assessing a range of perceived behaviors and attitudes related to entrepreneurship. Respondents must determine the level of self-correspondence for each item on a 4-point scale from "not at all" to "totally" corresponding. The ECQ results in a total score and 6 specific scales: 1) Energy/commitment, 2) Motivation, 3) Results orientation, 4) Initiative/creativity, 5) Self-competition and 6) Leadership. The higher the score on a scale, the more competency on that dimension is being perceived by the subject. The EQQ total score has a very good homogeneity (alpha=.95) as the 6 dimensions scores with Cronbach's alpha between .75 and .86.

An exploratory structural equation modeling within confirmatory factor analysis (EwC; Morin & Asparouhov, 2018) was used to replicate the second-order factor structure of the EQQ with problematic items previously identified (n=2) removed from analysis (Yergeau et al., 2023). The MLR estimator was used. Model fit was assessed with the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA). According to typical guidelines (e.g., Hair et al., 2010), CFI or TLI values equal or above .90 are considered acceptable while values equal or above .95 are considered excellent in model fit assessment. Regarding RMSEA, values lower than .08 can be qualified as acceptable, whereas a value lower than .06 can be qualified as excellent.

3. Results

Table 1. Summary of factorial structure validation analysis of EQQ 2.0.

Description	χ^2 (*df*)	CFI	TLI	RMSEA	90% CI
Sample 1					
EFA 4-factor 59 items	19,224.207(1537)*	.884	.871	.050	[0.050;0.051]
ESEM 57 items	14,663.396 (1374)*	.911	.897	.046	[0.045;0.047]
EWC 57 items	14,627.807 (1376)*	.911	.897	.046	[0.045;0.047]
Sample 2					
ESEM 57 items	14,820.418 (1374)*	.913	.899	.046	[0.045;0.047]
EWC 57 items	14,633.992 (1376)*	.911	.897	.046	[0.045;0.047]

Note. * *p* < .05; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling

Table 1 shows factorial modeling analysis for both samples. The EwC model of perceived entrepreneurship related competencies revealed acceptable fit to the data in both samples. A four-competency model with a second-order general level of perceived entrepreneurship related competency was thus supported as the best performing solution. Information about factor loadings and cross-loadings of the first-order factors are reported in Table 2.

Table 2. Descriptives statistics of EQQ 2.0 first-order factor loadings (sample 2; n= 4620).

Scales	Factor loadings			Cross loadings		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
F1. Dedication / success	.60	.40	.85	.09	-.13	.32
F2. Initiative	.52	.32	.76	.06	-.26	.36
F3. Responsability	.43	.29	.67	.06	-.30	.35
F4. Leadership	.46	.20	.72	.05	-.15	.30

Dedication/success (25 items), Initiative (10 items), Responsibility (13 items) and Leadership (9 items) items were all well related to their expected factors. This new factorial structure with 57 items shows all items are good indicators of their respective factor. Cross-loadings were generally low. For each first-order scale, there was no report of high level cross-loading with an unexpected factor. Moreover, the second-order factor loadings were all acceptable (see Figure 1 below).

Figure 1. Second-order factor loadings.
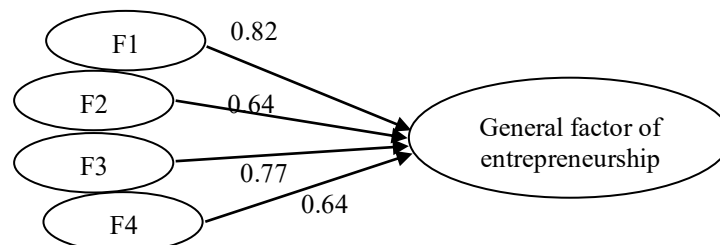
4. Conclusion

This study tested the structural validity of the Entrepreneurship Qualities Questionnaire 2.0, a revised version of a questionnaire measuring perceived entrepreneurship related competencies. Factorial analysis showed that a four factors structure was the most performing solution and was validated in a satisfactory manner. Results tables indicate that very few items were still unrelated to their expected factor, a much smaller account than in the original version. Overall, second-order factor loadings were satisfactory, which supported the relevance of these competencies for assessing a general factor of perceived entrepreneurship related competencies. Future works should consider the results of this study to use the updated version of the EQQ 2.0 in relevant research ventures. For example, the validity of the updated version of the EQQ could then be further examined through divergent and convergent validity analysis.

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DEVELOPMENT OF AN ASSESSMENT METHOD FOR INDIVIDUAL GRADING OF A GROUP PROJECT WORK

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Abstract

In engineering education, project-based learning (PBL) is irreplaceable for implementing active studies in applicable, engineering courses. The example of this paper is taken from a course Product design and development given for the third-year students at speciality Product development for mechanical engineers at Linnaeus University. The course is project-based and the projects are given by the industries where students work with an external collaboration partner. In the 15 ECTS course, done in one semester the students are trained in conceptual product design using different methods for problem solving and decision-making. They work in project teams of 3-4 students. The assessment and grading were done on the base of the grade of the report written during the project time. The individual knowledge and contribution to the project work was evaluated more in informal than in a formal way during the tutoring sessions and the seminars. This is where the authors have faced a big challenge to assess formally and individually the students when a group has done the work. The question was how fairly to evaluate the students' knowledge, skills and contribution to the group work. In this paper, the authors are presenting an attempt to answer this question and to propose a method for individual grading of a group project work. The method for assessing individually the students' performance is based on a Competence Advancement matrix with standardized criteria- production, perception, reflection, systematic approach and complexity.

Keywords: *Evaluation method, individual grading of a group work, higher education in engineering, project-based learnings.*

1. Introduction

In the engineering field and especially in the field of mechanical engineering, it is both the problem analysis and the problem-solving phases that are important learning phases. Furthermore, it is important that these learning processes are team based in order to acquire the knowledge sharing within a smaller team as well, and that the collaboration is oriented toward both process and product so that engineers learn the competence of collaborative knowledge construction. The dual purpose of group work - to develop the ability to collaborate and to acquire academic knowledge, seemed to be an issue for the teachers. The issue became even more challenging when the groups were working in different locations in the school and the teachers' chances of observing the groups for more than short periods were limited. The focus in this paper is to understand what happens in the meet point between group work and assessment in pedagogical practice. There seems to be a tension between the demand for individual assessment of students' knowledge and abilities and the demand to teach students collaboration abilities through group work. The challenge is to define the right criteria and to concretising what and how is to be assessed. The dilemma comes from the fact that that a collectively produced assignment is to be assessed individually what creates competition among students in the group, contrary to group assessment, which creates interdependence and collaboration among the group members. (Chiriac & Frykedal, 2022).

2. Method

Assessment of group work could be undertaken with help from the students through self and peer assessment. The students might be active in their own assessment process to control their own learning and outcomes. There are two different learning outcomes that could be assessed - academic achievement (result or product) or collaborative and learning strategies (process). The product is the result of the

students' work, while process is mainly considered as the collaboration between the students when they work on a common task. The product outcome can be informally accessed by the teachers valuing such aspects as A) seminars and tutoring presentations; B) final result, and C) written report. The evaluation of the product could give possibilities for individual but mostly group assessment. The final product is a significant basis for assessment at both the group and the individual levels. How the final product turns out depends on the task, and, consequently, a text, a 3 CAD model and a simulation will be assessed according to different criteria. The teachers assessed the final product as a whole (group level), as well as assessing if and how group members assumed responsibility (individual level) during the work process. The process outcome could be also informally accessed by the students, measuring such criteria as A) time in hours for reading theory and external research; B) time in hours for preparing the planning and the presentations; C) time in percentage for group work and tutoring and D) contribution in percentage to the midterm and the final result and the final report. (Backlund & Garvare, 2019; Frikedal & Chiriac, 2011)

The example of this paper is taken from a course Product design and development given for the third-year students at speciality Product development for mechanical engineers at Linnaeus University. The course is project-based and the projects are given by the industries where students work with an external collaboration partner. In the 15 ECTS course, done in one semester the students are trained in conceptual product design using different methods for problem solving and decision-making. They work in project teams of 3-4 students. The project follows the steps of the Product design and development process for achieving a conceptual solution presented in text, 3D models and simple prototypes, optimized, and verified by computer simulations. The course consists of lectures, guidance lectures, seminars, tutoring sessions and written report. Flipped education is applied – the lectures are available on the platform of the course and the students can read them and the reference literature in their own pass. The guidance lectures are given in synchronous mode and help students to understand the theories and to apply them in the project. There are three seminar presentations during the course. The assessment and grading used to be done on the base of the grade of the report written during the project time. The individual knowledge and contribution to the project work was evaluated more in informal than in a formal way during the tutoring sessions and the seminars.

The developed method consists in several steps where students are also actively involved together with the teachers in self and pear assessment. The first step is an individual evaluation of the time dedicated to the project work, and to acquire knowledge done by the students. (see Table 1)

Table 1. Method of acquiring information for informally accessing the process outcome (done by students).

Group #	Time for reading theory and external research (h)	Time for planning and preparing presentations (h)	Time for group project work + tutoring (h)	Contribution to the result (%)	Contribution to the written report (%)
Name 1					
--	--	--	--	--	--
Name4					

Students are submitting the fulfilled Table 1 twice during the course- in the midterm presentation and in the final presentation. In this way they are assessing the learning process inside the group. The criteria affecting the most the individual final grade is the contribution to the result and to the written report. They will be directly applied to the final grade of the written report. (see Table 3)

Table 2. Method of acquiring information for formally accessing the continuous tutoring presentations
(done by teachers).

Group #	Tutoring Sessions & Seminars				Σ_n/n
	Meeting 1 (date)	Meeting 2 (date)	------	Meeting n (date)	
Name 1					
--	--	--	--	--	--
Name 4					

In Table 2. the teachers are filing in during each tutoring session. The feedback in the course is given very often 1-2 per week. The grading scale used in filling the table and assessing the continuous activity of the students in the tutoring sessions is 0, 1, 3, 4, 5. The grade "0" is given when students are

missing the tutoring meeting. While "1" stands for pour performance, when the students are not active or he/she does not understand what the group has done in the respective step of the project. The rest of the grades "3, 4, 5" are the grading scale for the performance of the student during the tutoring session. In the last column, the mean value from all the tutoring meetings is calculated and it goes to Table 3.

Table 3. Method of acquiring information for formally accessing the product outcome (done by teachers).

Group #	Tutoring sessions	Seminars sessions	Midterm result	Final result	Written report
Name 1					
--	--	--	--	--	--
Name 4					

In Table 3 the summarized information for formally assessing the product outcome, both result and written report, is presented. The column for tutoring sessions is filled by the information from Table 2. The grading scale for all the criteria is the same as for Table 2. Table 2 and 3 are filed once for the whole course. For the midterm and final result, the criteria used for grading are production, perception, reflection, systematic approach and complexity. The result is assessed also together with the collaboration partner from the industry (the expert from the project company).

At the end of the course, for final evaluation and individual grading of the course is systemized in a Competence advancement matrix (CAM) (Koblank, 2007), There using the information acquired in Tables 1 and 3 on a single A4 page is reflected the work and the result of the group. In the CAM it is possible to see how the time dedicated to work on the project and the actual contribution to the group project work imposed on the grade of the report are giving a clear picture of the individual grade of student working in gout and taking part in cooperative learning. The assessment of individual knowledge and abilities should be frequently undertaken when learning is developed in interactions with other students, such as in group work. That is why the basic of the proposed method are the active presentation of the student in the tutoring sessions and the seminar presentations. According the syllabus they are only graded by passed and not passed, but with applying the proposed new methodology they have huge impact on the individual grading of the project-based course.

3. Conclusion

On many occasions in educational settings, an assessment of individuals' knowledge and abilities need to be accomplished in situations where learning is developed in interactions with other students in a social context, such as in group work. There is a tension between the demand for individual assessment of students' knowledge and abilities and the demand to teach students collaboration abilities through group work.The focus of this paper is methodological, and its purpose is to provide a systematic approach to the individual grading of a group project work. (Frikedal & Chiriac, 2011),

For the successful application of the proposed method, it is important to inform the students about how the assessment will be implemented during the course, about their role in self and pear assessment. This will not only give the students clear picture on how they will be evaluated but also will reduce the tension among the group members. They need to feel that the project work is a result of team cooperation but also that the efforts and acquired knowledge of every one will be fairly graded. The students have to be informed that the final grade is not only result of written report and taking part in seminars, but it is result of continuous active performance along the whole course. Another positive side of the new method is that every step in the process is documented and teachers are ready to give detailed feedback on the continuous performance of the students.

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DOMAIN OF COGNITIVE-LINGUISTIC, READING AND WRITING SKILLS OF BRAZILIAN STUDENTS IN THE INITIAL LITERACY PHASE IN THE POST-PANDEMIC CONTEXT

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Abstract

Introduction: In the post-pandemic context, learning difficulties have increased and this can be attributed to social and school isolation, which significantly compromised the development of cognitive-linguistic, reading and writing skills. Aim: Verify the domain of cognitive-linguistic, reading and writing skills of Brazilian students in the initial literacy phase in the post-pandemic context. Method: 176 students from initial literacy phase of Elementary School participated in this study, distributed in two groups, GI composed by 78 students from the 1st year and GII composed by 98 students from the 2nd year. All students were submitted to the application of the Cognitive-Linguistic Skills Assessment Protocol for schoolchildren in the early phase of literacy. Results: students from GI and GII showed average performance for phonological awareness, reading, writing, processing speed. GI showed lower performance for the auditory and visual processing and GII showed only lower performance for the visual processing. Discussion: cognitive-linguistic skills are necessary for the full development of reading and writing in an alphabetic writing system such as Brazilian Portuguese. Conclusion: students in the 1st and 2nd grade showed lower performance in cognitive-linguistic skills in in the post-pandemic context, which could compromise the teaching-learning relationship in the classroom.

Keywords: Literacy, post-pandemic, learning, child development, education.

1. Introduction

The learning of Brazilian schoolchildren in the literacy phase, in public schools, was extremely hampered by the COVID-19 pandemic, causing many difficulties in the teaching-learning relationship. With the closure of schools, most of the teaching was carried out in homes, with conditions that were not the same among students, with difficulties in accessing the internet, in the study environment, in the education of other residents who helped students in carrying out activities, access to books and school materials, among others (Cavalcante, Komatsu, & Menezes Filho, 2020). However, the Covid-19 pandemic made the discrepancies between the different realities experienced by young students even more evident, access to virtual classes using more advanced digital tools and teachers trained to practice was not egalitarian or homogeneous between the systems of public and private education (Camacho, Joaquim, Menezes, & Sant'Anna, 2020; Joye, Moreira, & Rocha, 2020).

A study carried out by Brazil, Stolf, & Capellini (2022) with Brazilian schoolchildren during the pandemic period demonstrated that schoolchildren in the early literacy in the 1st and 2nd year showed lower performance in cognitive-linguistic skills that are important for the development and learning of reading and writing. In that, schoolchildren from the 1st year still presented a refusal response to several of these skills since they did not know how to perform the tasks requested. This was probably due to the fact that they were not sufficiently literate and therefore unable to use the cognitive-linguistic skills necessary to trigger the analysis and synthesis processes necessary during the formation of words for both reading and writing.

2. Objective

This study aimed to Verify the domain of cognitive-linguistic, reading and writing skills of Brazilian students in the initial literacy phase in the post-pandemic context.

3. Methods

This study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences of the São Paulo State University "Júlio de Mesquita Filho" - FFC/UNESP - Marília-SP, under number 4.862.668.

A total of 176 schoolchildren of both sexes, aged from 6 years to 7 years and 11 months from the 1st and 2nd year of Elementary School participated in this study. All students were from the same municipal public school in the city of Marília, São Paulo, Brazil. The schoolchildren were distributed in two groups, Group I (GI): composed by 78 students from the 1st year and Group II (GII): composed by 98 students from the 2nd year.

All schoolchildren were submitted to application of the collective and individual version of the Cognitive-Linguistic Skills Assessment Protocol for schoolchildren in the early phase of literacy (Silva & Capellini, 2019) consisting of the following tests: name writing, alphabet writing in sequence, copy of forms, word and pseudo word dictation, figure dictation, number dictation, sequence alphabet recognition, random alphabet recognition, word reading, non-word reading, rhyme, alliteration, syllable segmentation, sound discrimination, repetition of words, repetition of non-words, repetition of numbers in reverse order, fast automatic naming of figures, fast automatic naming of digits, visual shape memory.

The procedure of this study was applied in person and followed the UNESP guidelines to reorganize activities during the pandemic. Data analysis was performed using the Statistical Package for Social Sciences, version 26.0. The results were statistically analyzed at a significance level of 5% (0.05).

4. Results and discussion

The results showed in table 1 only present the results of comparing the performance of GI and GII that were statistically significant in the Cognitive-Linguistic Skills Assessment Protocol for schoolchildren in the early phase of literacy (Silva & Capellini, 2019). In this table there was a statistically significant difference between the study groups with the application of the Likelihood-Ratio Test.

Table 1. Frequency distribution of the performance classifications of schoolchildren from groups GI and GII in the Cognitive-Linguistic Skills Assessment Protocol. Likelihood-Ratio Test (p<0.05).

Subtests	Classification	Group				P Value
		GI		GII		
		Freq.	%	Freq.	%	
RAOA	Refusal	6	7,70%	2	2,00%	0,026*
	Inferior	18	23,10%	19	19,40%	
	Average	10	12,80%	29	29,60%	
	Superior	44	56,40%	48	49,00%	
MSF	Refusal	18	23,10%	5	5,10%	0,005*
	Inferior	15	19,20%	25	25,50%	
	Average	21	26,90%	35	35,70%	
	Superior	24	30,80%	33	33,70%	
RP	Refusal	12	15,40%	3	3,10%	< 0,001*
	Inferior	12	15,40%	12	12,20%	
	Average	36	46,20%	28	28,60%	
	Superior	18	23,10%	55	56,10%	
NWR	Refusal	10	12,80%	14	14,30%	0,032*
	Inferior	2	2,60%	15	15,30%	
	Average	15	19,20%	13	13,30%	
	Superior	51	65,40%	56	57,10%	
RNRO	Refusal	31	39,70%	17	17,30%	0,002*
	Inferior	22	28,20%	38	38,80%	
	Average	21	26,90%	26	26,50%	
	Superior	4	5,10%	17	17,30%	

Caption: RAOA: alphabet recognition in random order, MSF: sequential visual memory of shapes, RP: word repetition, NWR: non-word repetition, RNRO: Repetition of numbers in reverse order.

The results of this study revealed that a greater number of schoolchildren from GI and GII were recognized by alphabet recognition in random order and sequential visual memory of shapes, while GI showed average performance compared to GII in auditory processing tasks related to the repetition of words and nonwords, while both schoolchildren from GI and GII presented a greater number of schoolchildren who had difficulty performing the repetition of numbers in reverse order.

The beginning of literacy is an important period for the acquisition of cognitive-linguistic skills, considered predictors for the learning of reading and writing (Cunha & Capellini, 2010; Silva & Capellini, 2019; Santos & Capellini, 2020; Brazil, Stolf, & Capellini, 2022).

The cognitive-linguistic difficulties of 1st and 2nd year schoolchildren found in this study revealed that in the post-pandemic context, students present difficulties in skills related to visual and auditory perception necessary for the development of reading and writing.

Learning to read and writing requires the development of auditory, visual and visuomotor skills. Reading models of word recognition generally include fundamental basic auditory and visual processes such as visual memory and word sequence repetition before the development of orthographic, phonological and semantic processes (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001).

A worrying aspect of these results is the fact that so many students from GI and GII present either a refusal or lower performance in alphabet recognition in random order and repetition of numbers in reverse order, this demonstrates may be due to the period of social and academic isolation imposed by the covid-19 pandemic or an inadequacy in the teaching of alphabetic and orthographic principle, that is, in teaching the letter-sound conversion mechanism, can trigger difficulties in the reading and writing of words (Brazil, Stolf, & Capellini, 2022; Stolf et al. 2021).

5. Conclusion

Students of the 1st and 2nd grade showed lower performance in cognitive-linguistic skills in in the post-pandemic context, which could compromise the teaching-learning relationship in the classroom.

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EXPLORING INTERACTIVE ONLINE SCRIPT CREATION AS A NOVEL ASSESSMENT METHOD IN HIGHER EDUCATION

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Abstract

This study presents a new assessment approach wherein students collaboratively develop interactive online scripts (text enriched by images, videos, and self-assessment quizzes) on course contents throughout the semester. The aim is for students to become subject matter experts, ensuring that the content is comprehensible for their peers. This method offers several advantages, including rapid integration of new contents into course material without a heavy workload for lecturers, who only need to produce in-class materials rather than exhaustive study guides. Moreover, students acquire valuable competencies and soft skills such as structuring of learning material as well as collaborative learning. It also aims to foster self-reflection on effective learning strategies. Results from a voluntary survey indicate that 17 out of 18 students found script creation beneficial for deepening their understanding of course contents. However, evaluation in a course of 57 participants yielded mixed results, with both exemplary and substandard submissions. The substandard results are difficult to deal with, as students then have no study material for these topics. Notable challenges include unclear assignment requirements, ineffective group dynamics, and a time-intensive nature of student tutoring by teaching assistants. Furthermore, despite defined assessment criteria, assessing script quality proved challenging due to strong homogeneity among submissions. Addressing these challenges requires enhanced training for teaching assistants providing feedback to the students, and strategies for managing gaps in script coverage. This study underscores the need for competent supervision and ongoing refinement of this assessment process to optimize learning outcomes in higher education settings.

Keywords: Assessment, cooperative learning, online learning.

1. Introduction

In today's rapidly changing world, university lecturers are under immense pressure to keep up with the latest developments in their fields while simultaneously delivering quality instruction to their students. This is made even more difficult by the fact that they often have very limited time besides their research to develop and update their teaching contents and materials. As a result, many lecturers find themselves resorting to traditional lecture-based methods of instruction, which may not always be the most effective way of promoting student learning and engagement (Afrasiabifar & Asadolah, 2019; Ge et al., 2020; Baumeister et al., 2023).

This paper presents an innovative approach to assessment that seeks to address this problem by leveraging the power of collaborative learning. Specifically, students are asked to work together to develop interactive online learning material on course contents throughout the semester. The goal is for students to become subject matter experts in their field, ensuring that the content is comprehensible for their peers.

This method offers several advantages over traditional lecture-based methods of instruction. For one, it allows lecturers to rapidly integrate new content into their courses without having to produce exhaustive study guides from scratch. Instead, they can focus on producing high-quality in-class materials that promote active engagement and critical thinking skills among students.

Furthermore, this approach helps students acquire valuable competencies and soft skills such as structuring of learning material and collaborative learning. It also aims to foster self-reflection on effective learning strategies, which can help students become more independent learners in the long run.

In the following chapters, a case study of this assessment method is presented in order to analyze its strengths and weaknesses in more detail.

2. Methodology

This study aimed to explore the use of collaborative learning through student-led script creation as a means of developing interactive online learning materials for university courses. The methodology involved creating and implementing an assessment approach that required students to work together to develop comprehensive, structured, and engaging online scripts on course contents throughout the semester.

The study was conducted in an elective module at a German University with 57 students (Computer Science for Engineers), both Bachelor and Master students from a mechanical engineering and engineering & management background. Creating these learning materials was voluntary but gave them bonus credits for the final exam (up to 10 out of 90 exam points). The task was mostly done in groups of 2 to 5 students, depending on the scope and depth of the topic. Students chose the topic they would like to cover at the beginning of the semester, and they had five weeks to complete the task after the respective topic had been covered in the lecture.

Students received a grading scheme before doing the task, giving them detailed information on how the online material will later be graded. The grading scheme comprised of: (a) comprehensiveness of the material, (b) structure, quality of (c) examples, (d) self-assessment questions and (e) video/animation material. The grading scheme presented different quality levels with corresponding scores for each quality criterion (e.g., "The learning module was structured in a uniform, orderly, comprehensible way and is conducive to the learning process. Subtopics are clearly separated from each other. The length and number of pages is good. Different structural elements (important/info/example/task/...) are color-coded according to the standard." = 3 points, "Learning module is sporadically unstructured, which is only very slightly a hindrance to the learning process overall." = 2 points, etc.). They also had access to a best practice example for the very first chapter of the lecture as well as a tutorial with guidelines on how to create good online learning material.

During their 5-week time frame to work on the material for their assigned chapter of the lecture, the students were also assisted by a student tutor with whom they had two 30-minute meeting sessions: a kick-off meeting to make sure that they had the proper idea of what is to be done, and an intermediary meeting where they received feedback on their current progress. The student tutor was also the person responsible for grading the final work (in consultation with the lecturer).

The online learning materials created by the students consisted of text enriched by images, videos, and self-assessment quizzes (single/multiple choice, fill in the gaps, assign terms to definitions, mathematical and programming tasks). Students were required to structure the learning content, write short definitions, provide example scenarios, create or find relevant images/illustrations, create short tutorial videos and come up with formative self-assessment question for the learner. The total workload per student was estimated to be between 15 and 25 hours.

Near the end of the semester, an anonymous survey took place where students were asked to rate their experience with this new approach.

3. Results

This newly implemented assessment format has been evaluated in two different regards: An anonymous survey was conducted near the end of the lecturing period asking for the students' perception of this task, and the quality of the resulting online material has been analyzed in-depth. The results of this evaluation are presented in the next two subchapters.

3.1. Student feedback

The students were given four statements as part of the survey, which they were asked to rate on a Likert scale of 1 to 5 (1 = Fully agree, 5 = Fully disagree). The following statements were given:

a) *"Creating learning modules has helped me to reflect on the learning content myself in more depth."*
b) *"I only created/will only create the learning module because I get bonus points for it."*
c) *"The group work involved in creating the learning module worked well."*
d) *"The requirements for creating my learning module were clearly formulated."*

These questions were answered by 16 to 21 participants (the questions could optionally be left unanswered). It is important to note that not all groups had completed or even started work on their assigned topic when the evaluation was conducted. The feedback was gathered during the official teaching quality evaluation run centrally by the University. We chose to include the survey in there since response rates are usually rather high in this evaluation. The results of this survey can be found in Table 1.

Table 1. Results of the student feedback survey.

Statement	1	2	3	4	5	Average
(a) Self-reflection	7	10	1	0	0	1.67
(b) Extrinsic Motivation	8	6	3	2	2	2.24
(c) Group work	9	4	2	0	1	1.75
(d) Requirements	8	6	3	1	0	1.83

Based on the data, it can be said that the student feedback was rather positive. All responding students stated that this task helped them with self-reflection or that they were at least neutral about it. However, there is still room for improvement in terms of cooperation within the groups and the precise quality requirements. This was also confirmed by some students in personal feedback: group work was sometimes unsuccessful, as some of the team members did not know each other before the task and most of the work took place remotely via video conferencing. In addition, the students come from a purely technical background, which initially presents them with a major challenge when creating didactic teaching material. The feedback also mentioned that there were some technical difficulties in creating material with the university's learning platform.

3.2. Submission quality

There were 26 topics in total, which were assigned to 26 groups (some of which were individual assignments). The students had to book a topic at the beginning of the semester. Of these topics, a total of only 17 topics were worked on, i.e., unfortunately no result was achieved by 9 groups. As the course is an elective subject, it is not unusual for students to decide against the module during the course of the semester and therefore no longer take on the work.

Of the 17 topics worked on, 11 topics were flawless or almost flawless and could be published as official learning material without any relevant changes. The other 6 learning materials were of average or poor quality and could not be published. Common problems were a highly unstructured script organization, incorrect or didactically unsuitable self-check questions, and gross errors in content.

4. Conclusion

This study has presented an innovative approach to assessment where students create interactive online learning material on course contents. The results from a voluntary survey indicate that the majority of students found script creation beneficial for deepening their understanding of course contents. However, the student submissions yielded mixed results. The challenges identified in this study include unclear assignment requirements, ineffective group dynamics, and a lack of preknowledge of students on the creation of didactic material. Additionally, despite defined assessment criteria, assessing script quality proved challenging and time-consuming due to strong homogeneity among submissions.

Addressing these challenges requires enhanced training for teaching assistants providing feedback to the students, as well as strategies for managing gaps in script coverage when submissions need to be rejected or are missing due to students dropping the module. Furthermore, ongoing refinement and optimization of this assessment process will be necessary to maximize learning outcomes in higher education settings.

In conclusion, the use of collaborative learning through student-led script creation holds great promise as a means of enhancing student engagement and facilitating deep understanding of course contents. However, it is important to carefully consider and address the challenges identified in this study in order to ensure the success and sustainability of this approach in practice.

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PERCEPTIONS OF COMPETENCIES AMONG IN-SERVICE SOCIO-PEDAGOGICAL PROFESSIONAL EDUCATORS: A NATIONWIDE EXPLORATORY SURVEY

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Abstract

The definition of different professional roles and the competencies of professionals in educational care has been, and continues to be, a highly debated topic in the political, social, and academic realms on both national and international levels. The current socio-cultural context is marked by a proliferation of diverse and complex educational and training emergencies that encompass a wide range of special educational needs (ONU, 2015; ISTAT, 2018). The plurality of educational and training situations in the field requires functional pedagogical approaches and responses formulated through new knowledge, literacies, and competencies of educators (Gaspari, 2018) that adhere to the principles of inclusion and respect for diversity (UNESCO, 2009; ONU, 2015; ISTAT, 2018). Socio-pedagogical professional educators, in this sense, represent a necessary response to socio-cultural issues, and for this reason, a profound reflection on the role played by the essential set of competencies needed to address educational practice is essential (Sposetti et al., 2022; Boffo, 2021; Gaspari, 2018). Law No. 205 of 2017 establishes and defines the roles and functions of professional educators operating in socio-educational and training contexts. The direction set by the recognition of the professionalism and identity of socio-pedagogical educators brings to the forefront the issue of professional competencies that qualify educational and social interventions. The fields of intervention and educational design have highly complex and flexible characteristics, requiring competent professional figures attentive to the needs of the users. But what are the essential professional competencies for educational practice? And how do educators in service build their competencies? The exploratory investigation is aimed at socio-pedagogical professional educators in service throughout the national territory with the goal of exploring the theme of constructing professional profiles in real and diversified contexts. The study is formulated using mixed research methods and aims to understand which professional competencies educators recognize as fundamental for acting in socio-educational and training contexts, and to reflect on the formative experiences that contribute to the development of professionalism. The objective of this paper is to present the current state of research progress. In particular, will be presented the research design, the tools employed, and the initial results obtained, providing a comprehensive overview of the early stages of this study and anticipating the perspectives that emerge from analysis.

Keywords: Socio-pedagogical professional educators, competencies, educational service, exploratory survey, national territory.

1. Introduction

The definition of professional roles and the necessary competencies for educational care professionals is a debated topic in various contexts, including political, social and academic, both nationally and internationally. Currently, society is marked by a range of complex and diverse educational and training emergencies involving a wide array of special educational needs (ONU, 2015; ISTAT, 2018). The diversity of situations in the sector requires pedagogical approaches that are functional and based on new knowledge, alphabets, and skills of educators (Gaspari, 2018), guided by principles of inclusion and respect for diversity (UNESCO, 2009; ONU, 2015; ISTAT, 2018). In this context, professional educators represent a necessary response to socio-cultural challenges, emphasizing the importance of a thorough reflection on the role they play and the indispensable competencies for addressing educational practice (Sposetti et al., 2022; Boffo, 2021; Gaspari, 2018). Improving and increasing the level of competencies to meet the new demands of the continuously and rapidly changing labor market and society is also the main objective of the Skills Pact of the European agenda for 2023. The European agenda for skills is a five-year plan aimed at developing and improving the skills of every citizen to adapt to the new structure of the labor market. The ongoing

transformations can be addressed through enhancing sustainable competitiveness, building strong resilience to react to crises, and ensuring greater social equity by achieving one of the European Pillar of Social Rights principles: access to education, training, and lifelong learning (European Commission, 2020). Regarding the Italian context, the first regulatory step defining the professional figure of educators is the Legislative Draft No. 2443, which clarifies the differences in terms of skills and intervention areas between socio-pedagogical educators and socio-health educators. The legislative process concludes with the recognition of the professionalism of socio-educational educators sanctioned by Law 205/17, where the educational and support professional operates within micro and macro social and educational contexts with the aim of ensuring full autonomy and citizenship rights in line with the inclusive perspective. The innovative aspect of the current regulations concerns the construction of professional identity with the goal of ending both the phase of weakness in the professional identity of educators and trainers and a series of role and competency ambiguities (Gaspari, 2018).

Professional educators operate in dynamic contexts that require attention to user needs, flexibility, mobility, uncertainty, and reflexivity (Buccolo, 2022), encapsulated in what Schön (1993) defines as artistic ability. Building an adequate set of theoretical and practical skills and knowledge becomes crucial for the affirmation of professional profiles that, to meet educational needs, must necessarily develop strong, flexible, and functional skills for the care and support of individual users and the social network of the territory in which they operate (Boffo, 2021; Gaspari, 2018). In light of Law 205/17, the reflection on how to train education professionals capable of addressing educational practice becomes an opportunity to redefine the profile of professional educators (Gaspari, 2018). Educational work represents a fundamental training experience that continually modifies the protagonists of the educational encounter (Fadda, 2016). Specifically, professional educators consolidate their skills in a more articulated and complex manner, integrating knowledge from a specific sector or topic with the best educational design strategies they experience (Sposetti et al., 2022). In this way, experienced educators become reflective actors involved in a continuous training process through reflection on educational practice (Schön, 2017). Adopting a reflective and design-oriented attitude in the educational field is essential to "avoid falling into pre-packaged, modular-standardized, and reductionist didactic solutions in relation to the complexity of the individual" (Gaspari, 2018, p. 32).

2. Research questions, objectives and methodology

The definition and construction of a solid professionalism for the application of knowledge and skills materialize within initial training paths to be planned with the perspective of achieving high levels of effective and quality training (Rossini, 2020). Universities bear full responsibility for training education professionals by organizing training programs according to the formative needs of professional educators already operating in real contexts, dealing with a diverse multitude of different and continuously evolving needs (Sposetti et al., 2022; Fioretti, 2022; Boffo, 2021; Biasin et al., 2020;). Reflecting on aspects related to the educational offerings to build the skills of professional educators within initial training paths is a crucial topic to discuss (Sposetti et al., 2022; Fioretti, 2022; Boffo, 2021), but it becomes even more necessary to establish a direct connection with the real contexts of educational work to design coherent training paths (European Commission, 2020, 2016). In this perspective, the research design arises from the following questions: What are the essential professional competencies for educational practice among professional educators? And how do educators in service build their competencies? To attempt to provide answers to the questions that have given rise to the project, it is appropriate to collect perceptions and viewpoints from educators in service. The specific objective of the project is to identify the ways in which educators develop their professionalism, the competencies they use, and consider fundamental to address educational and formative demands, based on their reflections on training and professional practice experiences.

At the current state, the research instrument has been developed, which will be administered to educators with at least 2 years of service in the Italian national territory. The questionnaire is formulated with the aim of exploring and capturing descriptive statistics on the competencies considered essential in educational practice, the level and type of initial training and, finally, allowing the recipients to self-assess the technical, organizational, relational, and reflective skills learned and consolidated during their professional experience. In addition to the demographic section, the instrument comprises 6 other sections that will investigate: the type of service in which educators operate, the type and level of pre-service and in-service training, the perception of skills necessary for professional practice, the self-assessment of skills that universities declare to provide training for educators, and concluding reflections on perceived training needs.

3. Discussions

The debate on the construction of professional profiles for educators in initial training paths represents a critical element for achieving a clear professional identity. Training plans have highly varied structures and objectives (Perillo, 2023), and it is necessary to start with the construction of initial training paths based on the educational practice of educators who are already working in real contexts. Universities and the workplace must converge in a common path to train professionals capable of facing the practice in educational services and ready to handle educational and formative issues (Boffo, 2021; Rossini, 2020). Establishing a coherent connection between the fields of educational intervention and training proposals becomes a priority (Perillo, 2023; Sposetti et al., 2022; Boffo, 2021; Rossini, 2020).

While it is true that the set of knowledge and methods of practices are transmitted in initial training paths, it is equally true that the situated experience of educators in service consolidates the connections between knowledge and skills and allows for the construction of new ones (Perillo, 2023; Sposetti et al., 2022). Understanding the modes of learning and skill consolidation and how the professionalism of educators develops in a service is a starting point for considering the application and investment of increasingly effective methodologies and teaching strategies for the training of competent professionals (Boffo, 2021). This is why the proposed research project can contribute to defining initial training paths coherent with educational practice: through listening to real experiences of professional educators in service, it is possible to open a privileged channel to the world of academic knowledge and that expressed in practice (Perillo, 2023).

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ASSESSMENT OF NUMERICAL COGNITION IN PRESCHOOLERS: PILOT STUDY TO VERIFY THE APPLICABILITY OF THE DEVELOPED INSTRUMENT

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Abstract

During the preschool years, the main difficulty that can predict the risk of mathematical difficulties is the delay in the ability of magnitudes associated with number words and Arabic numerals. Understanding this process of mathematical learning, its difficulties and consequently academic failure is a challenge for all professionals linked to the area of education. Aim: to develop an assessment of numerical cognition for preschoolers, aged 2 years to 5 years and 11 months. Methods: From the literature review, mathematical skills were selected to compose the assessment of numerical cognition, including: subitizing, numeral knowledge, counting, one-to-one correspondence, perception of magnitude, cardinality, comparison, measurement and approximation and estimation. A pilot study was carried out to verify the applicability of the instrument developed in 74 Brazilian preschoolers at municipal public Kindergarten in the city of São Paulo, Brazil, distributed in the age groups of: Group I (GI): composed by 15 preschoolers, aged 2 years to 2 years and 11 months; Group II (GII): composed by 18 preschoolers, aged 3 years to 3 years and 11 months; (GIII): composed by 19 preschoolers, aged 4 years and 4 years to 11 months and (GIV): composed by 22 preschoolers, aged 5 years and 5 years to 11 months. The numerical tasks were presented to the children in the form of games to keep their attention. The development of an instrument to assess numerical cognition in preschoolers can contribute to the development of logical-mathematical reasoning in these children, helping teachers in the development of activities and games that teach basic numerical, spatial, geometric, measurement and statistics, contributing to future gains in mathematics learning.

Keywords: Numerosity, mathematical abilities, dyscalculia, early childhood, early childhood education.

1. Introduction

Children's numerical and spatial skills play a critical role in mathematical development, and it is therefore essential to understand the potential impact that age can have on these skills and their relationships with learning (Moeller et al., 2012), as they can be useful for the development of educational interventions (Geary, 2017).

There are still few studies in the literature focused on investigating mathematical development in children in early childhood (Gersten et al., 2005). In Brazil, this literature is still non-existent, therefore, the present study presents the proposal to, based on the theoretical foundation, develop an instrument to assess numerical cognition for preschoolers aged between 2 and 5 years old.

2. Objective

This study aimed to develop an assessment of numerical cognition for Brazilian preschoolers, aged 2 years to 5 years and 11 months.

3. Method

This study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences of the São Paulo State University "Júlio de Mesquita Filho" - FFC/UNESP - Marília-SP, under number 6.138.570. The study was divided into two phases:

3.1. Phase 1: Development of assessment numerical cognition for preschoolers

Based on the national and international bibliographical survey on skills for evaluating numerical cognition for the age group of 2 to 5 years and 11 months, a protocol was developed containing the following skills: subitizing, knowledge of numerals, counting, one-to-one correspondence, perception of magnitude, cardinality, comparison, measurement and approximation and estimation.

3.2. Phase 2: Pilot study

74 Brazilian preschoolers at municipal public Kindergarten in the city of São Paulo participated this study, distributed in the age groups of: Group I (GI): composed by 15 preschoolers, aged 2 years to 2 years and 11 months; Group II (GII): composed by 18 preschoolers, aged 3 years to 3 years and 11 months; (GIII): composed by 19 preschoolers, aged 4 years and 4 years to 11 months and (GIV): composed by 22 preschoolers, aged 5 years and 5 years to 11 months.

All preschoolers were submitted to assessment numerical cognition for preschoolers. The numerical tasks were designed to be applied as games to keep your attention. Short breaks were provided between tasks as needed. The results of phase 1 were statistically analyzed at a significance level of 5% (0.05).

4. Results

Table 1 presents the comparison of the performance of preschoolers in the assessment numerical cognition or preschoolers. The table 1 showed statistically significant difference between the groups, showing that a gradual increase in performance with increasing age group.

Table 1. Distribution of the mean, standard deviation and p-value of the performance of preschoolers from GI, GII, GIII, and GIV in the assessment numerical cognition.

		Mean	Standard deviation	p-value
Verbal Counting	Group1	1,67	2,66	<0,001*
	Group 2	5,28	5,40	
	Group 3	11,11	7,31	
	Group 4	29,32	23,44	
Sequence count	Group 1	1,80	3,14	<0,001*
	Group 2	3,67	3,91	
	Group 3	6,68	3,77	
	Group 4	9,36	2,08	
Match one to one	Group 1	3,53	3,76	<0,001*
	Group 2	5,94	4,01	
	Group 3	7,58	3,25	
	Group 4	10,00	0,00	

In this study, we found that preschoolers from the 4 groups showed similar performance in the skills of object comparison, measurement, and perception of magnitude, showing that these skills did not serve to differentiate the groups.

5. Discussion

The results of this study showed that it was possible to develop an instrument to assessment numerical cognition skills for preschoolers aged 2 to 5 years based on literature.

The ability to subitize small quantities, discern numerical patterns, compare numerical magnitudes, and estimate quantities, count, and perform simple numerical transformations are key elements of number sense in young children (Berch, 2005).

The results of this study are in line with Jordan et al. (2008), who suggested that in the age group between 3 and 6 years old, interrelated skills develop involving numbers and operations, such as subitizing, identifying quantities without counting; counting items in a set of at least five with the knowledge that the final word in the count indicates how many are in the set.

The pilot study showed that verbal counting, sequence count and match one to one were sensitive skills in characterizing the performance of preschoolers according to age group. However, the object comparison, measurement, and perception of magnitude skills did not present this sensitivity, highlighting the need to re-elaborate the assessment protocol developed in the phase 1 to adapt to the objective of the study.

6. Conclusion

The development of an instrument to assess numerical cognition in preschoolers can contribute to the development of logical-mathematical reasoning in these children, helping teachers in the development of activities and games that teach basic numerical, spatial, geometric, measurement and statistics, contributing to future gains in mathematics learning.

This study showed that was possible to develop a procedure for assessment numerical cognition skills for preschoolers while also indicating which skills differentiated the groups by age group.

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PROJECT BASED LEARNING IN MECHANICAL ENGINEERING EDUCATION

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Abstract

The final year of the three-year bachelor program in Mechanical engineering at Linnaeus University (LNU) consist of applicable, engineering, project based-courses – Machine design B, Product design and development course, and degree project course. Those project-based courses emphasize learning activities that are long-term, interdisciplinary, and student-centred. Project based learning (PBL), as a method that contributes to the active learning of the students; consist not only of learning activities and of understanding the theories delivered but also of working activities where the theory is applied for a problem solving. Students learn about the area of product design by working for an extended period, to investigate and respond to a complex question, challenge, or problem. The project-based courses consist not only of lectures and project but also of seminars, guest lectures and company visits. In this way the students have the impression about the real work at industries and how theories are applied. In this paper, the importance of PBL for mechanical engineering education is presented. The curriculum for the final year is explained and the project-based courses are viewed and compared in terms of implementing PBL together with different pedagogical approaches. The challenges in executing and assessing students work in project-based courses, where students work in project teams, are examined. As a conclusion, the different ways of applying PBL depending on the purpose of the course, will be discussed.

Keywords: Project based learning, active student-centred learning, mechanical engineering education.

1. Introduction

In the 70s a problem-oriented and project-organized model was developed in Europe. This model was introduced at Aalborg University and Roskilde University, Denmark, and in the first years at Bremen University, Germany. PBL problems can be small or big, authentic or scholastic, practical or theoretical, etc. There are many combinations of small problems and big projects, and there is a need for a more theoretical definition of PBL that allows for variation in practice. In particular, there are differences in the way the curriculum is organized.

Figure 1. PBL curriculum model (Kolmos & De Graaff, 2015).
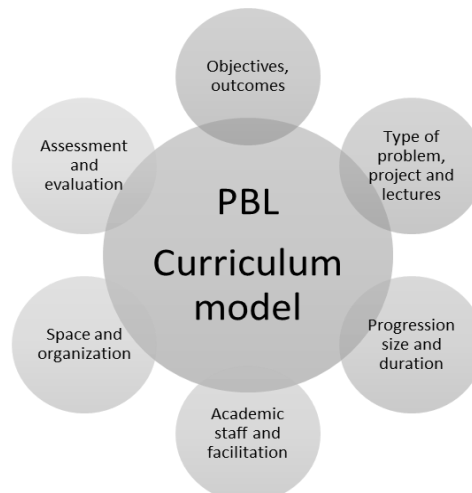
For example, Problem-based learning (PBL) begins when students are confronted with an open-ended, ill structured, authentic (real-world) problem and work in teams to identify learning needs and develop a viable solution, with instructors acting as facilitators rather than primary sources of information. In comparison, Project-based learning begins with an assignment to carry out one or more tasks that lead to the production of a final product – a design, a model, a device or a computer simulation. The culmination of the project is normally a written and/or oral report summarizing the procedure used to produce the product and presenting the outcome.

The PBL curriculum model is linked to the PBL learning principles, but the seven elements have been identified as objectives and outcomes, types of problems and projects, students' learning, progression and size, academic staff and facilitation, space and organization, and, finally, assessment and evaluation, see Figure 1.

2. Methods – variations in practice

The final year of the three-year bachelor program in Mechanical engineering at Linnaeus University (LNU) consist of applicable, engineering, project based-courses – Machine design B, Product design and development course, and degree project course, see Figure 2. Those project-based courses emphasize learning activities that are long-term, interdisciplinary, and student-centred.

Figure 2. The learning pyramid of the bachelor program Mechanical engineering at LNU.
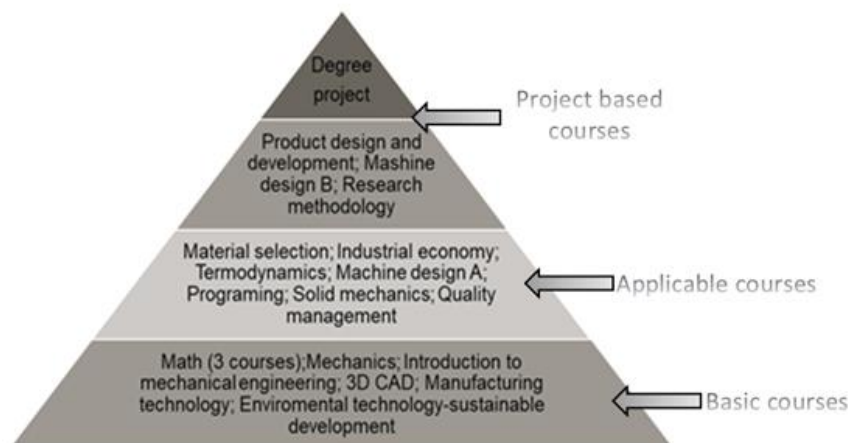
2.1. Curriculum model of the machine design b course

The objectives of the course are to apply scientific theories together with standards and company catalogues to dimension and design different types of mechanical transmissions and drives with respect to loads and selected material. Knowledge about mechanical failures in machine parts is also included in the course.

The task of each student group is to dimension and design a combination drive, of an electric motor, a belt transmission, a gearbox, and a chain transmission, to be used in a lifting machinery. The dimensioning is based on lifting mass, lifting time, and lifting height. The needed power must be calculated so that the electric motor will be selected based on that. All the parts will be dimensioned based on the power the electric motor will deliver.

The project is running during a whole semester parallel with lectures and other activities. There is a 2-hours project meeting every week where every part of the project task will be presented in a progression way. Relevant theories and other important knowledge are delivered in lectures etc. when it is needed for the project work.

The course teacher and examiner are the person who has the full responsibility for the course and the project, but other people are involved in delivering knowledge and support. There are people from industry who are giving lectures in their specialties, at the same time as study tours to industries connected to the project specialty are accomplished.

There is ongoing communication between the teacher (supervisor) and the project groups during and outside the panned project meeting time. Each project group has project leader, and it is the leader, who will communicate with the supervisor. The project meetings are normally in a classroom or a bigger space, but sometimes they must be accomplished in computer rooms.

Assessment and evaluation is partly done during the project work, at the time of project meeting or other time when the project groups are struggling with problem solving and calculations. The supervisor is normally going around and discussing the solutions with the groups. Before proceeding to the next step, every group must explain their work in oral combined with discussions. There are also some moments where the manual calculations have to be checked through computer calculation programs. Finally, each group have to submit a written project report at the end of the course. Written exam about the theoretical part of the course is accomplished in the middle of the course.

2.2. Curriculum model of the product design and development course

The objectives in the course are focused on acquiring the theories needed to apply the product development process in order to handle an open-ended, authentic industrial problem. The outcomes in the course are presented as a 3D CAD models, computer simulations, presentations simple prototypes and written report.

The problem and the project are defined as a first step in in applying the theory and are presented in the introduction of the report. The lectures are planned to follow the steps in the Product development process and a flipped learning is applied – the lectures are available in the platform of the course so every student can read them in his/her own pass and do it as many times as needed.

The course is running during a whole semester, 50 % of the time parallel with the course Machine Design B. The students are working in groups of 3-5 students and they have planned from the beginning that their work will not exceed 20 hours per week (including the individual time to read the theories or to do external research).

The teachers in the course are involved first in delivering a guidance lectures, where it is facilitated and explained the application of the theoretical lectures in the project. There is one such lecture for every step in the Product development process. On second hand there is continues tutoring on the project 1-3 times per step. Therefore, every pitfall in applying the process can be identified early and improved, so that it will not affect the continuous work.

A platform for the course is giving access not only to the lectures but also to the whole information needed to organize the course and to submit the students work. Lecture rooms, meeting rooms and computer rooms are available for the different moments in the learning process.

Assessment and evaluation are done during the oral presentations and apprising the written final report. The biggest challenge is to assess students learning when working in teams. Authors are currently working on developing a method an assessment method for individual grading of group project work.

3. Conclusion

In the engineering field and especially in the field of mechanical engineering, it is both the problem analysis and the problem-solving phases that are important learning phases. Engineers need to know what the problems are, to formulate the requirements, and to solve the problem by development of relevant technological solutions. Furthermore, it is important that these learning processes are team based in order to acquire the knowledge sharing within a smaller team as well, and that the collaboration is oriented toward both process and product so that engineers learn the competence of collaborative knowledge construction. There are variations of in planning and organizing the project-based courses depending on the purposes and objectives of the courses. As it was presented in the method chapter, the last two courses in the mechanical engineering program are project based but they vary a lot. Both of the courses are important for the students to transmit knowledge and to develop skills so that they can handle the degree project, which is done more independently and in smaller groups of two. Problem based courses are more suitable for the earlier applicable courses, while the Project based courses are irreplaceable in the final year of Mechanical engineering education. The feedback from the students is that the Machine design course and the Product design course are the courses that prepare them to manage with the Final project and are the most applicable in their work as fresh engineers.

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FLU-EM – ASSESSMENT OF HANDWRITING FLUENCY: DEVELOPMENT THROUGH CRITERIA AND AGREEMENT AMONG JUDGES

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Abstract

Introduction: Difficulties in legibility and writing speed are associated with impairments in cognitive integration, motor planning, eye-hand impairment, visual perception, visual-motor integration, kinesthetic perception, sustained attention, and manipulation with the hands, thus causing changes in the writing fluency development manual. Aims: This study aimed to develop the items of an Assessment Protocol for the Handwriting Fluency (FLU-EM) for Brazilian students aged 9 to 16 years old and present the preliminary findings of its validity and reliability. Method: (a) elaboration of items and criteria; (b) validation by judgment of specialists; and (c) definition of the final shape of the instrument and its scoring. The assessment protocol was applied to 32 students, 16 females and 16 males, four from each age group from 9 to 16 years old. Results: The protocol elaborated was easy to apply, due to the students' acceptability and understanding of the proposed tasks, with no need for semantic adjustments. Conclusion: The Assessment Protocol for the Handwriting Fluency (FLU-EM) can be applied in the Brazilian population; however new studies are being developed with the objective of providing greater reliability and validity of the instrument.

Keywords: Handwriting, assessment, measurement, learning, education.

1. Introduction

The ability to write is not innate at birth, in other words, was developed only through education (Erdogan & Erdogan, 2012), being the period of literacy, therefore, a moment that involves cognitive, language and motor skills that require of the students, the capacity to words decoding and motor action suitable for the execution of the motor act of writing, this is, the use of sensory-motors and perceptive components (Capellini & Souza, 2008). International studies report that the disorder of written expression results in writing skills below that expected for age, related to legibility (quality of letter formation, alignment and spacing of letters and words and sizing of letters) and low speed (rate production) (Feder & Majnemer, 2007; Kushki, Schwellnus, Ilyas, & Chau, 2011), showing an important relationship between legibility and the writing speed, this is between the quality and quantity of handwriting.

Handwriting speed is fundamental for example in a moment of realization of exam/tests because the student needs to be able to transfer your ideas to paper while trying to keep up with his thoughts in a determined time (Prunty, Barnett, Wilmut, & Plumb, 2013). However, if the student has to write quickly this could affect the quality/legibility of the text or if he writes more slowly, trying to produce his best letter this could affect negatively the productivity/quantity of writing (Burger & McCluskey, 2011).

Though there in international literature several studies investigating the handwriting of different optics, such as handwriting speed, socioeconomics levels and laterality (Summers & Catarro, 2003), the fatigue effect about the handwriting production (O'Mahony, Dempsey, & Killeen, 2008), the handwriting difficulties associated with autism spectrum disorders (Fuentes, Mostofsky, & Bastian, 2009), with attention deficit hyperactivity disorder (Frings et al., 2010), in Brazil these studies are scarce, making it difficult to establish the profile of calligraphic of the students and, consequently, the investigation of problems related to handwriting.

2. Objectives

This study aimed to develop the items of an Assessment Protocol for the Handwriting Fluency (FLU-EM) for Brazilian students aged 9 to 16 years old and present the preliminary findings of its validity and reliability.

3. Methods

This study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences of São Paulo State University, Júlio de Mesquita Filho, FFC/UNESP, Marília-SP, under number 0444/2012.

The FLU-EM was prepared through three procedures according to Pasquali (2003):

3.1. Item and criteria construction procedure

In constructing the instrument, a review of the literature on the area of handwriting and handwriting fluency was used offered the elements for the formulation of 3 items of the protocol: task 01 - writing the alphabet, task 02 - best copy and task 03 - text production.

3.2. Scale validation study through consultation with experts sample

Ten independent judges participated in the study being three speech therapists, two occupation therapy, two teachers at elementary school and three psychologists.

3.3. Pilot study

The FLU-EM was applied to 32 students, 16 females and 16 males, when four in each age group, from 9 to 16 years old. Even as a selection criterion a cognitive assessment test was applied (Raven Progressive Matrices), to the exclusion of cases of mental retardation. Was also carried out a survey with pedagogical coordinators on students who had school complaint, psychoaffective problems or even speech therapy diagnostics (e.g., autism, ADHD, dyslexia, etc.), and in these cases excluded from the sample data from this study.

The selection of these students was realized by call list, being invited to attend the first two boys and first two girls from of the list. They should follow the inclusion criteria, as described above and having ages according to seriation school (Table 1). If the student did not fit these selection criteria, the next name on the list was invited to participate.

Table 1. Age corresponding to seriation school.

Seriation school	Age
4th grade of elementary school	9 years to 9 years and 11 months
5th grade of elementary school	10 years old to 10 years old and 11 months
6th grade of elementary school	11 years old to 11 years old and 11 months
7th grade of elementary school	12 years old to 12 years old and 11 months
8th grade of elementary school	13 years old to 13 years old and 11 months
9th grade of elementary school	14 years old to 14 years old and 11 months
1st year high school	15 years old to 15 years old and 11 months
2nd year high school	16 years old to 16 years old and 11 months

All the students were applied three tasks proposed in FLU-EM, as described below:

Task 01 – Alphabet writing: The student was oriented to write the alphabet, in order, with cursive letters lowercase, continuously for one minute. On reaching the letter "z" and there was still time, the school should start the alphabet until the end of time.

Task 02 – Best Copy: The student should write, without interruption, a determined sentence, classified as pangram (sentence containing all the letters of the alphabet - One day Max played soccer with his neighbor Pedro) with your best handwriting, for two minutes, that is, copy the phrase as often as he managed, within two minutes.

Task 03 – Text Production: The student was requested the elaboration of a wording on the theme "My Life" for 10 minutes, however, every two minutes the student should make a mark in the text, which allows us to monitor the frequency production of the children in different periods of time.

The data collection with the students was realized in groups of four students in a single session, not exceeding the time 50 minutes duration.

4. Results and discussion

There was a return of 70% of the questionnaires sent. Two treatments were carried out on this material. The first consisted of surveying the reliability indices between judges using the Kappa measure

(a measure of interobserver agreement, which quantifies the degree of agreement between judges on categorical scales) and the second, in the analysis of the items for which found an agreement rate between judges above 70%.

In the pilot study the students were asked about the possible difficulties to understand and perform the proposed tasks, and all reported complete understanding. Therefore, this step revealed easy applicability of the instrument, due to the acceptability and understanding of the students in the proposed tasks, there is no need for adjustments final semantic in the adapted version of the procedure.

According to the literature the group of judges should be formed by experts in the field of knowledge about the theme (Pasquali, 2003), so the judges were speech therapists, psychologists occupational therapists and educators, that is, professionals who work with handwriting and analysis of handwritten of students, which facilitated discussions for the best composition of the FLU-EM.

The application of the instrument in the target population (pilot study) followed exactly the number of students requested in specialized literature (Beaton & Guillemin, 2000) that is between 30 to 40 students. This step was important, not only for permitting the verification of understanding of the items, but also allow for discussion of the viability of application of the instrument in the Brazilian population, since they were selected educational levels and age groups corresponding the original procedure and found value in a satisfactory internal consistency.

5. Conclusion

The Assessment Protocol for the Handwriting Fluency (FLU-EM) can be applied in the Brazilian population; however new studies are being developed with the objective of providing greater reliability and validity of the instrument.

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THE ROLE OF AUTHENTIC EXPERIENCES IN FOREIGN LANGUAGE LEARNING: ROAD TRIPS AS A WAY TO GRASP THE SOUL OF A TARGET LANGUAGE

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Abstract

This paper explores the significance of authentic experiences in enhancing foreign language learning, given that they immerse language learners in real-life situations, leading to deeper comprehension and retention of linguistic elements. Based upon the already widely debated criticism of language learning approaches, which argues against the extensive focus on form (*know what*) to the detriment of meaning (*know how*), the study analyses the progress made by students learning the Romanian language following participation in road trips. During such non-formal activities, learners get to engage with native speakers in spontaneous conversations, encountering colloquialisms and regional dialects that enrich their language repertoire. Furthermore, the journey itself becomes a catalyst for cultural exploration, as learners navigate diverse landscapes, interact with local communities, and partake in cultural events. This firsthand exposure deepens learners' cultural understanding, sensitizing them to the nuances of language use within its socio-cultural context. Such interactions provide invaluable opportunities for learners to refine their listening and speaking skills in authentic contexts, thereby bridging the gap between classroom instruction and real-world application. The students' immersion in authentic Romanian settings was evaluated through a blend of qualitative and quantitative analysis methodologies, which included the examination of teachers' observation sheets, as well as conducting in-depth semi-structured interviews with the participants. The research focused on the application of language theory in real-life situations, the development of listening and speaking skills, cooperative problem-solving, refinement of soft skills, increase of student self-confidence and motivation, and enhancement of cultural awareness. The study's findings indicate that practicing foreign languages in unconventional settings and through authentic interactions, with genuine communicative goals in mind, generates a significant improvement in communicative skills. This suggests that integrating road trips into language learning curricula holds significant potential for cultivating linguistic proficiency, cultural competence, and a passion for language acquisition.

Keywords: Foreign language learning, non-formal education, listening and speaking skills, pragmatic skills, intercultural awareness.

1. Introduction

The dominance of form-focused language teaching methods often results in learners acquiring extensive theoretical knowledge without practical skills, an imbalance that leads to learners struggling to apply theoretical understanding in real contexts. Critics argue that form-focused language teaching impedes natural language input essential for acquisition, lacking opportunities for learners to activate their language knowledge (Harmer, 2007). Consequently, learners proficient in grammar rules may falter in real communicative situations. To address these deficiencies, meaning-focused methods like Task-Based Language Teaching (TBLT) have been advocated (Nunan, 2004; Willis & Willis, 2007). Ellis (2009) emphasizes TBLT's focus on problem-solving and real-life relevance, contrasting it with mere exercises. Constructivist learning environments also endorse task-based approaches, aligning with Herrington et al.'s (2003) notion of authentic activities. Such methods bridge the gap between classroom learning and real-life applications, facilitating purposeful language use (Herrington, Reeves, & Oliver, 2010). Road trips serve as invaluable conduits for cultural immersion in language acquisition. Learners are exposed to colloquial expressions, regional dialects, and cultural practices, fostering an intuitive grasp of language usage (Brown, 2007). These experiences function as linguistic laboratories, allowing learners to experiment with the target language across diverse communicative scenarios (Larsen-Freeman, 2000).

Whether conversing with locals, deciphering road signs, or navigating unfamiliar territories, learners engage in real-time language production and comprehension (Ellis, 2008). Such interactive engagement promotes linguistic autonomy and confidence, enabling learners to participate in authentic communicative exchanges with ease (Mitchell & Myles, 2004).

2. Data collection

This study was centered on a group of 20 students from varied cultural backgrounds (Ukrainians and Arabs), aged 17 – 23, who were enrolled in the Preparatory Year of Romanian Language for Foreign Citizens program. The research encompassed two authentic experiences: the first trip was conducted in late autumn, at the A1 – A2 proficiency level, whereas the second took place 7 months into the program, late spring, at the A2 – B1 proficiency level. These excursions were meticulously organized to complement traditional classroom instruction, facilitated by institutional support, and structured to incorporate task-based language teaching, team-building activities, and didactic games. Furthermore, a sociocultural dimension was integrated into the excursions, consisting of visits to museums, picturesque locales, and guided nature walks. The students' immersive encounters were assessed through a combination of quantitative and qualitative methods, which involved teacher observation sheets and semi-structured interviews with the participants. The parameters surveyed referred to language proficiency, cultural awareness, student motivation, and student anxiety. The questions of the semi-structured interview were crafted to ascertain the perceived value of the authentic experiences encountered, while also leaving room for interpretation and expression of personal evaluation and feelings. They required instances of specific communicative contexts, idiomatic expressions, and language usage that they could either learn for the first time or enhance their mastery of. Additionally, these interviews incorporated a quantitative component, thus seeking to measure the degree to which students attained their communicative objectives in task-based activities and spontaneous interactions with peers or native speakers. The teacher observation sheets provided a perspective from the educator's viewpoint, offering insights into students' performance and conduct before, during, and after the excursions. These observations facilitated the assessment of progress by comparing students' behavior and achievements across different contexts. To ensure consistency and reliability, the observation sheets were structured to evaluate identical parameters across both excursions, employing a combination of rating systems and descriptive accounts to capture the nuances of the experience. The teacher's evaluation of language proficiency, supported by the students' perspectives, faced the challenge of quantifying the distinct advantages of immersive activities and differentiating them from the progress achieved in the classroom.

3. Results

The comparative analysis of the data collected following the two road trips from both students and the teacher revealed findings that confirm the assumptions of the study and previous research: language proficiency, cultural sensitivity, and motivation increased at various paces, while anxiety levels lowered. This also sheds light on the dynamic relationship between motivation and anxiety, confirmed by previous studies (Dörnyei & Ushioda, 2013; Teimouri et al., 2019).

Following the autumn trip, students predominantly cited their key accomplishments in terms of proficiency as gaining new vocabulary, successfully navigating real-life situations (such as ordering food, asking for directions, and seeking clarification), and enhancing their listening skills. They also recognized the challenge of understanding informal, rapid conversations with native speakers and the complexities of Romanian pronunciation variations. As the students' proficiency levels advanced, their evaluation of the second trip focused on more complex areas: engaging in negotiations with locals, carrying casual conversations with new Romanian acquaintances, and participating in lighthearted banter and humor. This viewpoint was supported by the teacher's assessment, as she observed the learners' gradual improvement in practical language skills and noted that the spring strip was associated with twice as many social interactions with locals, according to her observations. If, during the first immersive experience, students avoided spontaneously engaging with the locals, the spring trip materialized in many communicative exchanges initiated by the learners. Furthermore, the teacher highlighted that the two trips resulted in enhanced rapport, social connections, and collaborative work among the participants, as they developed inside jokes, and broadened their interactions beyond their native language group.

Furthermore, the quantitative processing of the anxiety and motivation questions revealed that the first trip was associated with a higher level of anxiety related to the use of the Romanian language in interactions with natives. When asked to rate their anxiety on a rate from 1 to 5 (1 being the lowest level) 75 % of the students reported levels of nervousness of 4 and 5, whereas the second excursion was

predominantly associated, according to the answers, with levels of 2 and 3 (80%). Notably, 3 students have given a rating of 1 when undertaking the second questionnaire, registering a considerable reduction in comparison to their first experience (where they considered that their communicative stress reached level 4). Participants admitted to experiencing nervousness when using the target language in unfamiliar settings and described fear of making mistakes or generating misunderstandings. Some learners also listed some solutions to cope with such setbacks: focusing on communication rather than being accurate about grammar, seeking support from their colleagues, or supplementing verbal engagement with nonverbal and paraverbal cues.

In terms of student motivation, the comparative analysis highlights less steep curves and an expected indirectly proportional connection with anxiety: the autumn trip was associated with an average motivation level of 2 and 3 (65 %), while the second generated a boost towards the high end, thus showing the fruits of the previous immersive experiences (80% - motivation rate of 4 and 5). The main sources of motivation named by the respondents to the semi-structured interview stemmed from the excitement of real-life application of language skills, which they considered to be far more engaging than traditional classroom activities.

Finally, interviewees also provided examples of cultural insights or experiences gained during the two field trips. They mentioned their appreciation for the Romanian hospitality and kindness, the surprise that Romanians unanimously showed undisguised enthusiasm at seeing foreigners learning their language and provided eager linguistic support without seeming deterred by flaws in discourse. Moreover, respondents pointed out the realisation that Romania has a rich and fascinating history, set against the background of breathtaking natural landscapes. All participants expressed the excitement to be presented with Romanian customs and traditions while visiting the cultural landmarks and the local households. The respondents acknowledged that these experiences have deepened their understanding and appreciation of the target culture, leading to greater cultural sensitivity and empathy.

4. Conclusions

The study shows that road trips serve as an effective supplementary tool for enhancing foreign language acquisition among learners at varying proficiency levels. The quantitative and qualitative data collected from both students and teachers corroborate the hypothesis that such immersive experiences significantly enhance language proficiency, cultural sensitivity, and student motivation, while concurrently reducing anxiety. Specifically, the findings reveal that students exhibited marked improvements in practical language use, evidenced by their ability to engage in complex communicative tasks and navigate social interactions with native speakers. The increased proficiency in pragmalinguistic skills and the ability to handle colloquial and fast-paced dialogues point to the considerable benefits of real-world language practice. Additionally, the development of social bonds and teamwork among students from diverse cultural backgrounds proves the positive impact of collaborative learning environments fostered during these trips.

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FOSTERING CRITICAL THINKING: ALIGNING ASSESSMENT WITH EDUCATIONAL EXPECTATIONS

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Abstract

Critical thinking is an often-discussed learning outcome in higher education. Critical thinking skills are viewed as important for student success in the classroom as well as for establishing a foundation of lifelong learning. Often, however, assessment measures, viewed as the ultimate test of learning, do not require students to utilize critical thinking skills in any practical or meaningful way. This sends a message to students that although critical thinking is espoused as important, it is not essential for success. Ideally, examinations should both assess and advance knowledge. Further, examination questions should test students' functional, applicable knowledge of concepts, rather than memorization and statements of facts. Examinations that allow student collaboration simulate real-world situations in which an individual's skills gathering, synthesizing, and applying information appropriately are essential. This paper presents data from an undergraduate course in speech acoustics taught over several semesters. During two of these semesters, the instructor utilized different collaborative assessment methods, allowing students to collaborate either before or after individual completion of the examination. Data from student surveys as well as examination scores demonstrate that rigorous take-home examinations with a planned opportunity for student collaboration can effectively assess student learning while also enhancing the learning opportunity for students by encouraging critical thinking skills and real-world problem-solving strategies.

Keywords: Assessment, critical thinking, collaborative learning, higher education.

1. Introduction

A growing body of literature supports student collaboration, not only for activities and assignments, but also for assessment. Collaborative assessment has been shown to enhance learning (Zipp, 2007), promote deeper understanding of concepts (Cortright, Collins, Rodenbaugh & DiCarlo, 2003; Johnson, Green, Galbraith & Anelli, 2015) and improve long-term retention of knowledge (Cortright et al., 2003; Johnson et al., 2015; Vogler & Robinson, 2016). Further, collaborative problem-solving during group assessment procedures simulates "real-world" situations, requiring individuals to pool resources to solve problems (Handelsman et al., 2004; Macpherson, Lee, & Steeples, 2011). Students also tend to prefer group assessment, citing reduced test anxiety (Johnson et al., 2015; Siegel et al., 2015) and increased engagement and motivation (Macpherson et al., 2011; Simkin, 2005). Finally, researchers have noted that exams designed with student collaboration in mind tend to have more challenging questions that facilitate additional student learning (Johnson et al., 2015; Simkin, 2005). Collaborative assessment also requires essential critical thinking skills, that is, accessing, evaluating, synthesizing, and appropriately applying information.

Many instructors and investigators have attempted to determine the best way to incorporate group assessment procedures into classroom instruction while still holding individual students accountable. Most instructors assess students individually prior to group assessment (Cortright et al., 2003; Macpherson et al., 2011; Moore, 2010; Vogler & Robinson, 2016; Zipp, 2007). Such combined procedures hold students accountable for learning the material while still allowing for the additional educational benefit of the group interactions. However, if collaborative group work does promote deeper understanding of concepts and improved retention of knowledge, students might benefit from a group assessment activity prior to individual assessment. In one model, students collaborated initially for one part of the exam and then completed the remaining exam individually (Siegel, Roberts, Freyermuth, Witzig, & Izci, 2015). This current paper compares two approaches to collaborative testing, one with student collaboration following individual completion of the exam and another requiring students to collaborate prior to the exam by completing a group pre-test.

2. Method

In a speech acoustics course taught over several semesters, students typically completed a take-home final exam individually. However, in two semesters, students collaborated while completing the exam. This investigation compares three semesters. In Semester A, students completed a take-home exam individually, as was typical for the course. In Semester B, students completed a take-home exam individually, but then were allowed to collaborate with other students in a group to attempt to improve their answers. In Semester C, students initially worked collaboratively in groups on a practice exam before individually completing an in-class final exam. Student survey data and examination scores were then analyzed to determine the potential effects of different collaborative assessment procedures on students' perception of learning as well as demonstrated knowledge and critical thinking skills on exams.

3. Results

3.1. Post-test collaboration

In Semester B, after completing the take-home exam individually, students were randomly placed in groups of three to four students to spend one hour discussing the exam. Following this group collaboration, students could choose to add to or revise any of their answers on the exam. The instructor told students they would receive additional credit for answers that improved following the group discussion. Following each student's revision of their exam, students completed an anonymous survey. Table 1 presents student responses to the survey.

Table 1. Student survey questions and response results for Semester B (N=23).

1. The time spent working with other students helped me learn		2. After working with other students, I was better able to answer exam question(s)	
Strongly agree	19 (83%)	Strongly agree	17 (74%)
Somewhat agree	3 (13%)	Somewhat agree	5 (22%)
Neither agree nor disagree	1 (4%)	Neither agree nor disagree	1 (4%)
Somewhat disagree and Strongly disagree	0	Somewhat disagree and Strongly disagree	0
3. After working with other students:		4. Which best describes your experience working with other students:	
a. my exam answers were both more accurate and more detailed.	10 (43.5%)	a. The other students and I learned equally from each other.	18 (78%)
b. my exam answers were more detailed.	3 (13%)	b. I learned more from other students than they learned from me.	3 (13%)
c. my exam answers were more accurate.	7 (30.5%)	c. The other students learned more from me than I learned from them.	2 (9%)
d. my exam answers did not change significantly.	3 (13%)		

The instructor graded each student's individually completed exam as well as their exam completed after collaboration, comparing any revised answers to determine to what extent students improved their responses. Figure 1 shows exam score results for every student, both pre- and post-collaboration with other students. Exam scores are arranged in ascending order based upon the score of the initial, individually completed exam. On average, students improved their scores by 8 points or 4%, though three students decreased their overall scores after collaboration. Lower-performing students appeared to benefit more from the group collaboration, a finding consistent with prior research (Giuliodori, Lujan, & DiCarlo, 2008).

Figure 1. Student exam scores prior to, and following, group collaboration.
(Scores are arranged in ascending order based on initial exam scores.)
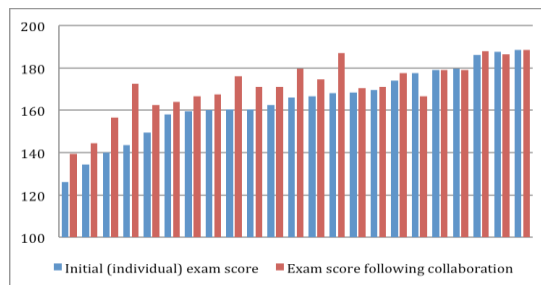
3.2. Pre-test collaboration

In Semester C, the instructor provided students with a practice exam similar in content and structure to the upcoming final exam. The instructor asked students to work collaboratively in groups of four to answer the practice exam questions. One week later, students individually completed an in-class final examination. After finishing the exam, students anonymously answered two survey questions. Table 2 shows student responses to the survey questions.

Table 2. Student survey questions and response results for Semester C (N=30).

1. Completing the practice exam with other students helped me learn the course material better.	
Strongly agree	17 (57%)
Somewhat agree	13 (43%)
Neither agree nor disagree & Somewhat disagree & Strongly disagree	0
2. Completing the practice exam with other students:	
a. helped me with some of the questions; I would not have been able to complete these questions on my own.	8 (27%)
b. added to my level of understanding; I was able to answer the questions more accurately and completely than I would have on my own.	20 (67%)
c. did not help me complete the exam any better than if I had completed it on my own.	0
d. did not help me, but I was able to help them.	2 (6%)

3.3. Examination score comparison across semesters

Table 3 displays range and average of students' final exam scores over the three semesters with different exam delivery format. For Semester B, scores are reported both prior to collaboration and following collaboration.

Table 3. Class final exam score average and range across semesters.

Semester	Final exam format	Average final exam score (%)	Final exam score range (%)
A (N=20)	Take-home exam, completed individually	87.86	68.7-97
B (N=23)	Take-home exam completed individually, prior to collaboration	82	63-95
B (N=23)	Take-home exam completed individually, following post-test student collaboration	86.5	67.5-98.8
C (N=30)	Collaborative pre-test practice exam, with individual in-class exam	87.01	72.7-98.8

4. Discussion

An important component of critical thinking is the ability to synthesize information from different sources, determine what is reliable, and make decisions based on all valid evidence. Collaborative assessment allows students this opportunity. In this investigation, student survey responses support the use of collaborative testing. Whether collaboration occurred prior to or following individual completion of the exam, students think the collaboration helped them learn the material and respond to exam questions more accurately and more completely. Most student exam scores increased when collaboration followed individual completion of the exam. However, it remains a challenge to assure that students of all knowledge and skill levels have the potential to benefit equally from collaborative opportunities. Additionally, average class exam scores across the semesters do not provide insight into whether collaboration is best before or after students complete the exam individually. Future studies should continue to assess the most effective use of collaborative group testing, particularly in undergraduate science courses. Regardless of course type, exams should no longer simply be tools for instructors to assess student knowledge at a moment in time. Rather, exams should be dynamic mechanisms to advance knowledge and reinforce the importance of critical thinking and problem-solving skills in real-world situations.

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'GET ME INVOLVED AND I WILL LEARN IT'.
SERVICE-LEARNING CASE OF STUDY AT UNIVERSITY

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Abstract

Schools cannot live in isolation from social realities. They are part of a wider community with diverse needs and interests. A preliminary study reveals that, in the field of English, primary school learners experience a decrease in motivation as they grow up, resulting in a number of difficulties in acquiring communicative competence in a foreign language. In response to this problem, we have designed an approach that links social reality with the school environment through the Service-Learning methodology. The aim is that our first-year students of the Primary Education degree at the University of Avila, through a service to the community based on the creation of English workshops for primary school students, acquire skills in the subjects of didactics and English at the same time as the primary school students foster their motivation and improve their competences in the foreign language. Our methodology is based on Service Learning, since it addresses a social need: the lack of motivation towards the foreign language and its application within a specific social context. It is a transversal and qualitative study in which university students undertake tasks of observation, design, development and evaluation of practical proposals. The results obtained through observation records, evaluation rubrics and open interviews confirm that learning by doing in community fosters the acquisition of competences and values of all the agents involved in the service. In conclusion, our study aims to ensure that our university students learn through community service and are capable of provoking positive changes in their environment.

Keywords: Social reality, Service-Learning, lack of motivation in English language, qualitative study, students of the Primary Education degree.

1. Introduction

In the realm of contemporary education, the intersectionality of academic knowledge and community engagement is becoming increasingly recognized as a catalyst for comprehensive learning experiences (Bellanca, 2010). As educators, we find ourselves at the juncture of not only imparting subject-specific knowledge but also instilling a sense of social responsibility and fostering holistic development in our students (Furco & Norvel, 2019).

As a result, many universities are integrating forms of engaged education that provide students with experiential learning opportunities in and with the surrounding community (Bell, 2010; Fitzgerald et al. 2012). One such practice linked to experiential learning is often referred to as service-learning (SL) or community-based learning (Kuh, 2008). Service learning is a pedagogical approach that transcends the traditional confines of the classroom, integrating academic learning with real-world community needs to benefit students, faculty, and community members (Carrington, Mercer, Lyer, & Selva, 2015). Students participate, and reflect on, services that benefit the (local) community as part of their curricular activities (Bringle and Hatcher, 1995; Tijsma et al., 2020; Cress et al., 2013). This educational approach seeks to inform how the SL student addresses the community's needs and promotes authentic relations between the two parties (Rosenkranz, 2012). Within academic settings, SL combines specific course learning objectives with community service to give SL students opportunities to cultivate their civic knowledge and interpersonal skills (Cashman & Seifer, 2008; Cress et al., 2013). Meanwhile, for those who receive service in an SL program, SL creates an open atmosphere where they can exchange their perspectives and skill sets with individuals providing service (Rosenkranz, 2012; Cress et al., 2013; Jacoby, 2015).

The social service of the University of Salamanca has created grants for the implementation of service-learning projects to promote their implementation in the different subjects in order to meet the

different social needs that arise and also to work towards the objectives of sustainable development (SDG).

This research seeks to contribute to the ongoing discourse on innovative pedagogical practices and their impact on students' development. By examining the theoretical underpinnings of SL and its application in fostering the sustainable objectives 5 (education of quality) and 10 (reducing inequalities) within primary education, it has been developed a partnership with a local school district to provide a SL programme, which aimed to design and implement different workshops for students of primary education whose motivation towards the English language has been sapped. we aim to provide insights that resonate not only within academic circles but also reverberate in the broader spectrum of education and societal enrichment.

2. Objectives

There were the following goals for the research: to bring future pre-service teachers closer to classroom reality; to analyse possible changes in the attitude of both participants towards the foreign language; to design learning situations that promote learner autonomy; to apply the content acquired in a practical way, contributing to the common good; to utilise active methodological tools that favour meaningful learning; to establish structures to develop citizenship awareness; to link social engagement with knowledge learning; to develop methodological strategies in English language learning to be applied in the primary classroom.

3. Method

This research arises in response to a key objective of Unesco: to support quality education. It addresses a proven social need of demotivation towards the foreign language in primary school learners and its application within a social context, a school in the city of Avila.

The research design employed a qualitative case study methodology and interviewing and observation tools (Denzin, 2008) in which a phenomenon within a particular context is researched through various data sources. A thorough analysis of individuals or groups unveils various aspects of the current situation. Our focus was on understanding the significance of real-time experiences for the subjects themselves, rather than extrapolating results to broader groups of individuals.

3.1. Participants

The participants are 70 preservice students enrolled in the subjects of Didactics and English in the first year of the Primary Education Degree of the University of Education and Tourism of Avila and the schoolers from first to sixth of Primary Education, ages from 6 to 11.

3.2. Research tools and data processing

Each of the seventy preservice students was assigned to a cooperative group formed by six of them and each group was paired with a class of the Primary school that took part in this study. Firstly, they were given a rubric of observation that filled in their first visit to the school. Then, they created a workshop to be carried out in that class and in the second visit they put it into practice and left extra digital resources for each class. Next, they visited school again and conducted an interview with the teachers who had been observing the workshops in each class. They videotaped and took notes. They then produced a transcript combining the information from the oral videotapes and written notes that were analysed using a qualitative content method (Denzin, 2008). Finally, preservice students took a self-assessment in the last class of Didactics and English and the teachers of Didactics and English conducted a 10-minute personal dialogue with all the schoolers of the Primary school to talk about how these schoolers had felt during the workshops. This was done in order to create an opportunity for dialogue that would interest both parties involved.

4. Findings

Based on the analysis of the results obtained, we can state the following findings arising from our investigation.

The transcripts produced by the preservice students highlighted that the development of the different workshops in each class of Primary Education fostered schoolers' motivation towards the English language, changed the attitudes of schoolers towards the English subject and promoted the use of active methodologies. The words: motivating, engaging, social needs, positive initiative, approach to

reality and active learning were repeated by all teachers when defining how they had perceived this experience on their learners. Furthermore, teachers interviewed remarked that schoolers had been demanding the use of the extra resources for the whole week and parents had been given access to them so that schoolers could continue working at home. Therefore, we can state that applying SL projects is beneficial for all involved and brings together social engagement and knowledge learning.

With regards to the self-assessment produced by the preservice students it is important to mention that 100% of them felt satisfied with the results obtained and considered that this project had approached them to the reality of the classroom. All of the preservice students felt part of an important issue and being in contact with the reality allowed them to foster citizenship awareness.

Last but not least, the ten minute personal dialogue produced between the schoolers and the researchers of this study together with the observation applied in all the sessions devoted to this research confirms that the relationship and interaction between the schoolers and the future teachers (preservice students) has been very enriching for both, since for the schoolers it has been an innovative moment where they returned their attention to learning, and for the future teachers it has served as practice and a way of getting closer to reality. Therefore, this kind of initiative should be part of the programme of both subjects (Didactics and English) in the upcoming years.

5. Conclusions

This research demonstrates the effectiveness of the use of service-learning. The proposed objectives have been achieved and the contents have been applied in a practical way to contribute to a social need. It has responded to Unesco's sustainable development objectives 5 and 10, and the results underline the need for implementing this type of methodology on a continuous and stable basis within the Primary Education Teaching degree.

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ADOPTING CONSENSUAL BEHAVIOURS: A LESSON PLAN

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Abstract

Consent entails the mutual agreement between individuals to engage in a particular activity or interaction. It serves as a cornerstone for developing and maintaining healthy relationships based on respect and communication. A common offensive behavior that characterizes many people, regardless of age or gender, is the invasive physical approach of a partner that might violate their somatic boundaries and self-determination. Here, we propose a lesson plan aimed at raising awareness about the significance of consent, as there is somewhat of a lack of related educational resources. It has been designed for an English for Academic Purposes course in Higher Education, to be held on the International Day of Consent (30th of November) and is intended for young adults. The present lesson plan comprises a three- fold approach: (1) In the first part, audiovisual materials are used to familiarize students with the meaning of consent and its verbal expression. (2) Subsequently, students explore the basis of such abusive behaviors, specifically focusing on the culture of romanticizing violence through kidnapping that is often promoted in films and other media. (3) Finally, students, after watching a video about physical theatre showcasing the non-verbal expression of consent, are encouraged to participate in theatrical exercises under the guidance of a specialist. This teaching micro-scenario is designed to promote empathy, communication skills, student initiative, and respect for others' boundaries.

Keywords: Consent, higher education, physical theatre, English for Academic Purposes.

1. Introduction

Consent refers to the "clear and unambiguous agreement, expressed in mutually understandable words or actions" (Dougherty, 2015). Notably, women and femininities tend to be the victims (Elliott, Mok, & Briere, 2004). The reasons for the absence of consent are complex (Holmström, Plantin, & Elmerstig, 2020) and may involve the romanticization of violence in popular media tropes (Groszhans, 2017; Olson, 2013). Considering the somewhat lack of relevant educational approaches (Willis, Jozkowski, & Read, 2018), we devised a lesson plan that draws on visual literacy (Elkins, 2009) to educate students in higher education on verbal and non-verbal consent.

2. Methodology

Subject: English for Academic Purposes (EAP) – Topic: Consent – Age group: students of higher education, young adults – Duration: 3h

2.1. Educational goals

Through this lesson plan, we anticipate students to: (1) Explore the concept of consent as a tool to defend self-autonomy, (2) Utilize verbal and non-verbal cues for successful, empathetic and respectful interaction and communication, (3) Appreciate that physical boundaries may vary from person to person, (4) Identify misconceptions related to consent, (5) Support their right and the right of others to physical determination, also for every individual regardless of gender, age, nationality etc., (6) Acknowledge that they have agency to make choices and act on them, free of threat of punishment or violence, also the right to change one's mind, (7) Promote their oral, writing and communication skills, (8) Engage in activities that boost cooperation, creativity, and responsibility, (9) Interpret audiovisual material (visual literacy), (10) Familiarize with the role and function of theatre education and its incorporation into the classroom.

2.2. Materials

(1) Projector, (2) Students' smartphones/tablets/laptops, (3) Classroom with internet access.

2.3. Procedure

The present lesson plan consists of three phases, each comprising a micro-activity, plus evaluation phase. The activities are designed to span over approximately three hours. Audiovisual materials are employed, so to actively engage students with the interpretation of visual information (visual literacy).

2.3.1. 1ˢᵗ Phase: 1ˢᵗ micro-activity (Duration: 30min). Introduction to consent and physical self-determination using a speaking activity. For this purpose, original comic strips were created.

1. Warmer: Students watch a video (https://www.youtube.com/watch?v=Zh_8xDmlU30) (duration: 3:00) by the University of Lincoln, which is entitled "*Let's talk consent*". Then, they watch the short video "*Consent matters*" (https://www.youtube.com/watch?v=j-xRDkCYQeM) (duration: 1:01) by Oxford Brookes University. Other appropriate materials may also be used by the instructor, involving young people exploring the concept of consent and its implications.

2. A discussion is held on the views expressed in the videos, also with regards to the definition and content of consent. We provide answers to student questions and a list is compiled with the most common themes and relevant issues raised.

3. Students are directed to a Google Docs (https://drive.google.com/drive/folders/1o_5M-Km4gETMAfB4g3mDpUCLNA4rIgAh) spreadsheet to work on a speaking activity. They are asked to interpret a series of comic strip storylines and to infer whether consent is given or not. Their attention is drawn to the verbal cues of the illustrations, but non-verbal cues are acknowledged as well. Finally, students are asked to identify misconceptions of consent.

4. A post-speaking activity discussion is held with reference to the initial list of issues that the students put together. An emphasis is given on whether their views have shifted as a result of their engagement with the speaking activity.

2.3.2. 2ⁿᵈ Phase: 2ⁿᵈ micro-activity (Duration: 50min). Here we employ the *Beauty and the Beast* fairytale to discuss the notion of pop culture romanticizing violence and abduction, via a writing activity. This activity also promotes creativity and critical thinking. For this purpose, an original illustration was produced.

1. Warmer: We project the trailer of Disney's *Beauty and the Beast* film (2017) (duration: 2:07) (https://www.imdb.com/video/vi179222553/?playlistId=tt2771200&ref_=tt_pr_ov_vi).

2. Students are requested to reflect on whether Belle has agency to make her own choices in the movie and a discussion is held on the topic.

3. We ask students to run a Google search to try to find common themes and motifs between Disney's *Beauty and the Beast* film (1991) and the following films: *The Terminator* (1984), *12 Monkeys* (1995), *V for Vendetta* (2005), *Passengers* (2016). We explain that the common element lies in presenting, in popular media, abduction and violence against women as romantic (also see https://youtu.be/t8xL7w1POZ0?si=wSfk7BfgwnBbOtnl).

4. Students are directed to a Google Docs (https://drive.google.com/drive/folders/1o_5M-Km4gETMAfB4g3mDpUCLNA4rIgAh) spreadsheet to work on a writing activity. They draw information from academic text excerpts that portray the *Beauty and the Beast* fairytale as a story that normalizes abusive behaviors and the absence of female self-determination. Under this light, students provide their views on the role that pop culture holds in this matter and attempt to rewrite the fairytale's storyline.

2.3.3. 3ʳᵈ Phase: 3ʳᵈ micro-activity (Duration: 90min). In this communication activity, we focus on the non-verbal part of consent, by means of engagement with audiovisual material and physical theatre exercises. For this purpose, original material was created comprising video art footage and physical theatre instructor's notes.

1. Prompt: Students watch a video art piece, portraying physical theatre, that is entitled "*(Un)Connected*" (duration: 2:51) (https://drive.google.com/drive/folders/1o_5M-Km4gETMAfB4g3mDpUCLNA4rIgAh).

2. Subsequently, they engage in storytelling; We ask them to describe the storyline and to interpret the actors' desires, fears, and intentions.

3. We explain that the director instructed the actors as such: "They would escape a place of isolation and loneliness to explore the new world around them. They would then discover one another,

full of expectation and curiosity. A playful interaction would follow; But shortly, they would stumble onto their egos, demands and disregard of one another. The clash would be imminent, unavoidable, and catastrophic; A blast would follow. After the disillusionment, the failed relationship ceases to exist. The characters are again diminished and enclosed in their spaces, there is no escape for them after all.".

4. Following the director's statement, we discuss with students to establish a link between the narrative and the concept of consent, its implications and impact on human interactions.

5. Students work on a Google Docs (https://drive.google.com/drive/folders/1o_5M-Km4gETMAfB4g3mDpUCLNA4rIgAh) communication activity, analyzing still images from the above video, in terms of the consensual or non-consensual behaviors depicted.

6. Students get on the stage and under the spotlight, for a series of physical theatre exercises, to express themselves and to acquire body knowledge on the issue of consent.

Figure 1. (i) Verbal expression of non-consent, as shown in a comic panel from the 1st micro-activity (illustration by Christodoulos Themi), (ii) Non-verbal expression of non-consent, as shown in a still image captured from the video of the 3rd micro-activity (videography by Nontas Garafas, actress and actor: Konstantina Kyriakidou and Konstantinos Papakostas, director: Petros Christakopoulos).
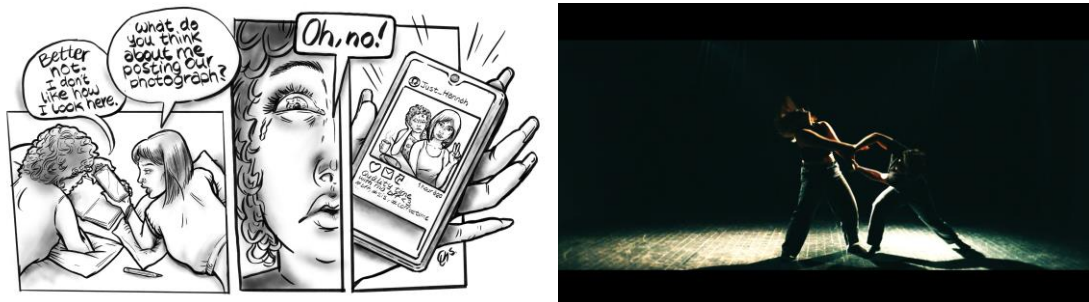
2.3.4. Evaluation (Duration: 10min). To assess the effectiveness of the present lesson plan, we get student insights, by means of a plenary discussion and exit tickets. Before leaving the class, students are asked to complete an Google Docs exit ticket, consisting of three sections: "How I felt today:", "What I learned today:", "I have a comment on" (https://drive.google.com/drive/folders/1o_5M-Km4gETMAfB4g3mDpUCLNA4rIgAh).

3. Conclusion

The present lesson plan involves a series of speaking, writing and communication activities that comprise original visual material to promote consent, self-determination, and agency, as foundations for thriving individuals, healthy interactions, and profound communication.

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BEHAVIORAL RATING SCALE FOR INTERNALIZING AND EXTERNALIZING PROBLEMS IN ACADEMIC SKILLS IN BRAZILIAN SCHOOLCHILDREN

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Abstract

Objectives: To develop a Behavioral Rating Scale of Internalizing and Externalizing Academic Skills for use by Elementary School Teachers and showcase its results concerning data corroboration. Method: The research was divided into three phases: 1) preparation of items and criteria for the scale; 2) data corroboration; and 3) internal consistency analysis. Conclusion: The rating scale was reliable enough for its application in forthcoming research regarding the identification of internalizing and externalizing behavioral issues among schoolchildren of Elementary School.

Keywords: Problematic behavior, Behavioral Rating Scale, teachers, schoolchildren.

1. Introduction

Externalizing behaviors are primarily expressed in regard to other people, such as opposition, aggression, hyperactivity, impulsivity and antisocial challenges or manifestations (Achenbach & Edelbrock, 1978). Internalizing behaviors refer to self-focused conducts and include some symptoms of depression and anxiety, such as sadness, social retraction, and solitude (Achenbach, Ivanova, Rescorla, Turner, & Althoff, 2016).

The association between externalizing and internalizing behaviors and hindrances to one's academic skills has been well established in literature (D'abreu & Marturano, 2010), which demonstrates how it can be easily identified early-on and the impacts it causes on overall schoolchildren development. Within this context, the early detection of emotional and behavioral risks is widely recommended, suggesting that behavioral tracking tools employed by teachers are substantially more effective when identifying schoolchildren at risk, particularly those who exhibit internalizing or externalizing behaviors (Chan, Bull, Ng, Waschl, & Poon, 2021).

In Brazil, although there has been a growth spurt in papers focused on the analysis of schoolchildren behavior (Correia-Zanini, Marturano, & Fontaine, 2018), there are still little to none concerning the development of tracking tools for the identification of externalizing and/or internalizing behaviors made for school teachers in order to provide clear methods for the identification of behavioral issues, which are closely related with the learning process.

On account of this concerning gap in knowledge, the following argument was brought to light: Would it be possible to develop an instrument – both valid and reliable – subject to psychometric criteria for the purpose of assisting teachers in identifying internalizing and externalizing behavioral issues during Reading, Writing and Math homework for schoolchildren? Consequently, the following hypothesis was formulated: It is possible to develop an instrument – both valid and reliable – subject to psychometric criteria for the purpose of assisting teachers in identifying internalizing and externalizing behavioral issues during Reading, Writing and Math homework for schoolchildren. As such, this paper aimed to develop the Rating Scale of Internalizing and Externalizing Behavioral Issues in Academic Skills, intended for the use of Elementary School teachers, as well as showcase the validity of its contents.

2. Method

A cross-sectional study was realized following approval by the Research Ethics Committee. The research was divided into three phases:

Phase 1: A systematic bibliographical inquiry was performed, using sources from national and international literature (PubMed, Scielo Brasil, LILACS and CAPES/MEC Periodic Portal), in order to enable the identification and selection of specific descriptors used in the preparation of the scale's items and criteria. The revision attempted to answer the following question: "What are the evaluation instruments most employed in the classification of behavioral traits in Elementary schoolchildren, used by teachers?"

Phase 2: For data corroboration, six independent judges (two speech therapists, two pedagogues and two psychologists) were brought in. To measure statistical rapport among them, each aspect was evaluated according to Fleiss' Kappa statistical methodology. The chosen level of significance was of 0.05 (5%) and the confidence interval was established at a 95%.

Phase 3: Six Elementary teachers from a state-funded school participated, completing the rating scale and evaluating 42 schoolchildren, aged approximately 8.57 years old, male and female, from the 1st to 5th year. For data analysis, Cronbach's Alfa coefficient and confidence intervals with 95% confidence were utilized.

3. Discussion

Results obtained in phase 1, literary revision and instrument analysis enabled the establishment of two behavioral issue categories: externalizing issues and internalizing issues (Achenbach, Ivanova, Rescorla, Turner, & Althoff, 2016; Achenback & Rescorla, 2001), as well as the identification of specific descriptors (APA, 2023; OMS, 2000; Achenbach, Dumenci, & Rescorla, 2001; Achenbach & Edelbrock, 1978; Reid, Patterson, & Dishion, 2002). Literary revision also revealed the scarcity of national research focused on developing evaluative and/or tracking instruments for the identification of behavioral issues in schoolchildren and employed by school teachers, which is something closely related with the Brazilian population's learning process (Lemos, Michelis, & Batista, 2017).

Within the literature the frequent association between the terms "internalizing behavior" and "externalizing behavior" with child behavior issues is widely observed (Compas, et al., 2017; Rescorla, et al., 2007; Burns, Geiser, Servera, & Becker, 2022). The association between externalizing and internalizing behaviors and hindrances to academic skills is well established in the literature (D'abreu & Marturano, 2010; Dodge & Pettit, 2003), demonstrating its early identifiability – in pre-school – and its impacts on overall schoolchildren development.

Next, in the data corroboration phase, results obtained through Fleiss' Kappa methodology enabled the measurement of statistical confidence among the judges, which corroborated the first scale's modifications, due to the fact that none of the analyses showcased statistical significance or at least considerable ones. Except for font size, font type and scale type (general aspects) criteria; as well as sentence size among the three categories (Reading, Writing and Math), in which a Fleiss's Kappa of 1.000 was obtained. Results obtained from the second analysis attained the maximum possible for Fleiss' Kappa; meaning, maximum agreement. Thereby, both the method and statistical results indicated to comply with instrument preparation techniques, guaranteeing the validity of its contents (Pasquali, 2003), allowing a clearer definition of its domains, its content sector and its content representation, the connection of its content with the processes which are to be evaluated, the relative significance of each unit, the preparation and theoretical analysis of the items, as well as its user-friendliness, relevance and empirical analysis for future use.

Data obtained through the internal consistency analysis revealed Cronbach's Alfa for the sample, to be almost perfect, with the lowest value found for the Internalizing Behavior Category in Writing being 0.814, leading to an internal consistency in all Behavioral, Academic Skill and Total Categories, not impacting the instrument's following analysis according to three conditions: removing the item in cross-reference and showing the Alfa for the instrument as a whole; removing the item in cross-reference and showing the Alfa for the category; and, lastly, removing the item in cross-reference and showing the Alfa for behavior category.

The stated value may depend on the fact that externalizing behaviors are expressed through reactions directed towards other people, which may be observed in problems related with aggression, lack of attention, disobedience and deviant behaviors. Internalizing behaviors, on the other hand, are expressed within the individual themselves, manifesting as anxious and depressive behaviors as well as somatic symptoms, which can be observed in the school environment (Achenbach & Edelbrock, 1978; Bevilacqua, et al., 2021).

4. Conclusion

This study's data lead to the conclusion that the aforementioned rating scale is valid enough to identify Internalizing and Externalizing Behavioral Issues in Academic Skills when used by teachers in schoolchildren from Elementary schools (EP-CEI). Therefore, obtained results are valid and reliable enough to justify the rating scale's application in other studies regarding the identification of Externalizing and Internalizing Behavioral Issues in schoolchildren from Elementary school.

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WHAT DO THE LEARNING DIARIES TELL US ABOUT THE LANGUAGE LEARNING EXPERIENCE BASED ON PEER-TEACHING?

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Abstract

This paper focuses on two language courses developed for learning Estonian: "Tandem Language Learning" and "Estonian Conversation Course". Compared to a traditional instructor-led activity-based course, these are based on peer-teaching of students and provide significant support for learner autonomy. The courses are part of the University of Tartu's humanities curricula, with the possibility of online participation for learners from universities outside Estonia. In both subjects, student pairs of Estonian language native and non-native speakers are formed, who plan and conduct their meetings related to the study of Estonian and, in the case of a tandem course, study of one other foreign language throughout the course. Both courses are based on a collaborative learning partnership: participants take control and responsibility for their own and their partner's language learning process. Participants complete a learning diary in which they analyse their work and receive feedback from their instructors. Analysis of the learning diaries shows that students value the opportunity to create the content of the language course based on their own and their partner's needs. According to the students, the use of a web environment for tandem work increases the flexibility of the study arrangements. In the teacher's role students feel responsibility with respect to their partners and emphasise that during the course their understanding of their native language increased. In the student's role participants point to the positive influence of partnership on the increase of their communication skills and vocabulary development in the language they are studying.

Keywords: CALL, tandem language learning, autonomy of the learner, learning diaries, Estonian as a foreign language.

1. Introduction

In this paper, we will analyse two university language courses developed for learning Estonian as a foreign language: "Tandem Language Learning" and "Estonian Conversation Course". The courses are part of the University of Tartu's humanities curricula, and students can study these on an optional or elective subject basis, with the possibility of online participation for learners from universities outside Estonia.

Compared to traditional instructor-led activity-based language learning courses, these courses are based on peer-teaching of students and provide significant support for learner autonomy. Usually learning autonomy is treated as the student's ability to take responsibility for their own learning; in language study this is inseparable from development of communication skills in the target language (Little, 2007). Schwienhorst (2003) foregrounds individual-cognitive, social-interactive, experimental-participatory perspectives in learner autonomy and tandem learning as an implementation of these principles.

In addition to learners' autonomy, both of these courses also support the reciprocity principle of language study. In both courses the intercultural, discursive ja semantic dimensions of reciprocity are expressed; in collaborational learning the focus is on both the language, the structure of a conversation as well as cultural specificities (Cappellini et al., 2020). In the tandem course the structure also follows the principle of organisational reciprocity: two languages are learned in tandem, while students can decide whether they will work with one language per meeting or two languages by turns. In the tandem course one of the languages studied is Estonian; the other can be any other foreign language. In the conversation course the language study partners only practice Estonian: the pairs consist of one native speaker and another for whom Estonian is a foreign language. In both courses students can choose how they will conduct their work: they can choose the topic of conversation, supplementary materials (e.g., webpages, dictionaries), the form of study (e.g shared activities in the language milieu, language study games, etc.).

The focus of this article is the learning diaries of language learners, which are a good starting point for qualitative research and provide a glimpse of the learning process and factors which influence it.

Previous research has used learning diaries to examine the experience of language learners primarily in instructor-led language study (e.g., Porto, 2007; Nešić & Spasić-Stojković, 2017). Less research has been conducted on learning diaries that reflect upon students' work in partnership (e.g., Leone et al., 2023).

2. Objectives

The objective of the research is to clarify the experience of students as language learners in university courses taught entirely in the peer-teaching format. Based on the analysis of entries in learning diaries answers are sought to the following research questions: 1) how participants experienced their roles as a language learner and their partner's teacher, and in what way peer-taught learning differed from their previous experiences, 2) what support was expected and received from the course instructor, 3) how work in a web environment influenced the learning experiences of participants in the course.

3. Methodology

Excerpts that connect with the research questions have been selected from the learning diaries of two courses (n = 87). The summary was composed which was illustrated with quotations. The learning diaries were filled out in the Moodle environment. Keeping a learning diary was a compulsory element for both courses. Since the students conducted their language learning meetings independently, the instructors could use the learning diaries to keep up and to communicate with them. During the course the students made entries about their meetings, posed questions to the instructor and reflected on their experience. The majority of the entries in the learning diaries were made in Estonian, though if they wished, learners could also write in other languages. Interaction between the students and the course instructors took place through the learning diaries; instructors provided ongoing feedback for the learning diaries throughout the course and answered the learners' questions. In this article only the students' entries are considered; the feedback provided by instructors is not included. The study follows the principles of qualitative research.

4. Findings

In the following we will give an overview of the experiences related in the learning diaries pertaining to foreign language learning in the peer teaching format.

1. Participants' roles in the two courses were partly similar and partly different. In the tandem course each participant was in two roles during the course (a reciprocal learner-teacher relationship). In the conversation course the participants' roles remained the same throughout. In both courses the partners got to know each other's culture and society, including everyday life and value judgments.

- There are topics that are current in both countries, and we would discuss them at length; as every country has their own problems, we would talk and ask questions about things that interested us.

For most students this was their first experience of this kind of collaborational learning experience and participants had to adjust to their partners. Those in the teacher's role mostly brought out their new experience of their mother tongue from a foreign language learning perspective; they had to keep their partner's language level in mind, slow down the pace of conversation, choose topics, answer questions, search for materials to better their own understanding of language structure.

- It was very interesting to see how people with different mother tongues speak and use Estonian. This made me think about the Estonian language differently, too.

- Teaching grammar was the hardest, for example, when to use the -ma and da endings.

According to the evaluation of the participants, courses based on peer teaching were mostly different from their previous experience with language learning. Individual learning together with one's partner makes it possible to focus on necessary topics for themselves; one can study what the learner desires and control over learning is completely in the hands of the students.

- .. here you create a complete language course for oneself.

- These are like individual lessons with a language teacher – you can learn exactly what you ask.

- I could devote myself to learning only what I considered to be the most important.

The learners valued the opportunity to practice the language they were learning with someone who spoke it as their mother tongue; what was considered particularly important was oral communication and growth in the courage to speak in the target language during the course.

- This course gave me the opportunity to speak on a range of topics with Estonians and I became more confident of my language ability.

2. For both courses the learning diaries functioned as an interactive platform through which participants could communicate with course instructors and ask them for advice. Despite the fact that course

instructors encouraged participants to pose questions to them in the learning diaries, participants in both courses made little use of this opportunity. The opporunity for asking questions was used primarily by students in the teacher's role and the questions touched upon the following topics: 1) carrying out language study; 2) advice on how to answer one's tandem partner's question on a topic of grammar or vocabulary; 3) soliciting recommendations on what materials to use while studying together with one's tandem partner. The instructors of both courses provided ongoing feedback on the learning diaries throughout the course and if there were questions, the answers were included in the feedback to the learning diary; specific language questions were explained and links and information on study materials were shared. The learners valued the opportunity to gain the instructor's support through the web diary.

- I liked the feeling that I was taken care of. I liked getting feedback on my journal and feeling that my partners could get feedback from the teacher as well.

- It was good to know that someone was following our activities on Moodle all the time. It was motivating. Perhaps otherwise I would not have completed the course to the required extent.

3. Because in these courses the participants themselves have to find a place for their language learning meeting, the web has become a comfortable alternative to meeting face to face. Students value the freedom to make choices themselves over when and where to meet and the partner work of students living abroad takes place entirely online. Learners can choose the web environment themselves; for example, Zoom, Skype and Google Meet have been used. Based on learning diaries one can say that from the perspective of language learning students consider web meetings equal to face-to-face meetings; it is emphasised that web learning particularly suits one-to-one collaboration, which is precisely what peer learning is.

- We could share a screen and look up words.

- Web-based language learning makes it easier to agree on meeting times, because it is easier to meet through the internet than face to face. It also provides the opportunity to converse with someone who is in another city or country.

5. Conclusions

The courses examined in this article are built upon the learners' collaborational learning partnership and support the principles of autonomy and reciprocity in language learning. Analysis of the learning diaries shows that the learners value the opportunity to create the content of the language course according to their own and their partners' needs; in collaborative learning the participants develop their knowledge of language and culture. As learners participants bring out the positive influence of tandem study on communication skills in the language and vocabulary development; the teacher's role offers the opportunity to regard one's mother tongue from the perspective of foreign language learning. Learning diaries function as an interactive communication platform between the learners and instructors. According to participants the use of the web environment increases the flexibility of tandem learning, and from the perspective of effectiveness it is not different from face-to-face learning. Courses with a peer-teaching format provide an exciting supplement to traditional university language learning courses.

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HOW CORPUS LINGUISTICS CAN HELP PROMOTE HEALTH EDUCATION: THE CASE OF SCHIZOPHRENIA

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Abstract

This paper explores findings from the largest scale linguistic study to date into representations of schizophrenia in the press. By examining a 15 million word corpus of all articles that refer to schizophrenia in the UK national press between 2000 and 2015, the paper identifies three dominant stereotypes: (1) people with schizophrenia are violent (2) schizophrenia is a multiple personality disorder and (3) schizophrenia is cause by illegal drug use. The paper concludes by identifying ways in which health campaigners can improve health literacy around the disorder.

Keywords: Corpus linguistics, critical discourse analysis, mental health, health literacy.

1. Findings

Schizophrenia is a serious mental health condition affecting 15.2 per 100,000 people in the UK (Kirkbride et al, 2012). Indeed, some estimates suggest that 1 in 100 people will experience symptoms of schizophrenia in their lifetime (Frith and Johnstone, 2003). People diagnosed with the disorder experience delusions (fixed beliefs which are not amenable to counter evidence) and hallucinations (e.g. 'hearing voices') (APA, 2013).

That said, schizophrenia is poorly understood by the public at large and is associated with inaccurate and harmful stereotypes (e.g. Corrigan, 2014). This is so much the case that early literature refer to stigma towards the diagnosis as a 'secondary impairment' (Wing, 1978). Importantly, these negative stereotypes have shown to lead to poorer clinical outcomes for people with the disorder (van Zelst, 2009). Indeed, it seems to be the case that stigma towards schizophrenia is a self-fulfilling prophesy. Internalised stigma has been shown to deter people experiencing psychotic symptoms from seeking professional help (Harrison and Gill, 2010) which can increase the frequency and intensity of psychotic symptoms and lead to a higher risk of violent episodes (Goldstone et al, 2012). One effect of this cycle of stigma is that legislation is imposed which deprives people with the disorder of basic human rights. The 2002 Mental Health Bill in the UK, for instance, allowed people with serious mental illnesses to be compulsorily detained, even if the person had not committed a violent crime.

Within this climate, this poster explores some of the main findings from a large scale corpus linguistic study (the largest study to date) into representations of schizophrenia in the UK press. Using the search query *schiz!,* all UK press articles that made reference to schizophrenia, either as the main topic of the article, or in passing, between 2000 and 2015 were collected. The resulting 15 million word dataset was cleaned and then separated by year and by newspaper. To examine the data, a number of quantitative methods were used. This paper largely reports on the findings of various keyword analyses, where words which are significantly more frequently in this dataset (with reference to a corpus of general British English, ukWaC) were identified. The use of these words were then examined in more detail using a concordance. Another tool which was used was the collocation tool, where words which occurred unusually frequently in the environment of the word *schizophrenia* or *schizophrenic* were identified.

The study identified a number of key stereotypes. This paper focusses on three dominant stereotypes and suggests ways in which awareness campaigners might improve a public understanding of the disorder.

Most prominently, schizophrenia is almost always represented in the context of violent crime. Collocates of *schizophrenic* for instance, include *dangerous* (n = 47) and *violent* (n = 50). Awareness campaigns are therefore encouraged to represent the disorder in a more diverse range of topics, and represent people with schizophrenia who are contributing positively to society. Journalists are encouraged

to clarify that people with schizophrenia who commit violent crime only make up a small minority of cases.

The word *schizophrenic* (and to a much lesser extent, *schizophrenia*) is used metaphorically in entertainment articles (e.g. 'schizophrenics of the shark world'; 'I'm schizophrenic about shoes'). These often reproduce harmful stereotypes around the disorder such as the notion that schizophrenia is a split personality disorder. Awareness campaigners should encourage journalists to avoid the metaphorical use where possible, and to provide materials which highlight the main symptoms of schizophrenia to avoid the promulgation of misconceptions.

Schizophrenia was often mentioned in the context of articles reporting on the classification of cannabis in the UK. This was shown to feed into a discourse of blame, where people with schizophrenia who suffered violent episodes were indirectly blamed for taking illegal drugs. The relationship between drug use and schizophrenia is a complex one and no causal link has been established. Awareness campaigners are therefore encouraged to highlight that schizophrenia is not a result of illegal drug use.

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GOOD PRACTICES IN TEACHING COGNITIVE NEUROSCIENCE TO BIOLOGY STUDENTS IN HIGHER EDUCATION

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Abstract

Cognitive Neuroscience refers to the scientific study of the mind and the brain, mainly by means of neuroimaging techniques and psychophysics. This field is considered rather complex, often posing learning challenges for students, especially in terms of the terminology and technical jargon used, as well as due to its interdisciplinary, STEM (science, technology, engineering, and mathematics) nature. To address this issue, an active learning approach was implemented. The present report describes a repertoire of targeted educational activities, developed in the context of a Cognitive Neuroscience course at a Biology Department in Higher Education. To approach consciousness, the theatre analogy for the Global Workspace Theory, developed by Bernard Baars, was used. This refers to a parallelism between elements of a theatrical production and consciousness. To this end, students attended a theatre performance and subsequently physically engaged in a series of onstage exercises. Next, a Science Spring Picnic was held to foster an informal dialogue on newly established knowledge, in a relaxed environment over food, beverages and kite flying. Finally, outreach activities were organized in the form of an art & science communication exhibition on visual illusions, at a major Science festival. Student feedback, by means of anonymous questionnaires, clearly denoted that the activities promoted motivation for learning, learning, and engagement beyond the classroom.

Keywords: Cognitive Neuroscience, good practices in education, higher education, active learning, science communication.

1. Introduction

How is a mechanical or chemical signal transformed into higher cognitive functions? To unravel this enigma, the field of Cognitive Neuroscience studies the mind and the brain, via advanced neuroimaging techniques and psychophysics (Poeppel, Mangun, Gazzaniga, & Bassett, 2020; Vallet, van Wassenhove, 2023). This domain stands in the intersection of STEM: Science, Technology, Engineering and Mathematics (Basu, Mondoux, Whitt, Isaacs, & Narita, 2017). This fact, alongside niche terminology and methodology, present significant hurdles to students (Baars & Gage, 2010). To tackle this issue, innovative teaching approaches may be implemented, namely active learning (Santosh, & Nakarmi, 2023). Active learning is an experiential educational practice so to increase student engagement (Zepke & Leach, 2010). The aim is to mitigate the academic burden through participation in -outside the classroom- course activities. The purpose of this report is to present good educational practices, that took place in the context of a Cognitive Neuroscience University course, offered to Biology students.

2. Methodology

2.1. The Theatre Analogy

To treat consciousness as an observable variable (Baars, 2017), students participated in a theatrical workshop (Figure 1.a). For this purpose, Bernard Baars' Theatre Analogy of the Global Workspace theory was used, i.e., a metaphorical framework that compares parts of a theatre and the conscious and unconscious contents that form the brain's mental processes (Baars, 2017). According to this analogy, the theatre stage corresponds to the working memory, whilst the spotlight on the stage represents voluntary attention. The content of consciousness is limited to the materials on the stage; the rest of the theatre represents unconscious knowledge and processes. Students first attended a theatrical

performance, and then found themselves on stage and under the spotlight. Through a series of physical theatre exercises, students worked on drawing several parallels to the concept of consciousness through a functional framework of human cognition. By forming emotional responses to external stimuli, they recreated the bottom-up attentional capture and they progressed to focus on top-down voluntary attention; ultimately, selectively directing their attention.

2.2. Science spring picnic

This extra credit course activity is a Journal Club with a twist, inspired by a previously published project, namely Science Tea Party (Andreou, Aletra, Athanasopoulou & Psarropoulou, 2018). A neuroscience curation of topics from the Nautilus Journal (http://nautil.us/) was made available to the students, so to choose their paper between the following options: 1. How Your Brain Fills in the Blanks with Experience; 2. Neuroscience has a Race Problem; 3. I Feel, Therefore I Am; 4. Why your Brain's Sense of Time is so Elastic; 5. Unlocking Mom's Brain; 6. Our Mind-Boggling Sense of Smell; 7. How We Remember Last Weekend; 8. The Brain Uses Calculus to Control Fast Movements; 9. Get Lost in Parking Lots -You Might Have Developmental Topographic Disorientation; 10. Are We Wired to Be Outside?. For presentation guidelines see Andreou et al. (2018). Students gave 5-minute talks, over food, beverages and kite flying, followed by plenary discussion (Figure 1.b). They were instructed to drill down to the most fundamental aspects of the publication and to interact with the audience. The premise of the activity was to boost science communication skills, outdoors, in a lax atmosphere. This way, a safe learning space was established, that nurtured informal conversations, on neuroscience and its implications on current culture and vice versa.

2.3. Science festival

An interdisciplinary student team was built and achieved their participation to a prominent three-day Science festival. There, they presented an art & science communication exhibition, entitled "Illusory vision: the human brain & illusions". This was essentially a STEM group, in which female representation was encouraged. The Cognitive Neuroscience course students held a science and science communication role. The topic of the exhibition involved the concept of error. "Cognitive Neuroscience informs us that error is an integral part of the learning process; our brain, by default, is wired up to make mistakes. A visual illusion begins where our senses fail. The false perception of reality, that the brain constructs, reveals to us the mechanism by which it operates. So, by learning from our "mistakes", we draw useful conclusions about the meaning of error in science and society; since in science we rely on experimentation to explore the unknown, while in education we often risk making mistakes in order to learn" (Andreou, 2023). The art exhibition negotiated these ideas in an open discussion with audiences of all ages. Alongside optical art printouts, graphic designs, and everyday objects, it mainly included exhibits created through 3D (three-dimensional) printing (Figure 1.c); that is, it employed art & technology for neuroscience communication of the study of the human brain. Henceforth, in this activity, students communicated complex neuroscience ideas to a diverse audience of 15.000 visitors, including 30 schools.

Figure 1. Student engagement in Cognitive Neuroscience educational practises (a) The Theatre Analogy (b) Science Spring Picnic (c) Science Festival.

(a)   *(b)*   *(c)*

3. Results & discussion

Students were requested to reflect on the aforementioned educational practices via optional, anonymously provided, open-ended comments. The student feedback was unanimously positive; indicatively one student remarked, "*Cognitive Neuroscience is one of the most interesting courses of the semester. The professor implemented various outreach activities to establish knowledge. During the*

Science Picnic, we had the opportunity to present science articles and further understand the concepts, through a fun, outdoor activity!". The comments provide a significant insight to students' perspective and merit further qualitative and quantitative investigation.

The vast majority of the comments provided affirmation with regards to the mitigation of academic burden, student engagement and subject-matter learning; and are in line with studies employing active learning strategies (Freeman et al., 2014). Students had the opportunity to elaborate on the science involved, in controlled, safe settings. They promoted their collaboration, public speaking, and science communication skills, while maintaining and sharing their enthusiasm and curiosity with their peers, their instructor and the general public. The incorporation of multidisciplinary practices, as the theatre analogy, the science spring picnic, and the participation to a science festival, underlines the multidisciplinary nature of the Cognitive Neuroscience field. Novelty and creativity enhanced motivation for learning, knowledge acquisition and student engagement in and beyond the classroom. Thus, the active learning activities reported here are deemed effective.

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HEALTH AND SOCIAL CARE PLACEMENTS IN TODAY'S CHANGING WORK ENVIRONMENTS: A GROUNDED THEORY STUDY

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Abstract

My research motivation as a lecturer at MCAST (Malta's state vocational education college) is to improve students' professional development, future-proof their vocational training, and explore better educational theory and practice in the light of fast-moving changes in the social care field. My initial research question is: "How can placements maintain efficacy in the changing context of Malta's culture and with increasing robotic and digital service provision?" Data is collected in Malta, a small island state, addressing technological change in provision of care and issues of culture arising from an increasingly diverse workforce and population. Using Grounded Theory methodology, with a constructivist approach, it builds conceptual knowledge directly from participant data. To mitigate bias arising from power relations between teacher-interviewer and student, and enrich data quality, focus groups are being used. Results emerging indicate the need for: More personalized learning environments and a pedagogy specifically fostering contemporary skill development; Improved communication between students and programme mentors; Closer working relationships between stakeholders and educational institutions. Also emerging is the complex issue of cultural difference between students, staff, and service users. Challenges include trust and respect for diverse attitudes and beliefs, and difficulties in communication and interpretation, all these potentially affecting care standards. The research asks how such challenges might be overcome and aims to propose new teaching strategies preparing graduates to be caring professionals who contribute to providers' business success.

Keywords: *Health & social care, placements, technology, culture, grounded theory.*

1. Introduction

I currently teach at Malta College of Arts, Science and Technology (MCAST), a government-run facility for vocational education in Malta. One of my duties is teaching level 3 social care students, who are placed in health and social care departments. Placements are required for the social care module in level 3, but few studies—especially in small island nations like Malta—have examined students' accounts and opinions regarding the learning outcomes from these placements. This doctoral thesis looks at the experiences of students during placements and to help with this, the study makes use of grounded theory.

2. Context of research

Educational institutions are under pressure to adapt in response to changes and demands that are occurring in the education sector both locally and globally. These changes and demands include new technology, globalisation of labor, economic and industrial restructuring, and the desire to increase productivity. Graduates who can hit the ground running and help businesses succeed are what the industry looks for. Today's students must also possess a wide range of abilities that will allow them to transition into the workforce with ease, solve complicated challenges, and show resilience, teamwork, effective communication, and good self-management. Placements offer students a first-hand, "hands on" experience in the industry, so this project tries to explain how placements are used, how useful they are as a teaching and training tool right now, and how this aspect of training may be enhanced and improved.

3. Research aims and problems

My initial research question is: "How can placements maintain efficacy in the changing context of Malta's culture and with increasing robotic and digital service provision?" My aims are to address the need for flexible teaching methodologies, giving lecturers the tools they need to meet the needs of the classroom of the future. It is in line with the issues that organisations like MCAST face.

4. Research methodology

The decision to conduct a qualitative study was obvious given that this method is frequently used to understand opinions and perceptions (Creswell & Creswell, 2018). It enables me to delve into the why behind particular actions and attitudes, providing a greater comprehension of what drives the participants.

A very important aspect for choosing qualitative analysis is that it will allow me to modify methodology and queries whilst diving more into the data, enabling a more dynamic research process. According to Sutton & Austin (2015) qualitative analysis gives the researcher the freedom to study the data without being constrained by preexisting beliefs, regarded to be of the utmost importance in this research since I as the researcher can have some bias considering I had placement settings myself while I was a nursing student. In fact, in the early stages of the study, I made notes about my ideas, emotions, perceptions and presumptions trying to guarantee credibility and open responsibility. Grounded theory will be the main technique used to undertake qualitative analysis in this study. By inductively analysing their data both after and during the collection process, researchers can create hypotheses and theories from the ground up using grounded theory (Birks & Mills 2015). This is particularly helpful when researching complicated and dynamic circumstances, such as placement settings, where standard theories may not apply or may not sufficiently capture the intricacies of the context.

Makri & Neely (2021) state that grounded theory places a strong emphasis on thoroughly examining the context. Grounded Theory urges researchers to document these people' viewpoints and experiences, enabling a more thorough investigation of the setting's dynamics (Cullen & Brennan, 2021). Besides this, in placement contexts where complex relationships and processes are in play, grounded theory emphasises the requirement for extensive and thorough descriptions of the data. Makri & Neely (2021) also state that grounded theory provides flexibility in study design, enabling researchers to modify their approaches and inquiries in response to new information. This adaptability is useful in placement situations, which might be unpredictable and prone to change.

5. Data analysis

Originally, I chose semi structure interviews to collect data in order to restore some control to the interviewees. This approach works well when the respondents are generally shy and reticent to communicate. Using semi-structured interviews allows some flexibility; for example, they permit the interviewer to pursue issues of particular significance that relate to the research question (Rose, 1994, as cited by Duffy, 2004) and at the same time give the opportunity to the participant to express himself / herself. However, trying to gather data without forcing responses that match what the researcher believes to be the 'main issues' is a major part of the Grounded Theory methodology.

Power dynamics during data collecting can be influenced by the researchers' experience and subject-matter competence. Researchers with more experience or knowledge might exert control over participants by directing the course of interviews or forcing their interpretations on them. Also, power dynamics in data collecting can be influenced by the type of relationship that exists between researchers and participants. Research partnerships with asymmetrical roles, like those between a teacher and a student, may give rise to unequal power dynamics that could affect participants' willingness to share information or voice divergent opinions.

In my research project, I experienced firsthand the problem of power imbalance between the interview subjects and the researcher because in addition to conducting the interviews, I also serve as the interviewees' teacher. Focus groups were then utilised to lessen this bias. Focus groups were also conducted with my former students from the previous year, whom I no longer teach. Employing an interviewer with no personal connection to the participants was another element that was tested.

6. Results

Currently, my primary findings indicate the need for more customised learning environments and a teaching style that encourages the acquisition of contemporary skills, improved communication between

students and programme mentors and a closer partnership between stakeholders and educational institutions. The complex issue of cultural disparities among staff members, clients, and students is also coming to light. The study examines possible remedies for these issues. Challenges include trust and respect for diverse attitudes and beliefs, and difficulties in communication and interpretation, all these potentially affecting care standards. The findings from the preliminary assessment of the literature and my experience both as a lecturer and as a former student doing placements complemented the participants' views, feelings, and reflective thoughts. I used the Strauss and Corbin (2015) paradigm by keeping an eye out for occurrences and happenings (contextual conditions), examining how the participants give meaning to these occurrences (actions and reactions), and then identifying the repercussions (consequences and outcomes). The matrix in figure 1 depicts the conditions which might influence the action interaction of participants that are impacted by the consequences derived by these conditions.

Contextual conditions: Participants discussed their views and challenges on study placements, highlighting the impact of contextual conditions such as work, personal characteristics and MCAST and teachers' management on the experience.

Actions and Reactions: Placement situations involve various behaviors and responses from individuals and organizations, depending on objectives, assumptions, and dynamics. Students, stakeholders, and educational institutions may act differently.

Consequences and Outcomes: Placement environments can have positive or negative effects on participants and companies. Negative effects include job dissatisfaction due to limited skill development and staff assistance. Benefits include recommendations and personal growth.

Figure 1. The interrelationships between the three constructs and their categories.

Contextual conditions

1. Research participants' issues and characteristics

2. Placement characteristics

3. Professionals within the industry and within higher education (MCAST)

4. Barriers to a successful placement experience

Actions and Reactions

1. School interventions

2. Teachers' interventions

3. Stakeholder's interventions

4. Addressing needs and preferences

5. Students' behaviour

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Consequences and Outcomes

1. Personal level

2. Professional level

3. Solutions to barriers

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SCREENING FOR DIFFICULTIES IN MATHEMATICAL LEARNING: ELABORATION AND PILOT STUDY

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Abstract

In Brazil, there are few studies describing early identification and intervention of difficulties in mathematical learning. Objectives: To develop a screening process to identify the difficulties in mathematical skills in students in early school grades and verify the applicability of a pilot plan. Methods: from a bibliographical survey, 8 mathematical skills were selected based on the Triple Code Model in order to create the screening process composed by number sense skills, number line, position value, addition, subtraction, multiplication, division and problem-solving. The screening process was elaborated to be applied in four 45-minute sessions, twice a week during class period collectively. 51 students in early school grades at a public school in Sao Paulo city, Brazil, took part in the pilot study. The study showed the necessity to reduce the number of skills to 5 numerical sense, numerical line, positional value, addition and subtraction. This reduction occurred due to the observation of the necessity to first develop the basic knowledge related to addition and subtraction in students in early school grades. Conclusion: The adjustments made based on the results of the pilot plan will enable the screening process application to identify the mathematical skills in students in early school grades.

Keywords: Learning, tracking, skills.

1. Introduction

Every student need and deserves to have knowledge, comprehension and competency to be able to acquire mathematical learning. However, many students show difficulties in mathematical learning according to data presented in the Results Report of National System of Basic Education Evaluation (SAEB) in 2019 (National Institution of Study and Educational Research Anisio Teixeira (Powell & Fuchs, 2015).

The early identification of these mathematical difficulties may detect students who need educational support or intervention before the learning difficulties occur (Jordan, Kaplan, Locuniak & Ramineni, 2007). This early identification can be done through a diagnostic of mathematical skills which helps teachers identify the strong and weak points in students and the comprehension of these weaknesses enables teachers to identify and adjust one or more intervention programs that address the difficulties the student presents (Powell & Fuchs, 2015).

Those difficulties may involve one or more areas in Mathematics due to cognitive deficits, inadequate instructions, or a combination of factors (Geary, 2004). Studies have shown that students participating in high quality preventive programs have obtained positive impacts in development and these benefits extend to academic, sociability and employability aspects (Carneiro & Heckman, 2003; Butterworth, 2005).

One of the most cited preventive programs in literature is the Response to Intervention Model (RTI) that also provides early interventions in levels to students at risk of academic failure (Fuchs & Fuchs, 2006). The RTI model is a multilayer system, divided in 3 levels, or three layers: Level 1 is a universal screening of difficulties in students, and it is performed by everyone in the classroom. Level 2 is composed by students that showed low performance in Level 1, identified as students at risk for academic learning and in this phase, they start to receive specific, progressive and effective interventions in small groups giving the students the opportunity to develop academic knowledge. Level 3 is for students who don't respond to the intervention in level 2 and need an individual intervention, this time in clinical

context, and the risk being confirmed, they are referred to an interdisciplinary team for the confirmation or exclusion of the diagnostic (Andrade, Andrade & Capellini, 2014; Fuchs & Fuchs, 2006).

Therefore, this study is justified by the fact that there is still a gap in studies regarding the respond to intervention program with mathematical skills in Brazil, as well as the lack of effective instruments for identification and intervention in students at risk of problems in mathematical learning. This way, the objective of this study was to elaborate a screening process to identify difficulties in mathematical skills in students in early school grades and verify the applicability of a study pilot.

2. Methods

This study was approved by the committee for Ethics in Research of the University of Philosophy and Sciences – FFC/UNESO – Marília – SP (number CAAE 40514615.8.0000.5406). As procedure, bibliographical research was conducted regarding the theoretical basis to elaborate a screening process to identify difficulties in mathematical skills in students in early school grades.

The databases consulted to elaborate the screening were Pubmed/MEDLINE, SciELO *and ERIC* and the descriptors selected were listed in the vocabulary indexing of Health Sciences Descriptors, in both Portuguese and English languages combining two terms: Response to Intervention” OR “Remedial Teaching” OR “Remedial teachings” OR “Teaching Remedial” OR “Teachings, Remedial”) AND (Math OR Mathematic OR Arithmetic) and 399 studies were located.

The pilot study was carried out with the aim of verifying the applicability of the screening elaborated with 51 regularly enrolled students in early grades at a public school in São Paulo, Brazil. The screening was applied to all students in early school grades, in four 45-minute sessions, twice a week during class period collectively.

3. Results

In Table 1 we can see the skills that composed the protocol for screening difficulties in mathematical skills composed of 8 abilities: number sense, number line, position value, addition, subtraction, multiplication, division, and problem-solving.

The number sense was composed of 11 tasks and each task was composed of 5 activities; the number line, position value and problem-solving skills were composed of 1 task with 5 activities each; addition, subtraction, multiplication, and division tasks were composed of 2 tasks each, with 5 proposed activities.

Table 1. Distribution of skills, tasks and activities per school year.

SKILLS	TASKS	ACTIVITIES	1st year	2nd year
Number Sense	Magnitude	More points, less points,	x	x
	Cardinality	Correct quantity of objects	x	x
	Ordinality	Position of an object in a conjunct	x	x
	Comparison	Difference in a category	x	x
	Length Measurement	Length	x	x
	Volume Measurement	Volume	x	x
	One to One Correspondence	One to One correspondence		
	Estimate	Approximate quantity without counting	x	x
	Image-Symbol Transposition	Image-Symbol	x	x
	Symbol-Image Transposition	Symbol-Image	x	x
	Verbal number	Name Number	x	x
Number Line	Number Sequence	Number Line	x	x
Position Value	Position - Value	Hundred/Ten/Unity		x
Addition	Addition - Concrete Addition - Operations	Concrete - Operations	x	x
Subtraction	Subtraction – Concrete Subtraction - Operations	Concrete - Operations	x	x
Multiplication	Multiplication - Concrete Multiplication - Operations	Concrete - Operations		x
Division	Division - Concrete Division - Operations	Concrete - Operations		x
Problem-Solving	Problem-solving	Problem-solving involving simple addition and subtraction	x	x

In relation to the implementation of the pilot study, it was possible to observe that the students did not present any difficulties regarding the instructions, and performed the tasks with good

understanding. However, the apllication of the screening protocol revealed the necessity to reduce the number of skills. Therefore, the screening protocol was reformulated, now having 5 tests tasks: number sense (magnitude/verbal/arabic transposition); number line, position value, Addition and subtraction. The protocol reformulation was necessary due to the fact that the multiplication, division and problem-solving tasks required more cognitive and learning demands which the students in early school grades don't master.

4. Discussion

Fuchs and Fuchs (2006) considered the necessity of screening tools with reference standards for early evaluation and identification of students at risk for any type of learning difficulties. According literature (Andrade, Andrade & Capellini, 2014; Fuchs & Fuchs, 2006), two components are important for choosing a screening to identify difficulties: the ability to measure the students' responsiviness to instruction and the student's non-responsiviness to the stimuli applied in the screening.

Therefore, the importance of the screenings is to identify safely, quickly and at a low cost which skills measure the students' performance identifying the risk of learning difficulties, more specifically in this study, the difficulties in developing mathematical skills.

Thus, the results of this study showed that the need for adjustments to the screening protocol for the mathematical difficulties elaborated in this study, based on the results of the pilot study, made the protocol more robust for investigating the mastery of basic knowledge related to addition, subtraction and, thus, capable of identifying students at risk for mathematical learning in early school grades.

These studies will be conducted to define the reference standard for the population of this study, so that this screening protocol will be able to be used for an early identification of difficulties in the development of mathematical skills.

5. Conclusion

The results of these studies allowed us to conclude that it was possible to develop a screening protocol through the Response to Intervention Model (RTI) based on bibliographical research considering the main mathematical skills to identify students in the early school grades at risk of mathematical difficulties.

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VIRTUAL PRESENTATIONS

INVESTIGATING THE IMPACT OF GAMMA-TUTOR ON THE DEVELOPMENT OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE IN CHEMISTRY TEACHING FOR SCIENCE TEACHERS

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Abstract

Numerous studies have examined teachers' Pedagogical Content Knowledge (PCK) at a topic level in various subjects, particularly in mathematics and science, drawing on frameworks like Shulman's PCK and Mishra and Koehler's TPACK. However, limited research addresses the professional development needs of physical science teachers regarding TSPCK development for post-COVID-19 teaching. This study focuses on South African curriculum reforms, emphasizing the integration of technology in teaching. It investigates the impact of Gamma-Tutor, an educational tool, on TPACK development among chemistry teachers, employing a mixed-methods approach with 20 participants. Quantitative assessments track changes in TPACK, while qualitative data from observations enrich understanding. Quantitative measures involve pre- and post-Cluster-Based professional development designed to gauge the baseline TPACK of participating teachers and track changes over the intervention period. Statistical analyses, including paired samples t-tests, are applied to discern patterns and trends in TPACK development. Concurrently, qualitative data is collected through classroom observations providing a deeper understanding of teachers' experiences, challenges, and perceptions related to Gamma-Tutor integration. Thematic analysis is utilized to extract key themes from the qualitative data, enriching the narrative. Results indicate improved pedagogical strategies and student engagement with Gamma-Tutor integration, suggesting its potential to enhance teaching practices and student achievement. This study underscores the importance of effective technology integration in enhancing pedagogical content knowledge, particularly in stoichiometry teaching, offering insights for educators and policymakers.

Keywords: Gamma-tutor, technological pedagogical content knowledge, stoichiometry teaching, science teachers, cluster-based professional development.

1. Introduction

In contemporary society, the utilization of science and technology is pivotal for the advancement of both industrialized nations and developing countries (UNESCO, 2010). Technology, as an integral part of modern life, plays a crucial role in shaping societal norms and transforming educational practices, including science teaching and learning (Campbell et al., 2015). The incorporation of technology in education has garnered increasing attention due to its potential to revolutionize traditional teaching methods and enhance student engagement and learning outcomes. However, despite the widespread adoption of technology in educational settings, there remains a gap in understanding its impact on teaching practices. This is problematic because it is impossible to employ explicit teaching strategies without their competency of the various aspects of teaching with technology (Hilton et al., 2016).

Moreover, the pedagogical knowledge possessed by experienced science teachers is instrumental in effectively delivering complex scientific concepts such as stoichiometry. Pedagogical Content Knowledge (PCK), as conceptualized by Shulman (1987), emphasizes the integration of subject matter expertise with pedagogical approaches tailored to specific topics. In the context of stoichiometry teaching, this specialized knowledge, termed Topic-Specific Pedagogical Content Knowledge (TSPCK), encompasses various components crucial for effective instruction.

The emergence of the Technological Pedagogical and Content Knowledge (TPACK) framework by (Mishra and Koehler, 2006) underscores the importance of integrating technology into teaching practices. TPACK highlights the synergy between content knowledge, pedagogy, and technology,

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emphasizing the need for teachers to adeptly navigate these domains. However, research examining teachers' TPACK in stoichiometry teaching, particularly concerning Gamma-Tutor integration, remains limited. This paper investigates the impact of Gamma-Tutor, an innovative technological tool, on the development of TPACK in stoichiometry teaching for science teachers.

2. Research question

The research questions guiding this study is: "To what extent does the integration of Gamma-Tutor contribute to the development of in-service physical sciences teachers' TPACK for effective stoichiometry teaching?"

3. Research objectives

This paper aims to explore the impact of Gamma-Tutor on the development of Technological Pedagogical Content Knowledge in stoichiometry teaching.

4. Literature review

The importance of stoichiometry education has been recognized on a global scale, highlighting the necessity for effective instructional strategies to improve students' grasp of quantitative chemical concepts (Taber, 2017). Incorporating models and representations into stoichiometry instruction, spanning macroscopic, sub-microscopic, and symbolic levels, has been identified as a key facilitator of meaningful learning engagement and conceptual understanding (Tang & Abraham, 2016). However, learners often struggle with connecting visual and conceptual representations, leading to misconceptions and learning obstacles (Al-Balushi & Al-Hajri, 2014).

In the realm of education, there has been ongoing debate regarding the integration of technological tools into daily teaching practices (Boateng et al., 2022). Abboud and Rogalski (2017) argue that technological tools can significantly influence learners' attention, motivation, autonomy, and academic achievement. Tools like Gamma-Tutor hold promise in supporting teachers' adoption of reformed-based science instructional practices (Yurtseven Avci, O'Dwyer & Lawson, 2020). Suh and Park (2017) further contend that teachers are at the forefront of bringing about change and innovation in education. To integrate technology into teaching, teachers need not only to acquire computer literacy, but they need TPACK and skills to be able to navigate through the Gamma-Tutor tool to make chemistry concepts accessible and understandable to learners. Bell et al., (2013) concludes the debate by stating that despite challenges such as teacher confidence with technology and inadequate professional development support, integrating technology into teaching shows potential for enhancing student outcomes.

By focusing on teachers' development of Technological Pedagogical Content Knowledge (TPACK) for specific topics, researchers can gain valuable insights into effective methods of integrating technology into teaching practices and enhancing Pedagogical Content Knowledge (PCK). TPACK recognizes the dynamic nature of teaching and underscores the importance of ongoing professional development. Therefore, examining TPACK development for specific topics can help identify effective professional development strategies to assist teachers in integrating technology into their teaching practices, particularly in the context of the fourth industrial revolution.

5. Theoretical framework

Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) underscores the importance of teachers' specialized knowledge in teaching specific content areas. In the terms of Carlson et al., (2019), the first realm refers to PCK acquired in a formal course where public and published knowledge about PCK is discussed, referred to as collective PCK. The PCK at a personal level, demonstrated through planning to teach as PCK in planning (plPCK), and in classroom teaching as the enacted PCK (ePCK). This study has a special focus on the topic-specific grain of PCK acquired through collective PCK. We track how the demonstrated plPCK is translated to the ePCK dimension. As mentioned earlier, the key competence in demonstrating acquired TSPCK lies in the manifestation of the reasoned 'knowing what to do' through planning for teaching, and 'doing what you know' in classroom enactment, drawing on the different content-specific components of the construct in an interactive manner. Thus, evidence for TSPCK components interaction is key in this study. It is the succinct feature consistently targeted in tracking the journey of in-service teachers' TSPCK across the planning–enactment settings.

The Technological Pedagogical and Content Knowledge (TPACK) model, developed by Mishra and Koehler (2006), an extension of Shulman's framework, emphasizes the integration of technology into teaching practices. Consistently, Santos and Castro (2021) state that TPACK recognizes the integral role

of technology in effective teaching and proposes that teachers need a combination of content, pedagogical, and technological knowledge.

6. Research methodology

This study adopted a congruent mixed-methods (CMM) approach, incorporating quantitative and qualitative data collection and analysis techniques. As Boateng et al. (2022) asserts, understanding in-service physical science teachers' professional knowledge bases require multiple sources of knowledge, including experiential, epistemological, and ontological views. The CMM approach appeals to those at the forefront of new research procedures, as it offers a sophisticated and complex approach. Moreover, it can be useful in situations where a small group's thinking differs significantly from that of the majority, as CMM design provides a better understanding of the research problem than either approach alone (Poth, 2018). Data collection methods included Class Observation Checklist and teacher responses. In addition, participants' biographies were also of interest in this study as these had been identified in other researchers as factors contributing to TPACK development among in-service teachers and their eagerness to participate in professional development that involves technology in rural contexts. Since we were interested in comparing observations before and after the professional development intervention, we used inferential statistics. In this case the statistical test deemed appropriate for paired observations (i.e., each teacher observed before and after the intervention), was a paired samples t-test. Furthermore, themes were developed for qualitative data analysis.

The population involved all in-service physical sciences teachers participating in the Cluster-Based professional development (CBPD) program in the OR Tambo Inland district, Eastern Cape Province, South Africa. The participants were selected using purposive sampling. This technique involves deliberately choosing participants based on their qualities being relevant to the study (Etikan et al., 2016). This sampling technique was suitable for this study because it helped decide what needed to be known and to identify information-rich cases (Etikan et al., 2016). A total of twenty participants who participated in the CBPD program were visited several times to collect the necessary data through Class observations, of which data from these educators are presented in this study. Due to their exposure and experiential knowledge, participants could "communicate experiences and opinions in an articulate, expressive, and reflective manner" (Etikan et al., 2016, p. 2).

A Classroom Observation tool was adapted from Center for Community College Student Engagement (CCCSE). Triangulation, the process of comparing data from multiple sources or methods, enhances the validity and reliability of research findings. By employing the Concurrent Triangulation design, researchers can triangulate qualitative and quantitative data, ensuring convergence and corroborating the results. The use of multiple data sources provides a more comprehensive understanding of the research topic, while also mitigating potential biases and limitations associated with individual methods.

Quantitative data were analysed through a statistical paired samples t-test. The statistical measures employed, including mean differences, standard deviations, t-values, degrees of freedom, and p-values, offer insights into the nature and significance of these differences. The qualitative data collected from teachers' comments were transcribed and responses from the participants were coded and developed into potential themes. The findings highlight the themes that emerged from the data, which helped answer the objective of this study. In our presentation of findings, we emphasize the relevance of the model (Mokhele, 2013) to the key findings as a justification for the educators' perceptions of the teacher-led cluster programs within the South African setting.

With regards to ethical considerations, Lichtman (2023) asserts that permission should be sought from all relevant participants and informed consent forms signed to validate the participants' willingness to participate in the study. After the findings were finalized, they were sent back to the participants to check for authenticity. Participants were consulted before any document for publication was submitted. Silverman (2011) emphasized the need for anonymity requirement even when not dealing with matters that seem to be particularly delicate or intimate. The study used pseudonyms as adherence to anonymity and in line with ethical standards for reporting empirical findings.

7. Results and discussions

7.1. Quantitative results

These results indicate significant differences between the observed teacher behaviours during Pre and Post CBPD classroom visits in all four paired categories, as evidenced by the very low p-values (< 0.05). The negative mean differences in Pairs 1, 2, and 3 suggest that post-CBPD tends to be lower than pre-CBPD, while the positive mean difference in Pair 4 suggests that post-CBPD tends to be higher than

pre-CBPD. In summary, the results of the paired samples t-tests indicate that there are systematic and statistically significant differences between Pre-CBPD and Post-CBPD across all four pairs. The direction of these differences (negative or positive mean differences) provides insights into the nature of the changes observed between the samples.

Findings from the study highlight the impact of Gamma-Tutor on teachers' TPACK development and its influence on classroom practices. Themes emerging from the data underscore the significance of ongoing professional development and technology integration in stoichiometry teaching.

Table 1. Inferential Statistical Analysis of the quantitative results.

Paired Samples Test

| | | Paired Differences | | | | | | | Significance | |
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | t | df | One-Sided p | Two-Sided p |
					Lower	Upper				
Pair 1	CompletelyT1 - CompletelyT2	-15,381	2,578	,563	-16,555	-14,207	-27,338	20	<,001	<,001
Pair 2	AdequatelyT1 - AdequatelyT2	-1,190	,981	,214	-1,637	-,744	-5,562	20	<,001	<,001
Pair 3	MinimallyT1 - MinimallyT2	,857	1,108	,242	,353	1,362	3,544	20	,001	,002
Pair 4	NotatallT1 - NotatallT2	15,571	2,461	,537	14,451	16,692	28,994	20	<,001	<,001

7.2. Qualitative results

Table 2. Categories and themes developed from the in-service teachers' responses.

Category	Themes
1. Classroom Learning Organization and Management	Active learning
2. Topic-Specific Pedagogical Content Knowledge of Stoichiometry	Lesson planning and presentation
3. Integration of Educational Technologies and Teaching Style	Teaching resources

Participants were requested to write some comments under each of the categories in Table 2. Emerging from the participants' responses, themes were drawn as in Table 2.

Active Learning: Most teachers' comments pointed out that before the CBPD intervention, learners were more passive during the lessons, and they performed very low in the science's paper two assessments as stoichiometric concepts appeared in most questions. For example, Teacher 14 stated, "*I have been a Physical Sciences teacher since Outcomes Based Education was introduced in the South African Curriculum and a learners' participation has always been a challenge, especially in stoichiometric calculations.*" On lesson planning and presentation, Teacher 7 stated, "*I have always found it very difficult to plan and present stoichiometric related concepts but after the professional development, I can plan and present the stoichiometric concepts more confidently.*" On teaching resources, Teacher 18 stated, "*Teaching chemistry through Gamma-Tutor has provided my learners with all more science resources including videos, tests, worksheets and a lot more.*"

8. Summary

This paper provides insights into the role of Gamma-Tutor in enhancing TPACK development in stoichiometry teaching. It underscores the importance of integrating technology into teaching practices to improve student learning outcomes.

9. Conclusions

In conclusion, this research contributes to the understanding of how Gamma-Tutor influences TPACK development in stoichiometry teaching. It highlights the need for continued research and professional development initiatives aimed at enhancing teachers' technological pedagogical content knowledge for effective science instruction.

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EMOTIONAL REGULATION – A TRAINING PROGRAM FOR TEACHERS

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Abstract

The contribution is aimed at development of a training program for teachers focused on the adoption, implementation and evaluation methodology to improve interpersonal communication skills, the development of emotion regulation and resilience. In the theoretical section it explains the concepts of emotion, emotion regulation, social skills and communication, resilience, and their relevance to the profession of the educator. In the application section we have designed the training program. The plan is elaborated in detail according to the content of the topics of each hour. The overall scope of the program is 120 hours. The themes from the method are listed in the practical part of the program which is designed in a range of 48 hours. The training program is developed for the purpose of continuous training of educators in the form of presentational.

Keywords: Emotion regulation, interpersonal competence, resilience, training of educators.

1. Introduction

Perceiving emotions and thinking about them is essential for emotional regulation. Emotion regulation is aimed at maintaining, strengthening, or suppressing emotions and their expression. If emotions are excessively suppressed, a certain emptiness and distance is created. Conversely, if they get out of control and are exaggerated, they can become morbid and bothersome. The ability to keep emotions under control is the key to a satisfying emotional life. Emotion regulation is the process by which an individual influences what emotions he will have, how he will experience and express them. With the help of emotion regulation, it is possible to achieve that a person remains calm in stressful situations, knows how to defend himself against feelings of fear and quickly regenerates after negative feelings.

According to Schultz and Roberts (2007), self-regulation can be perceived as a form of problem solving with the aim of mitigating the difference between reality and the target value of a given internal state. In this case, self-regulatory activities aim at changing the current emotional state to the target state. According to Martinčeková (2012), the main components of self-regulation are:

• Reliability – the ability to observe the basic rules of decency.
• Conscientiousness – the ability to take responsibility for one's own behavior and performance.
• Adaptability – the ability to adapt to changes.
• Innovativeness – the ability to accept innovations well and come up with new ideas yourself.

Self-regulation is based on the knowledge that people are able to direct their own feelings and internal processes. They can thus learn to handle emotionally tense situations. According to Marman & Jurášek (2014), we can point to three key areas that need to be developed: 1. Get rid of your fear. 2. Promote your strengths. 3. Be more receptive every day.

It is good to know the influence of a specific emotional experience on motivation and will, on achieving success, for example, how positive and negative emotions affect the way of thinking and the way of solving problems. If he can recognize his own feelings, define his needs and set goals, he can work better with his emotions.

1.1. Emotional regulation strategies

Emotional regulation strategies relate to the experience of emotions and are focused either on the prerequisites for the emergence of emotions or on the manifestations of emotions themselves (Garnefski & Kraaij, 2014) identified a total of 9 strategies for cognitive regulation of emotions – self-blame, acceptance, thinking, positive focus, planning, positive reappraisal, judging in context, catastrophizing and blaming others. When developing emotional regulation, it is necessary to focus on strengthening

strategies that positively affect our emotional experience. They are mainly acceptance, positive focus, assessment in context. A suitable strategy is to accept the inevitability of negative emotions and assess them in context, i.e., knowing that even negative emotions contain valuable information that can help a person to act effectively. Inappropriate strategies are, for example, passivity and self-blame, when the individual does not take into account his needs and experiences, or, on the contrary, aggression and blaming others, when the individual expresses his emotions without inhibitions verbally and non-verbally.

It is possible to regulate the experience of emotions and to reach the target state more easily with the help of training. Pletzer elaborated several methods of emotional regulation (Pletzer, 2009):

• visualization of the target state
• elimination of stereotypes and cancellation of bonds
• leaving the comfort zone
• registering negative feelings and activating positive ones
• imaginations evoking feelings
• judging from a distance, changing the point of view
• awareness of responsibility for your own feelings.

Emotional regulation in the profession of teachers significantly affects the educational and educational results of their work. On the one hand, there is self-regulation, when teachers consciously work with their own emotions, and on the other hand, they influence the emotional development and motivation of pupils and students. The goal of emotion regulation in educators should be the ability to direct their emotions so that they can better manage stressful situations, eliminate negative experiences, and be able to actively use emotions in the learning process. Perceiving other people's emotions and influencing them is an interpersonal competence in the construct of emotional intelligence.

1.2. Requirements for teacher competencies

School is an important socialization institution that fulfills four basic goals – educational, professional, social-civic and personal (Zeľová, 2007). The effectiveness of the teaching process is related to the characteristics of the learner, teacher, learning material and learning conditions. Emotions are naturally part of the educational process. Their sources are related to all aspects of school life, the learning process and relationships between teachers, students and parents (Zeľová, 2007).

All these areas can be a source of both positive and negative emotions. The predominance of positive emotions is likely to be reflected in the pupils' performance. As he further states, such pleasant emotions as joy, self-satisfaction, and satisfaction can be associated with success, mastering tasks and problems, recognition and appreciation from the teacher, and gaining the respect of classmates. The teacher has an irreplaceable role and responsibility in creating a pleasant emotional atmosphere in the classroom. Among the primary requirements placed on the teacher in the context of developing students' emotional intelligence are personal maturity, appropriate social competences, sensitivity and receptivity, the ability to accept individual peculiarities of students in the field of experience and behavior (Salbot, 2011).

An important element of a teacher's work is communication with parents of students. He should try to get the parents to cooperate. Gaining parents' trust and establishing good cooperation requires certain abilities, social and communication skills from the teacher. He encounters situations where family relationships are problematic and the child's behavior is negatively affected by them. He also meets parents who take a large part of the responsibility from the child on themselves, or who overestimate their child.

Sometimes parents behave inappropriately, aggressively, offensively. It is necessary to prepare for the meeting with the parents so that the teacher can argue objectively and create a friendly atmosphere. Training in verbal and non-verbal communication, which condition the effectiveness of the interview, can significantly help them in this. The third area is relationships with colleagues and superiors.

The teacher should contribute to a positive working atmosphere, support cooperation in the exchange of experience, provide and seek help if he needs it. Assertiveness, creativity and initiative will be significantly manifested in this area. Schulze and Roberts suggested that pre-service and continuing teacher education should include subjects that meet the needs of supporting the development of emotional intelligence in schools.

As stated by Schultze & Roberts (2007): educators need a wide repertoire of knowledge, methods and professional experience using emotional intelligence in learning and achievement situations. Emotional skills can contribute to improving the quality of cognitive functions and intellectual behavioral outputs, especially through the improvement of decision-making processes, self-management and stress regulation. The teachers themselves are aware of the importance of self-knowledge and self-reflection for the successful performance of the teaching profession and the necessity of improving communication skills.

2. Design and methods

Based on knowledge and theoretical studies, we have developed an educational program for teachers, focused on the adoption, implementation and evaluation of the methodology for improving interpersonal communication competences, developing emotional intelligence and resilience.

In the process of preparation, we approached teachers to find out their opinion on the importance of teacher preparation in the field of emotional intelligence competencies. It included a short, 4-question questionnaire, which we used to verify the assumption that the education of teaching staff in the field of emotional intelligence is important and insufficient.

The sample consisted of school teachers. A total of 98 teachers were approached. Answers could be recorded on a scale from 1 to 4 with values not at all (1), weak (2), average (3), very (4).

3. Objectives of the educational program

The main goal of the educational program is to acquire knowledge in the field of individual components of EI with an emphasis on self-regulation, interpersonal skills, understand them and improve professional competences so that graduates can apply them in pedagogical activities to develop their personality and the personality of their students.

This main goal is fulfilled by specific goals:

• To understand the essence and importance of emotionality for managing one's own way of life and achieving life satisfaction.

• Deepen self-knowledge, realize responsibility for one's own emotional experience and learn ways to support them in one's students.

• Improve the ability to manage anger, anxiety and fear.

• Understand motivation more deeply and use this knowledge to motivate students more effectively. • Increase the capacity for empathy in yourself and your students.

• To improve social perception, understanding of pupils' behavior and to be able to reveal their possible causes.

• Understand and respect the attitudes and opinions of other people, the ability to give and receive feedback.

• Improve non-verbal and verbal communication, presentation and negotiation skills.

• Know how to resolve conflicts and settle disputes more effectively.

• Understand group processes and know how to use them in practice.

• Be able to build trust and openness in interpersonal relationships, understand the importance of being able to provide help, as well as accept help, or ask for it.

• Know how to use acquired skills when innovating the educational process.

• Apply the basic principles of a healthy lifestyle in everyday life.

4. Results and conclusions

When designing the program, we placed a lot of emphasis on the practical side of the training, which is not yet sufficient in the psychological preparation of teachers. The thematic plan for the modules and suggested exercises are exemplary, the lecturer can modify or supplement them based on his own knowledge and experience. It is important to maintain the scope of the practical part and a certain playful form of exercises and teaching. The goal is for teachers to understand the individual components of emotional intelligence after completing supplementary education, and especially to be able to use them for the development of their students.

The program was compiled with an eye on the application of emotional intelligence in the teaching profession. The total scope of the program - 120 hours. Topics and methods in the practical part of the program are designed in the scope of 48 hours. We designed the program so that the individual modules build on each other and at the same time so that knowledge is expanded and consolidated through repetition. In the first part of the program, focused on intrapersonal competences, a significant part of the education is dedicated to self-awareness, self-regulation and resilience. Graduates will gain knowledge about how they can further develop these constructs, impulses and motivation for self-management. In the second part of the program, we focused on interpersonal competences and communication skills. Teachers will have the opportunity to compare the content of the lectures with their practical experience, as they use these skills in their work every day. The program should teach them to work efficiently, constructively and with interest.

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PUTTING THEORY AND PRACTICE TOGETHER IN PRESERVICE TEACHER TRAINING COURSES. IS IT POSSIBLE?

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Abstract

Practical training is an integral part of pre-service professional development and plays an important role in promoting awareness amongst preservice teachers, there is a realization as to the importance that theory plays in their practice. In the academic school year of 2022-2023, the Early Childhood Department at Kaye Academic College of Education in Israel created two innovative courses based on Theory and Practice (T&P) together. The courses are theoretical, based on a specific disciplinary topic, and include pedagogy practices that accompany the theory. The framework of the courses is composed of three parts; The first was theory-based lectures by college staff members that took place in the college, as synchronous and asynchronous classes. The second was an experimental component that consisted of mandatory tasks that were implemented in the preschools where practical training was performed. The third was in-service support and guidance by the lecturers of the courses while they worked with the preschoolers. The first course was a dialogue-based one, resting on the concept that it is the educator's responsibility to create classroom environments that will allow optimal and meaningful communication with children to meet their various developmental needs. Truly a challenging task since kindergarten teachers hold a traditional perception that dialogue is used to manage behavior and performance (Lyle, 2008). The second course dealt with early childhood geometry and promoted game-based teaching in length measurements, symmetry transformations, and bodies. The focus is on playing through experimentation, where meaningful learning is achieved while maximally adapting to the cognitive, social, and emotional developmental stages of the children including geometrical thinking (Van Hiele,1986). We will present results from 12 thematic analyses done with second and third-year preservice teachers' when asked to describe their professional development during these courses. The preservice teachers' chosen were of different academic capabilities ranging from moderately low, moderately high, and very high. Our findings show that they all experienced significant learning and a sense of security knowing that they had close personal guidance by the lecturers while interacting with the children. The importance of this study is to demonstrate that the combination of theoretical knowledge with practical pedagogy led to meaningful pre-service teacher training. In addition, the T&P courses proved to enhance a deeper sense of understanding that play and dialogue open opportunities to learn about the way children think and act.

Keywords: Training courses, theory and practice, game-based teaching, meaningful dialogue.

1. Introduction

In the academic school year of 2022-2023, the Early Childhood Department at Kaye Academic College of Education in Israel created two innovative courses based on Theory and Practice (T&P) together. The courses are theoretical, based on specific disciplinary topics, and include pedagogy practices that accompany the theory. The main goal was to study and demonstrate the importance of training pre-service teachers to combine their theoretical knowledge with practical pedagogy.

2. Theoretical review

2.1. What is a course based on Theory and Practice (T&P) together?

A course based on Theory and Practice (T&P) originated as a theoretical one. Its main goal is to bridge the gap between theory and practice to improve the relevance of the training program and develop a pedagogy adapted to the course. The practical knowledge acquired will provide a strong base for quality

training and the theoretical knowledge will develop as a response to the reflective thoughts of the participants (Korthagen, 2017).

In the T&P courses, *Dialogical Discourse Interactions with Children* and *Development of Geometric Thinking in Early Childhood*, there was an explicit connection between the field of knowledge, the syllabus, and the actual teaching of the course at the academy.

One of the main objectives of this research was devoted to understanding the experiences of the teachers while analyzing the assignments given that connect theory to practice, enabling them to be proactive learners.

In the courses, there was ongoing interaction with the lecturer aimed at learning the theoretical material and processing the experience. The interactions were synchronous or asynchronous and were unrelated to the day they were in the preschool. The lecturers arrived regularly throughout the academic semester at the preschools to observe the teacher's interaction with the children, making them mediators of theory into practice.

2.2. Professional development

Professional development for teachers starts upon their enrollment into training programs. After 4 years, they receive their bachelor's degree in education as well as their teacher's license. This is just the beginning of their professional development as they need to constantly continue learning and developing their teaching skills to meet the dynamic changes of time.

Professional teacher development is a combination of preservice and in-service education. The pre-service training programs vary in the length of their training. It has been shown that the best result is in four-year programs that specialize in the age group the teacher will teach in the school system. The number of years a teacher is enrolled in professional development training before being accredited leads them to establish a more positive classroom climate, where the teacher is more understanding and caring of the child's needs (Lee, 2018).

Early childhood educational programs that are geared towards understanding children's developmental stages, as well as developmentally appropriate practices, create quality child care (Copple & Bredekamp, 2009). Lepida & Veniopoulou (2015) claim that successful professional development in teachers is often seen as their ability to reflect on their work to assess their interactions and improve their pedagogy.

Teacher's perceptions, beliefs, and expectations of a child will determine the role they play upon entering the classroom (Chen et al., 2021). When a preschool teacher understands that their support and their ability to cultivate the children's social and emotional needs as well as their academic development will aid the transition into elementary school culture, they will have the desire to be the best they can (Rakap, Balikci, Kalkan, & Aydin, 2018)

When referring to a teacher's professional development, the knowledge they acquire will improve their teaching skills and their own personal social and emotional skills. These provide a foundation for ongoing learning and a strong sense of well-being which in turn will assist them in developing quality relationships with children. The social learning climate that the teacher provides will determine the quality of their interactions with children and their success in school. Therefore, they need to implement this knowledge into lesson planning, teaching pedagogy as well and social and emotional responsiveness to children (McNally & Slutsky, 2018).

2.3. Problem statement

Previous research in teacher education and internship has shown a wide gap between theory and practice. Faced with everyday challenges and multiple preservice teachers' needs, the theoretical knowledge acquired in colleges and universities seems insufficient for the demands a teacher is faced with in the classroom and the school system (Zeichner, 2010).

This discrepancy has been consistently described in teacher educational literature as the theory-practice gap (Korthagen, 2010; Shavelson, 2020). To successfully tackle this issue, higher educational institutions need to create strong connections between theoretical courses and internship experiences (Grossman et al., 2009).

3. Purpose of the study

To describe and demonstrate the importance of training pre-service teachers in the ability to combine their theoretical knowledge with practical pedagogy.

4. Research questions

How do preservice teachers describe their professional development acquired during T&P courses; *Dialogic Discourse Interactions with Children* and *Development of Geometric Thinking in Early Childhood?*

5. Research methods

The research methodology used is qualitative research. It is a research methodology that concentrates on understanding human beliefs, practices and values. This type of methodology is often used to enable a researcher to reach a deep understanding of a given phenomenon. The analysis of the detailed descriptions of a given problem of practice offers insight regarding professional practices within a given context (Lester, Cho, & Lochmiller, 2020).

6. Participants

The participants consisted of 12 Israeli preservice teachers in their second and third years of training in the Early Childhood Department at Kaye Academic College of Education. The academic capabilities of the preservice teachers ranged from moderately low to very high.

7. Research tools and data processing

The study is based on students' reflective writing and diaries kept throughout the courses. These were written descriptions of their experience and their thoughts on their professional development. The results presented are from 12 thematic analyses done with second and third-year preservice teachers' when asked to describe their professional development during the courses.

8. Findings

The analysis revealed three main themes in the teacher's reflective thoughts on professional development as they appeared in their reflective diaries.
1. The ability to reflect on their work to assess their interactions and improve their pedagogy;
2. The understanding that children's developmental stages and development-appropriate practices create quality childcare;
3. The importance of responding to children's social and emotional needs.

8.1. An example of the first theme*: The ability to reflect on their work to assess interactions and improve their pedagogy*

E.: "During the conversation with the girl, I felt that I needed to pause before responding and not directly ask another question or reinforce what she says. At the beginning of the conversation, I said to her: *tell me something about yourself and I will tell you something about myself*, but at the end of the conversation I noticed that I didn't tell her anything about myself. In my opinion, that created a lack of trust and perhaps disappointment on her part because she wanted to hear something about me. It is important to pay attention to this in future conversations and prevent it." In this quote, E. begins to understand that to create meaningful dialogue and improve her classroom interactions, it is essential to create symmetrical discourse, as it has a positive effect on the sense of security and well-being of both herself and the child (Strickland & Marinak, 2016).

L.: "When the children in the kindergarten began measuring in different ways the length of the pipes, they had to create a gas station stand in the yard, I noticed that they had the ability to work on their own without my intervention as to possible solutions to their problem. Just being there, mediating, when necessary, gave them confidence to continue on their own. I am slowly realizing that they can solve their problems in creative ways if they are just given the opportunity. Teachers need to be there to mediate but not make the decisions." The reflections of L. help understand that she came to the realization, as Van Hiele (1999) claims that to achieve optimal progress, mediation by the adult is important which helps the child better understand what is required of him and the actions he performs concerning length measurements.

8.2. An Example of the Second Theme: The Understanding that Children's Developmental Stages and Development-Appropriate Practices Create Quality Childcare

D.: "I felt that M., was interested in talking to me and was open to asking me questions about *my* personal life. I found that she reached a stage where her language is developed enough to carry on a symmetrical conversation. She was also able to take an interest in others as she was not in the egocentric stage anymore. She told me that she likes to go on trips with her aunts and then turned to me and asked: *"Do you have any aunts?"* I enjoyed talking to her, getting to know her better, and having a pleasant and respectful conversation with her. It is important for me as a future kindergarten teacher to create quality relationships that are based on friendly and emotional dialogue with children. To improve the conversation, I think it is important to always give the child the option to lead the conversation and the teacher needs to know when she should ask follow-up questions or wait to hear what the child wants to reveal. I am glad that I was able to see how her developmental abilities enabled her to be a meaningful part of the dialogue" The reflective thoughts of D. show that she believes that to promote personal discourse, the teacher should foster a supportive environment, and follow the children's interests and developmental needs. This requires providing dialogical spaces that will allow children to make their voices heard and express their thoughts and experiences (Strickland& Marinak, 2016).

Li.: "My lesson plan included a walking tour in the yard to find geometrical bodies, I noticed that during the planning phase, I had difficulties coming up with riddles and activities that would suit the children's age and developmental stage. I realized that it is important to take into account the children's prior knowledge and personal interests. During the tour, I encouraged the children to share their thoughts and ideas about the various bodies and structures they found. This allowed them to process their learning and make connections between the current tour and their prior knowledge of the topic. This enabled me to adjust my teaching accordingly." Li's reflections on the planning stage as well as the actual activity is directly related to the term, "experimental learning" as Alexander (2015) describes. This is an educational approach that incorporates children's experiences through active play and their ability to understand concepts and generalize principles from past experiences. This is an ability related to developmental stages of thinking and the student here, understood that and designed her lesson plan accordingly.

8.3. An example of the third theme: The importance of responding to children's social and emotional needs

A.: "After the conversation with S, I had a few insights. First, I feel that I managed to create a safe open space for him to lead the conversation. The more I kept quiet, the more S. filled that space with personal stories of his experiences. Secondly, as the dialogue continued, I became aware of the child's imagination, and his desire to share his thoughts and feelings. An example of this can be seen in the following quote. S: *"When the butterfly's wing broke, I gave him another one instead so that he can fly".* When I heard that, I realized what compassion S. had for the butterfly and through his imagination, found a solution that will enable the butterfly to fly again. Thirdly, I need to keep learning on how to improve my ability to let children speak as they wish, without being judgmental. I need to practice holding back my immediate desire to respond and teach him what happens when a butterfly loses a wing. This will only damage my dialogic interaction with the child" In A.'s reflection she realizes that a positive dialogic environment can be created through providing an open space for the child to lead the conversation. She emphasizes the need to continue developing professionally to bridge the gap between theory and practice (Korthagen, 2010).

N.: "At the beginning of the activity I read the book "Anat" to the children, enabled the children a mediated experience as each child had their own mirror to practice symmetry as well as observe their peers performing similar actions. As the stages continued, the tasks became more challenging for them. To my surprise, I began seeing friendships being created as children started feeling a sense of security in the group and showed a desire to help each other. They discussed things they already knew and tried in incorporate new knowledge to problem solve. Through mutual play, they improved their social and emotional skills such as; cooperation, active listening, making concessions to each other, tolerance to other's needs, and self-restraint. It is important to note that through N.'s reflections, she understands as Rasmussen et al. (2020) claim that collaborative learning and being part of a group of peers, advances high-order thinking such as problem-solving and the construction of new knowledge. In addition, through play, they are developing their social skills, enabling them to take on these challenges together. (Schwarz et al., 2015).

9. Conclusion

Referring to the question of "How do preservice teachers describe their professional development acquired during two courses based on T&P together? Three main conclusions were attained as to promoting pre-service teachers' professional development:
a. Peer and lecturer feedback improves student's ability to reflect on their work with children with regard to assessing their interactions and improving their pedagogy for meaningful dialogue;

b. The more a pre-service teacher practices dialogic skills, there is a possibility to bridge the gap between theory and practice to create meaningful dialogue

c. Teachers need to foster a supportive environment, expressing sensitively while addressing children's interests, personal and developmental needs. This requires providing open discourse spaces that will allow children to make their voices heard and express their thoughts. This may help them respond better to children's social and emotional needs.

The significance of this study is to demonstrate the importance of training pre-service teachers in the ability to combine their theoretical knowledge with practical pedagogy. In addition, both T&P courses proved to enhance a deeper sense of understanding that through play and dialogue, opportunities to learn about the way children think and act are necessary to help them continue to develop to their fullest potential.

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MEETING STUDENTS' EXPECTATIONS: CULTURAL INSIGHTS FOR ENHANCED EDUCATIONAL PROGRAM MANAGEMENT

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Abstract

Meeting students' expectations is crucial for the success and effectiveness of educational programs, and incorporating cultural insights can significantly enhance program management. This research explores the relationship between cultural dimensions and the anticipated quality of educational services. The study, conducted in a specific educational program for prospective teachers by utilizing a non-probabilistic selection of 113 trainees, examines how various cultural dimensions impact their expectations regarding educational service quality. The main research hypothesis was that there is no relationship between the six EppekQual dimensions of educational service quality and Hofstede's five cultural dimensions in a specific training program for prospective teachers in Greece. Findings indicate significant correlations between specific cultural and educational service quality dimensions. Prospective teachers who prefer rejecting hierarchy exhibit elevated expectations, particularly in curriculum and learning outcomes, highlighting the need for personalized educational experiences. Those with a neutral stance on uncertainty and risk expect equal quality across all program dimensions, emphasizing the importance of a balance between clear guidelines and flexibility. Students with a realistic long-term orientation anticipate higher-quality learning outcomes, emphasizing cultivating future-oriented virtues. Surprisingly, an orientation toward feminine values positively influences service quality expectations, particularly in curriculum and learning outcomes. Collectivism also positively affects quality expectations, leading students to seek opportunities for personal development. These insights offer valuable managerial implications for educational program design targeting to optimize program quality and meet the expectations of prospective teachers.

Keywords: EppekQual, education management, student expectations, cultural values, service quality.

1. Introduction

One of the major challenges faced by educational executives is the effective management of available resources to provide educational services that meet the expectations of learners (Lynch et al., 2020; Madani, 2019). The need for efficient resource management leads to the adoption of specific strategies and tools from the administrative science that contribute to making more effective administrative decisions. However, these strategies should be aligned with the principles and the broader environmental context of the educational organization to contribute to the achievement of its goals (Day et al., 2020). Measuring the quality of services offered by an educational organization serves as an assessment tool for the satisfaction of learners' expectations, thus contributing to the effective management of the organization (Athanasiadis & Papadopoulou, 2023).

Shaping the expectations of participants in an educational program is a subjective matter and appears to be influenced by various factors. In the literature, it is evident that previous experiences (Rehman et al., 2022), advertising (Tan, Choong & Chen, 2022), and demographic characteristics of students statistically significantly influence their formation (Akareem & Hossain, 2016). Recent literature emphasizes the exploration of the relationship between cultural backgrounds and students' expectations of educational service quality and demonstrates that national cultural backgrounds have a significant impact on students' quality expectations (Gruber et al., 2011; Wang, 2018). However, there is limited research on the impact of individual culture on educational quality expectations.

This study investigates how the individual cultural backgrounds of prospective secondary education teachers in Greece, who are enrolled in a specific educational program, affect their expectations of educational service quality.

2. Literature review

Quality is determined by service users' expectations and perceptions encompassing student satisfaction as a key evaluation criterion. Various models assess service quality in the educational context. Among these, the EppekQual model assesses educational service quality in pedagogical training programs (Athanasiadis et al., 2023). Quality is assessed through the evaluation of six dimensions of the quality of educational services provided by an educational organization. These dimensions pertain to Academic Staff, Teaching Organization, Learning Outcomes, Administrative Services, Curriculum, and Support Services. Culture is defined at national and individual levels. Individual culture encompasses values, behaviours, and beliefs shaped by personal experiences and backgrounds (Kueh & Voon, 2007). Despite the criticism, Hofstede's model is the one utilized in various settings in measuring individual culture through five dimensions: Hierarchy/Authority, Individualism/Collectivism, Femininity/Masculinity, Uncertainty Avoidance, and Short-Term/Long-Term Orientation (Hofstede, 2011).

Most of the studies mainly focus on national culture's impact on international students. For example, Zhu and Sharp (2022) examined the influence of Chinese culture in shaping the international Chinese student quality expectation in a UK university and suggested caution when assuming that the 'service quality' of Higher Education can be comprehensively understood and efficiently improved from the student perspective alone. Similarly, Sultan and Wong (2014) showed that different cultures perceive service quality differently.

Limited research explores the influence of individual culture on quality expectations in the educational context by combining Hofstede's model with specific service quality models to find correlations between individual cultural characteristics and students' expectations of service quality in tertiary education. A study among these is that of Tsiligiris et al. (2022) who concluded that individual culture influences student service quality expectations in higher education as they indicate a large number of statistically significant correlations between the cultural dimensions and the service quality expectation items surveyed in the study.

Understanding how students form expectations regarding the quality of educational services in tertiary education provides significant information for the administration of the educational organization. This insight aids in the planning and effective delivery of educational programs. Such information contributes to ensuring the quality of inputs, processes, and outputs as part of the overall academic service system in tertiary institutions (Ali et al., 2020).

3. Materials and methods

This research investigates the relationship between EppekQual's six dimensions of educational service quality and Hofstede's five cultural dimensions in a specific pedagogical training program for prospective teachers in Greece. The main hypothesis of our research is that there is no relationship between Hofstede's cultural and EppekQual's dimensions based on trainees' expectations of educational service quality.

The specific program is an annual initiative independent of the candidates' primary studies. Its successful completion ensures the acquisition of essential pedagogical competence following the Greek law, thereby qualifying candidates for entry into the teaching profession. The program admits a total of 2000 students and is offered across 7 branches throughout Greece. For the sake of convenience, one branch was selected for this research, and evaluated based on the demographic characteristics of the students to ensure its representativeness for the entire program. The research involved the participation of 113 aspiring teacher candidates, constituting a participation rate of 56.5% of the total branch population. Within this participant group, 39.8% were male, and 60.2% were female.

Confirmatory factor analysis confirmed the structural validity of both scales. The reliability of the scales was assessed using Cronbach's alpha coefficient, demonstrating their reliability. In this research, the authors used an alternative form of Hofstede's cultural dimensions scale, consisting of five dimensions and twenty statements, to assess the individual cultural backgrounds of aspiring teacher candidates (Furrer et al., 2000). Participants rated these statements on a seven-point Likert scale (1: strongly disagree to 7: strongly agree), with higher scores indicating alignment with the right end of the polarity and lower scores indicating alignment with the left end.

To ensure the structural validity of both the cultural and EppekQual scales (used to measure educational service quality), the researchers conducted confirmatory factor analysis using IBM AMOS 22. The results indicated stability in the structure of both scales, Specifically, the comparative fit index (CFI) and the Root Mean Square Error of approximation (RMSEA) values were 0.886 and 0.077 for the EppekQual scale, and 0.767 and 0.079 for the cultural scale, just below the 0.08 threshold. Loadings on

the individual statements of the EppekQual scale ranged from 0.930 to 0.622, while for the cultural scale, they ranged from 0.874 to -0.299. While some statements in the Hofstede scale had loadings below 0.5, the researchers chose not to remove them, as doing so would improve fit indices but affect the scale's content validity. Multicollinearity among the dimensions of the Hofstede scale was assessed using the Variance Inflation Factor (VIF), and low correlations among the independent variables (VIF<1.6) ruled out multicollinearity issues.

Reliability was assessed using Cronbach's alpha coefficient, and the EppekQual scale scored 0.972, while the cultural scale scored 0.817, confirming the reliability of both scales since these measurements exceeded the 0.7 threshold. Statistical analysis methods included descriptive statistics and correlation analysis to investigate the relationship between individual cultural backgrounds and educational service quality expectations.

4. Results

The prospective teachers in the study exhibited tendencies towards rejecting hierarchy (M=2,72, SD=1,031) and individualism (M=3,84, SD=1,436). They also leaned more towards adopting feminine values (M=3,05, SD=0,906), avoiding uncertain situations and risks (M=3,91, SD=0,467), and having a future-oriented perspective (M=4,06, SD=0,461). Regarding the expected quality of educational services, the participants had very high expectations across all fields. Administrative Services (M=6,26, SD=0,847) and Learning Outcomes (M=6,22, SD=0,784) displayed the highest expected quality, while Support Services and Facilities (M=6,01, SD=1,007) had the lowest score of expectations among the others. High standard deviations indicated significant deviations in opinions from the mean.

The cultural dimension related to feminine/masculine values significantly influenced expectations among prospective teachers across all facets of program quality. Short-term/long-term orientation had a weak but significant impact on learning outcomes expectations. Individualism/collectivism and hierarchy rejection/acceptance negatively correlated with certain quality dimensions. Learners with a future-oriented cultural orientation expressed high expectations in specific quality statements related to pedagogical knowledge and administrative efficiency. Those averse to uncertain situations held high expectations for learning outcomes and administrative staff efficiency.

Table 1. Correlation table: EppekQual service quality vs Hofstede culture dimensions.

EppekQual Dimensions	Cultural Dimensions				
	LTO	UAI	MAS	IDV	PD
Academic Staff (ACS)			-,192[*]		
Curriculum (CUR)			-,336[**]	-,212[*]	-,313[**]
Suport Service Facilities (SSF)			-,193[*]		
Learning Objectives (LRO)	,187[*]		-,304[**]		-,286[**]
Administration Services (ADS)			-,264[**]		-,203[*]
Teaching Process (TGP)			-,206[*]		

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

5. Discussion

Our research has identified statistically significant correlations between various cultural dimensions and dimensions of educational service quality. Consequently, our initial hypothesis has been rejected. We observed a negative correlation between the dimension related to hierarchy acceptance/rejection and three out of the six dimensions of educational service quality. Importantly, this dimension did not exert a statistically significant influence on trainees' expectations regarding Academic Staff, Support Services and Facilities, and Teaching Processes. The partial negative correlation of this dimension with a subset of quality dimensions is supported by existing literature and other empirical studies (Furrer et al., 2000; Tsiligiris et al., 2021). Prospective teachers in our study tend to reject hierarchy, indicating an expectation for the Curriculum and Learning Outcomes to be customized to their needs, resulting in elevated expectations. Specifically, the statement evaluating trainees' expectations regarding the appropriateness of the program's purpose and objectives exhibited the highest correlation. We also noted a positive correlation between the dimension of acceptance/avoidance of uncertainty and all six dimensions of educational service quality, although it did not reach statistical significance. In our research, trainees maintain a neutral stance toward uncertain situations and risks, evaluating all

dimensions of educational program quality equally in their expectations. In contrast to our finding, Tsiligiris et al. (2021) concluded that uncertainty avoidance is positively and statistically significantly related to two service quality dimensions. Participants in our study adopt a realistic long-term perspective, resulting in high expectations for the quality of learning outcomes. Hofstede et al. (2011) state that a high long-term orientation represents the cultivation of virtues oriented towards future rewards (p. 240). The dimension of orientation toward feminine/masculine values exhibited statistically significant relationships with all dimensions of educational program quality, contrary to the corresponding finding of Kueh and Voon (2007). The dimension of Individualism/Collectivism was substantiated, showing a statistically significant association with the Curriculum dimension.

6. Conclusion

The effective management of an educational program particularly in the context of prospective teachers, requires a nuanced understanding of their needs and expectations (Athanasiadis et al, 2018). The findings from our research offer valuable insights into the effective management of an educational program when dealing with prospective teachers. To optimize the program's quality and meet the expectations of the participants, managers of the educational program should consider several implications. By recognizing the rejection of hierarchy among prospective teachers and their desire for personalized educational experiences they can adapt the curriculum and learning outcomes to align with individual needs and goals (Kubat, 2018). The program's purpose and objectives must be articulated and resonate with the expectations of trainees, as this dimension had a significant impact on their perceptions of quality (Dhamodharan et al., 2010). As we acknowledged that trainees maintain a neutral stance towards uncertain situations and risks, the educational program design ought to strike a balance between providing clear guidelines and fostering flexibility (Veness, 2010). Educational managers must avoid over-restrictive rules and regulations that may hinder creativity and adaptability in the learning process (Acar et al., 2019). In contrast they may leverage the inclination of participants towards a realistic long-term perspective by emphasizing the development of skills and knowledge that have long-term value, including employability (Scandurra et al., 2023) and academic excellence (Lerman, 2013). The impact of orientation toward feminine values on expectations of service quality, especially in the Curriculum and Learning Outcomes dimensions could encourage a supportive and inclusive learning atmosphere that values collaboration, empathy, and interpersonal skills (Kubat, 2018).

Incorporating these managerial implications into the design and management of an educational program can help create a learning environment that aligns with the cultural dimensions and expectations of prospective teachers. By recognizing and accommodating these cultural factors, educational institutions can enhance program quality and better prepare their students for successful careers in teaching.

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EVALUATION OF LEARNING OUTCOMES IN MASTERS DEGREE. THE PERCEPTION OF THE COORDINATORS

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Abstract

One of the main challenges that university professors have to face is evaluating the students' learning outcomes. The aim of this research is to identify different elements of the evaluation practices of the university master's degree in Social and Legal Sciences at the University of Oviedo (Spain) from the point of view of the people responsible for coordination. The research has been proposed as a survey study, through an in-depth and semi-structured individual interview, carried out through the Teams platform with seven coordinators of four master's degrees in Education and three in Economics. The qualitative analysis of the responses linked to the category analyzed in this communication, "evaluation", has followed an inductive procedure. 280 discursive fragments have been analyzed, emerging eleven subcategories: technology, participation, satisfaction, feedback, teacher training, coherence, coordinator training, purpose, means, evaluation tasks and instruments and tools. The results report that there is a lack of student participation in the evaluation processes in the master's subjects. Furthermore, the coordinators indicate that the feedback provided to students using technology is essential to contribute to their learning process. Likewise, they state that the evaluation is carried out through group work, which promotes skills linked to teamwork. All of them express the need for specific training on evaluation to be able to implement new strategies that improve the quality of evaluation practice. In conclusion, it should be noted that it is necessary to promote the participation of students in the evaluation processes to proceed with a paradigm shift that replaces the conception of evaluation as a verification of knowledge with the concept of evaluation as a tool for students to learn.

Keywords: Learning outcomes, evaluation, coordinators, perception, master degree.

1. Introduction and objectives

University teachers have many challenges to face. One of them is the assessment of the students' learning outcomes. Even today, evaluation is still understood as the mere verification of the level of knowledge achieved, so that it can be certified (learning evaluation). The evaluation must overcome this approach and even the one that maintains that the evaluation is carried out to learn (supported by the feedback that must be provided to the students), to consider evaluation as learning, understood as taking advantage of and relevant use of feedback to be able to apply what has been learned to other learning contexts and situations (Ibarra and Rodríguez, 2019).

The different legislation that comes from the European Higher Education Area and the National Agency for Quality Assessment and Accreditation (ANECA) in Spain shows, among other aspects, that the study plans of master's degrees must include detailed information on the competencies and evaluation systems to be used to evaluate student learning This aims to ensure that the training and skills level achieved by the students corresponds to what is established in the degree reports (Aneca, 2021).

This is the reason why learning outcomes take on special relevance in the articulation of study plans as indicated in laws and regulations. On the one hand, due to what is indicated in RD 822/2021, which establishes the organization of university education in Spain and, on the other hand, due to what the Qualifications Framework indicates regarding the definition of learning outcomes ("description of what people in the learning process should know, understand or be able to do at the end of a training cycle" (Aneca, 2022).

The definition of learning outcomes and the incorporation of students into evaluation systems require a significant conceptual rethinking of the term "evaluation" (Boud, 2020). Furthermore, the relevance of learning outcomes has been highlighted in the Incheon Declaration (UNESCO, 2015) and the

2030 Agenda for sustainable development (United Nations, 2015), among others. If at the end of the 20th century interest was focused on the validity and reliability of evaluation processes, today the challenge is on the sustainability and justice of evaluation as bases and objectives for educational excellence. This will only be possible if the evaluation provides all actors in the educational process with the relevant information necessary to make fair decisions that favor lifelong learning. Therefore, it will be necessary to incorporate innovations in the evaluation that is based on the principles of sustainability, in addition to ensuring its validity and reliability (Boud & Soler, 2016), justice (McArthur, 2019) and empowerment (Ibarra-Sáiz & Rodríguez-Gómez, 2020). In this context, the FLOASS Project (RTI2018-093630-B-I00) was designed. Its general objective is to analyze how the evaluation of learning outcomes is carried out in university master's degrees in social and legal sciences knowledge branch. The purpose is to design a framework of action for the evaluation of learning outcomes. This work is derived from that project, which focuses on identifying different elements of the evaluation in university master's degrees in Social and Legal Sciences at the University of Oviedo (Spain) from the point of view of the people responsible for their coordination.

2. Method

The research has been carried out at the University of Oviedo in order to know the state of the art of the evaluation of learning outcomes in university master's degrees in social and legal sciences. The research has been proposed as a survey study, through individual in-depth and semi-structured interviews with seven coordinators of four master's degrees in Education and three in Economics. (Table 1, collects the identifying data of the university master's degrees in Social and Legal Sciences that have been analyzed).

Table 1. Master's degrees in the Social and Legal Sciences of the University of Oviedo in the fields of Education and Economics.

Code	Master	Field
4315628	Master's Degree in Research and Innovation in Early Childhood and Primary Education	Education
4312885	Master's Degree in Integrated Teaching of English Language and Content: Early Childhood and Primary Education	Education
4310552	Master's Degree in Socio-educational Intervention and Research	Education
4310551	Master's Degree in Teacher Training for Compulsory Secondary Education, Baccalaureate and Vocational Training	Education
4312881	Master's Degree in Tourism Management and Planning	Economics
4315569	Master's Degree in Information Systems and Accounting Analysis	Economics
4312951	Master's Degree in Business Administration and Management	Economics

The interviews were carried out using MS-Teams, which allowed them to be recorded in audio and video. The interviews with the coordinators have focused on the aspects detailed in Table 2.

Table 2. Content of the interviews with coordinators.

Interview topics
Identification data
Concept and knowledge about evaluation
Coordination. Management of teaching guides
Evaluation: caracteristics
Student participation
Teacher training

To analyze the information collected, the recordings were transcribed with the responses and comments of the informants in an appropriate support for their coding. The transcripts and the rest of the information related to the people and each university master's degree were analyzed using the MAXQDA qualitative data analysis program (v.20). The qualitative analysis of the responses linked to the "Evaluation" category has followed an inductive procedure to analyze 280 discursive fragments. Eleven subcategories have emerged from the analysis: tecnology (TEC), participation (PAR), satisfaction (SAT), feedback (RET), teacher training (FPR), coherence (COH), coordinator training (FCO), purpose (FIN), products (MEV), evaluation tasks (TAE) and instruments and tools (IEV). Table 3 shows the profile of the informants.

Table 3. Characteristics of the informants.

Characteristics of the informants
7 interviewed (4 Education, 3 Economics)
6 women y 1 man
Experience average: 10 years
Coordination experience average: 5 years
Experience as a Master's teacher: 9 years

3. Results

The results shown focus on the "Evaluation" category, which accumulates 280 discursive fragments that have been organized into eleven subcategories following a thematic criterion (Table 4 and Graph 1).

Table 4. Discourse fragments analyzed in the subcategories that make up the "Evaluation" category.

	Discursive fragments	%
4.8. Tecnology (TEC)	65	21,81
4.6. Participation (PAR)	46	15,44
4.9. Satisfaction (SAT)	37	12,42
4.7. Feedback (RET)	33	11,07
4.2. Teacher training (FPR)	22	7,38
4.11. Coherence (COH)	21	7,05
4.1. Coordinator training (FCO)	20	6,71
4.10. Purpose (FIN)	18	6,04
4.4. Products (MEV)	18	6,04
4.3. Evaluation tasks (TAE)	13	4,36
4.5. Instruments and tools (IEV)	5	1,68

Graph 1. Percentage of discursive fragments analyzed in the "Evaluation" subcategories.
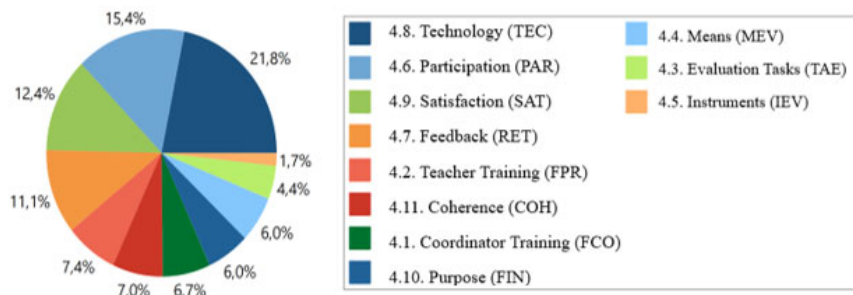
A lot of dispersion has been found in the comments in relation to the discursive fragments on "Evaluation". The highest percentage of comments refer to the use of technology in the evaluation process (21.81%). The coordinators say that it is necessary to incorporate digital tools for the monitoring and evaluation of students, as was done during the time of the Covid-19 pandemic. A lower percentage refers to the participation of students in the evaluation process (15.44%). Furthermore, the master's coordinators point out that students rarely participate in their own evaluation processes. Although they indicate that some teachers develop evaluation practices that actively involve students (self-assessments or peer evaluations). But basicly teachers are who carry out the evaluation of the learning and skills acquired by the students. The opinions and perceptions of the coordinators reflect the transparency of the evaluation process carried out by the teaching staff, but they demand time and space for students to get involved in these processes. "[…] Students must be involved, they must know what they are going to be evaluated on, it must be transparent, it must be clear, they must know what to expect. […]" (UNIOVI_EDU_M4310551_COORD_5).

However, another coordinator emphasizes that some strategies were already in use: "*Because there are indeed aspects that were already used before, but sometimes the immediacy with which we assess, for example, those oral presentations by students that are usually valued immediately by the*

teacher in the same way they occur, well, many times it gives us room for a more measured approach" (UNIOVI_EDU_M4312885_COORD_7). This allows, as one coordinator points out, the introduction of other assessment approaches: "*Even so that self-assessment processes can occur, the student can assess what they have done afterward; that peer assessment processes can occur*, [...]" (UNIOVI_EDU_M4312885_COORD_7).

Teacher and students satisfaction with the evaluative practices is another topic that arises in coordinator comments (12.42%). In connection with this, feedback accumulates 11.07% of the comments. Thus, coordinators express that students receive useful information for improving their learning outcomes at the end of an evaluation task (assignments, exams, classroom practices, etc.). They indicate that these processes reinforce student learning and promote their involvement in the subject's development. "*I consider feedback to be fundamental. It's a perception I have about assessment, [...]. The purpose is for that learning to be demonstrated through that feedback, and I do know that there are teachers who are implementing it.*" (UNIOVI_EDU_M4315628_2).

Regarding teacher and master coordinators' training, the comments (14.09) reflect the lack of training plans in evaluation by institutions, with teachers managing their own training. They believe that specific training will contribute to the improvement of evaluative practices, implementing new tools and assessment methods. "*Although the faculty, in general, is trained, I think current training, occasional refreshers, I think that would be good for everyone. In that sense, it wouldn't hurt if all of us occasionally took a training course to update ourselves. Especially, that, new strategies, new evaluation methodologies that might sound familiar but since we've never used them and they intimidate us a bit, we don't dive in, and maybe we're always staying a bit in the same place*" (UNIOVI_EDU_M4310552_COORD_6). A coordinator adds: "*I do think that more specific training on the evaluation of learning outcomes would be very beneficial for teachers*" (UNIOVI_EDU_M4315628_COORD_2).

About assessment tasks, resources, and instruments, 12.08% of the comments address the various activities that students undertake to achieve learning outcomes and the tools used by evaluators to systematize assessments. Coordinators emphasize the subcategory "Assignments," primarily carried out in groups to attain a competency (teamwork) highly demanded in the professional field and outlined in all program specifications. Only in some subjects are individual assignments given. This response aligns with their perception, based on their experience as program coordinators, that in all subjects, even when part of the assessment involves an exam, continuous assessment carries more weight. However, this is not without limitations, as sometimes students feel overwhelmed by the numerous assignments: "*The master's program doesn't rely much on exams; in fact, exams are an exception and are only used in very specific subjects. Assessment is mainly done through continuous assessment, task submissions, participation in forums, group work. What we do have are guidelines to, in a way, coordinate and allow students to carry out all that work in an organized and continuous manner, so that all the assignments are not concentrated at a specific point in the course, and the rest of the time students are idle*" (UNIOVI_EDU_M4310552_COORD_6).

4. Discussion and conclusions

This paper shows results on the degree of use that teachers make of different strategies, media and tools to obtain information that allows evaluating the learning outcomes of students. The results show the perceptions of the coordinators of the university master's degrees in social and legal sciences at the University of Oviedo. The results focus only on the analysis of one of the categories ("Evaluation") emerged from the qualitative analysis process of the responses provided by the coordinators in interviews. Therefore, it remains to contrast these results with those obtained in other different branches of knowledge (sciences, and in other master's degrees from this university and from other Spanish universities.

The results achieved in this study indicate that teachers must continue training in evaluation matters. Only in this way can the excessive caution that teachers continue to show regarding the use of different means to evaluate students be reversed; Likewise, it is necessary for students to be involved to a greater degree and with greater decision in the processes of evaluating their competency levels, which are reflected in the learning outcomes; For this, it will be mandatory to guide students towards other approaches and attitudes towards evaluation. For the evaluation of learning results, student participation is essential. All of this leads to the conclusion that the process of evaluating students' learning outcomes requires their active participation and this entails a significant paradigm shift.

Acknowledgments

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EARLY DETECTION OF STEM SKILLS DURING SECONDARY EDUCATION. A WEAK SIGNALS APPROACH

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Abstract

Currently, the gap between students' professional preparation and employers' expectations is well known by both the academic and business communities. This gap could be bridged by early detection of fundamental STEM (Science, Technology, Engineering, Mathematics) skills, even before students reach university. The present study adopts a weak signals approach to identifying and analyzing a basic set of engineering skills (ES) and science and technology skills (STS). The present study started from the awareness of changes in the field of engineering and examines the difference between what universities offer and current industry requirements, emphasizing the importance of actions taken by educational institutions for the development of specific skills. This paper is composed of an extensive literature review, which addresses the topic of weak signals and early warning systems. The paper also investigates to what extent early identification of key competences can be an accurate indication of future career directions in engineering. Moreover, within this present paper, we aim to pinpoint certain tools for detecting weak signals. This study highlights the importance of fully understanding engineering roles and the skills essential for getting a job in this field. It also discusses the purpose and relevance of early detection of weak signals as a proactive strategy to adapt the curriculum to current engineering requirements. By identifying and assessing STEM skills in a comprehensive setting, the results of this study contribute to the enrichment of the literature. In addition, by highlighting the importance of integrating innovative methods such as serious games into secondary education, methods and strategies for strengthening engineering skills among students are presented. The results obtained from this study are relevant for teachers in secondary education, but also for university education, for employers and for decision-makers in the field of education, offering models and methods through which students can be educated so that they are prepared for the constantly changing requirements in the engineering field.

Keywords: *Weak signals, early detection, science and technology skills (STS), engineering skills (ES), science-technology-engineering-mathematics (STEM) skills/competences.*

1. Introduction

Undoubtedly, both academic and business communities agree that there is a gap between 'students' career readiness and employers' expectations. (Doherty-Restrepo et al., 2023). There also is an agreement that sooner the career skills are identified, the students can be better educated and prepared for their future career, and better for employers as well. The better-prepared and more knowledgeable students are, the more they will succeed in driving innovation and attracting intellectual and commercial investments. (Wendler et al., 2010) In many domains of performance, early identification of talented individuals is increasingly crucial. In sports, current talent identification schemes often rely on discrete and unidimensional measurements during uncertain periods of athletes' development (Čančar & Podmenik, 2012).

With globalization and rapid technological progress, there is a consensus among researchers and employers regarding the necessity for the 21st-century engineer to possess skills such as teamwork, communication, and management, which were not prioritized in the past. Consequently, many higher education institutions have started to make adjustments to their programs to prepare engineers with a comprehensive skill set. However, there exists a disparity between the offerings of universities for engineering students and the industry requirements. Therefore, it is imperative for universities to place special emphasis on developing the skills necessary for a career in engineering (Itani & Srour, 2015).

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It is well-established that engineers occupy a diverse range of positions within the engineering field, and the importance of professional competencies can vary depending on this aspect. However, the majority of research related to professional competencies, employability, or career counseling does not take into account this diversity of professional roles (Craps et al., 2020).

There exists a disparity between the skills required in the industry and those developed within educational institutions, creating a misalignment between job requirements and educational preparation. It is crucial to comprehend that, in the career exploration stage, individuals begin to explore thoughts and behaviors that may guide them towards a future career choice. If students in this career exploration phase are provided with the opportunity to acquire career knowledge at the right time, they can prepare more effectively for the future (Keishing & Renukadevi, 2016).

Serious games have found applications in education, and their role in educational settings has been on the rise (Squire, 2003), encompassing various disciplines, such as programming (Toukiloglou and Xinogalos, 2023). The use of educational digital games in the instructional process has significantly increased over the past decades, particularly during the COVID-19 pandemic. However, little is known about how diverse student groups interpret and evaluate serious games concerning academic and professional success. A sequential exploratory mixed-methods study, based on responses from 201 students regarding the utility of an intuitive serious game for learning engineering mechanics in civil structural design, reveals that students had distinct expectations from serious games compared to entertainment games used outside the classrooms. Some students considered the opportunity to design their own structures and observe real-time failures as a valuable advantage in understanding how beam structures react to physical loading conditions. Despite this, only a few students believed that the serious game would be beneficial for exam preparation (14/26) or job interviews (19/26). Students favored engineering games that illustrated course content and mathematical calculations used in STEM disciplines more than those that did not include these elements (Cook-Chennault et al., 2022).

2. Literature survey

Recent incidents, such as the East Palestine, Ohio train derailment, underscore the importance of weak signals. It was later discovered that a wheel had overheated, leading to the derailment of a train carrying significant quantities of hazardous chemicals. A similar incident occurred in 2009 in Viareggio, Italy, where a train transporting liquefied petroleum gas (LPG) derailed due to a malfunction in a wagon axle. In 2013, in Quebec, Canada, a train's braking system failed, resulting in a derailment. Although the source of each derailment in these situations was different, there are certain similarities regarding cause and consequences. These derailments exhibited warning signals or weak signals, but they were not understood or heeded by those responsible. These signals are present in everyday life, but we, as humans, may not perceive their true significance. A weak signal may appear isolated, without a direct connection to other information, and it can be an unexpected alarm or a hint that may be overlooked as insignificant or even a minor observation made by an employee. Although such signals may seem inconsequential, they could indicate a gradual change approaching the point of causing a significant incident (Kerin, 2023).

Initially, the early warning system was primarily adopted by military and security systems to identify threats to national security. Presently, in addition to its use within these organizations, the concept of the early warning system has been successfully applied in the context of maintaining stability in the international security environment (UN, NATO, OSCE, etc.), environmental protection, predicting natural disasters, controlling epidemics, and, more recently, in project and business management. By employing both a focused early warning and opportunity identification system, as well as a more general scenario analysis, a visionary manager can formulate scenarios for various situations and develop strategies that enable prompt responses with optimal solutions. The potential benefits of an early warning system include the identification and learning from lessons, proactive identification of opportunities and threats, and laying the foundation for strategic business simulation (business wargaming) and scenario analysis (Popescu & Scarlat, 2015).

2.1. "Gap" identification

Despite the existence of literature on weak signals (Trish, 2023) and early warning (Davis et al., 2013), there are still not many well-defined and implemented tools, methods, or programs in schools worldwide that leverage these concepts to identify students inclined toward an engineering career and provide support for them. Within the existing literature addressing emerging weak signals in science and technology, as detailed by Yang et al. (2023), a discernible gap is evident concerning the thorough investigation of fundamental engineering skills (ES), science and technology skills (STS), and/or other indispensable STEM (Science, Technology, Engineering, and Mathematics) competences. This

insufficiency specifically relates to the scrutiny of these skills and competences as potential indicators for early detection and subsequent analysis as weak signals prognosticating the trajectory of a student's forthcoming engineering career. The lack of emphasis on this critical facet prompts inquiries into the current comprehension and assessment of the foundational attributes crucial for success in the field of engineering, necessitating a more nuanced exploration of the factors contributing to the identification of prospective engineers within current student cohorts.

As a result, the authors aim to identify weak signals and early warnings to efficiently prepare students for a career in engineering from a young age. Thus, this paper seeks to pinpoint useful methods and tools for detecting weak signals and early warnings in the context of fostering effective career preparation for students in the field of engineering.

2.2. A basic set of engineering skills

Recent studies emphasize the need for a broader set of skills that engineers require than ever thought before. The term "Skills" is conventionally employed to denote the proficiency in task execution. Skills are occasionally interchangeably referred to as 'Competencies'. Within the engineering context, skills are typically dichotomized into two classifications: 'technical' or 'hard' skills and 'non-technical' or 'soft' skills. Both technical and non-technical skills constitute complementary proficiencies essential for engineers. Abdulwahed et al. (2013) provide a comprehensive list of skills that an engineer should possess: Communication Skills (CS), Teamwork Skills (TWS), Problem Solving Skills (PSS), Business & Management Skills (PMS), Ethics & Responsibility (E&R), Lifelong Learning (LLL), Creative Thinking (CrT), Leadership Skills (LsS), Practical Skills (PrS), Cultural & Social Awareness (CSA), System Design Skills (SDS), Analytical Thinking (AnT), Critical Thinking (ClT), Inter/Multi-Disciplinary Skills (I/M-DS), Innovation Skills (InS), Systems Thinking Approach (STA), Professionalism (PsS), Information and computing technology skills (ICTS), Entrepreneurship Skills (EpS), Foreign Language Skills (FLS), Technical Skills (TcS), Managing Change Skills (MCS), Decision Making Skills (DMS), Numeracy Skills (NmS).

The analysis revealed that the literature places the greatest emphasis on five skills for Engineering Graduates (ENGD): 1- Business and management, 2- Communication skills, 3- Teamwork skills, 4- Problem solving, and 5- Lifelong learning. In contrast, for Generic Graduates (GEND), the highlighted skills are: 1- Communication skills, 2- ICT skills, 3- Problem solving, 4- Teamwork skills, and 5- Business and management. A notable disparity in emphasis between ENGD and GEND is evident in 12 skills. The literature places a higher emphasis on ICT skills, numeracy skills, technical knowledge, language proficiency, and decision-making skills in the context of generic required skills compared to engineering-specific skills. The gap in skills like ICT, numeracy, or technical knowledge is straightforwardly understood as engineering training and education should encompass these areas.

Modernizing the engineering curriculum is crucial to support engineers with such a broad array of skills. This modernization could involve a shift from traditional teaching methods towards more constructivist learning approaches, such as technology-enabled learning. (Abdulwahed et al., 2013)

It is well-known that secondary school students are not sufficiently equipped with adequate mathematical and scientific skills, compared to certain countries, which consequently hinders colleges from increasing the supply of engineering graduates to meet industry demand. Furthermore, other countries, such as China, are intensifying their production of engineers, supporting the notion of a general need for more engineers, although this may not be entirely accurate. However, it remains unclear what skills engineers precisely need to be productive in the current economy. In 2009, a study was conducted based on findings derived from four investigations on changes in manufacturing engineering in the United States, Germany, and Japan, on the IT industry and skills requirements, on globally distributed engineering by U.S. and European multinationals, and on the education and workforce demand in science and engineering. Over 300 individuals from more than 100 company locations participated in the interviews. While many findings regarding skills and workforce development are specific to a particular engineering field, company, or country, there are also common and consistent findings across all companies, jobs, countries, and fields. Hence, a discrepancy between the skills possessed by current engineers and those sought by employers is noticeable. Constant reports of skill deficits were identified in interviews with engineers and managers from various companies. These deficits are often associated with communication skills and the ability to operate across various "borders" – be they organizational, technological, disciplinary, or of cultural and national nature. Notably, no manager indicated that recently hired engineers in the U.S. lacked the required technical skills, and none of the interviewed managers encountered difficulties in finding engineers with strong technical abilities.

Therefore, the presented research suggests that the essential modernization of engineering education to ensure technological competitiveness in the U.S. involves less deepening of specific technical skills and more the development of new boundary-spanning skills (Lynn & Salzman, 2010).

Regarding the utilization of serious games to develop fundamental engineering skills, they have been used for decades in engineering education, but still lack widespread adoption. Learning through gaming is often seen as not rigorous enough in higher education and vocational training, leading to its exclusion from academic curricula. As a result, students miss the chance for active knowledge acquisition in lessons and face barriers to effective engagement in serious games later on.

Despite the multitude of skills associated with the engineering profession, specialized literature lacks a clear definition of a basic set of skills; instead, there are only specific sets of competencies formulated based on certain criteria (Hauge et al., 2013).

3. Methodological approach

In the current available literature, there is no clear definition of methods through which the identification, analysis, or evaluation of weak signals or early warnings regarding engineering skills can be accomplished. Despite the apparent recognition of the benefits of using early warning systems, and the existence of programs that utilize early warnings to identify students facing difficulties in certain subjects (Rumack et al., 2017), there is no clear definition or classification of early warning systems specifically for identifying, analyzing, or evaluating engineering skills.

An example of such an early warning system aimed at improving students' academic performance is proposed by Allensworth (2013). It relies on three ways in which early warning indicators are useful for improving student performance: (i) focusing conversations and efforts on actionable issues; (ii) identifying students for intervention; (iii) using indicator models to strategically address low performance. In schools where this system was implemented, changes were observed in how teachers and school staff interacted with each other, with students, and with parents to improve students' academic outcomes. Additionally, three key data tools were developed within these schools. One tool was designed for prevention – identifying students who would need support from the beginning of high school. Another tool was designed for early intervention – identifying students as they showed signs of failure or withdrawal during the year. The third tool was designed for recovery – bringing students back on track after they had failed (Allensworth, 2013).

Thus, following an analogous approach presented above, early warning systems could be used for identifying students exhibiting weak signals in the field of engineering, and various tools could be designed to support and develop students to meet the future workforce demands.

4. Further steps

Since we haven't extensively presented specific methods or tools for identifying weak signals among students in this article, the next step in our research involves developing and refining tools for the early detection of weak signals in engineering skills. Additionally, considering the significance of a comprehensive approach, we aim to explore strategies for integrating early detection and warning systems into educational institutions and industries to align the curriculum and skill development with industry requirements. This entails not only identifying weak signals but also implementing effective warning mechanisms. Continuous research and ongoing evaluation in the field of early detection and warning systems for weak signals are crucial for adapting to emerging trends in the engineering profession.

5. Conclusions

Therefore, as society as a whole evolves rapidly, and the progress that technology makes is increasingly astonishing, it is extremely important for the education and preparation of young people to start at the earliest ages. For this education to be carried out in line with the skills that students already possess, teachers and other individuals involved in the education process must be able to identify, assess, and develop each student's abilities correctly and as much as possible. In order for this to be possible and for students to become competent employees, there is a need for schools to have effective methods and tools for identifying weak signals and early warning systems.

The literature review underscores the disparity between educational offerings and industry needs, emphasizing the necessity for universities to adjust programs to adequately equip engineers. Additionally, since jobs in the field of engineering are diverse, it is important for professional requirements in education to be integrated to align with labor market demands.

In conclusion, our study provides valuable insights for educators, employers, and decision-makers, laying the groundwork for effective educational strategies in engineering. Continuous exploration of weak signals and early warning systems remains crucial for adapting to the ever-changing demands of the engineering profession.

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COMPARISON OF VISUAL AND PHONOLOGICAL SKILLS IN DYSLEXIA SUBTYPES

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Abstract

The objectives of this study are to characterize and compare the visual, phonological and mixed subtypes of students with an interdisciplinary diagnosis of developmental dyslexia. A total of 122 students, aged between 8 years and 11 years and 11 months, from the 3rd to 5th year of Elementary School I in the public network, divided into groups, being GI (61 students with an interdisciplinary diagnosis of dyslexia); and GII (61 students with good academic performance), paired with GI in relation to the school year. All were submitted to Phonological Skills and Visual Perception Assessments. Factors were created for profile classification for GI, with dyslexics separated into phonological, visual and mixed profiles. The results indicated that there was significance for all comparisons between GI and GII. There was a significant difference between the GV and GPH groups; GPH and GM groups and Between GV and GM. The findings of this study allow us to conclude that students with dyslexia can present visual defects regardless of the phonological one. These findings have clinical and educational implications.

Keywords: Phonological awareness, visual perception, learning, education, educational measurement.

1. Introduction

Developmental dyslexia is a neuro-cognitive disorder described as a difficulty in acquiring reading skills, despite adequate intelligence and sufficient reading opportunities (Shaywitz, 1996; Shaywitz & Shaywitz, 2005). Reading requires the coordination and integration of visual and verbal information. In particular, children's awareness of the relationship between sounds and letters, or letter-sound correspondence, has been emphasized. Phonological awareness was suggested to underlie grapheme–phoneme conversion (Share, 1995). In contrast, visual perceptual skills, which appear to be essential to letter learning, have been much less thoroughly investigated (Woodrome & Johnson, 2009) especially regarding dyslexia. Therefore, this study was based on the hypothesis that students with dyslexia subtypes would have difficulties with visual and phonological skills.

2. Objectives

The objective was to characterize and compare visual, phonological, and mixed profiles in students with an interdisciplinary diagnosis of developmental dyslexia and with good academic performance.

3. Methods

This study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences – CEP/FFC/UNESP, under numbers 3.202.014 and 4.862.668.A total of 122 students, aged from 8 years to 11 years and 11 months old (35 women, 43 men, mean age = 25.25, SD = 2.248), from the 3rd to the 5th year of Public Elementary School I, were divided into GI groups composed of 61 students with the interdisciplinary diagnosis of dyslexia; and GII composed of 61 students with good academic performance, matched with GI in relation to the school year. GI was composed of students with the interdisciplinary diagnosis, carried out by the Learning Deviations Laboratory (LIDA/ UNESP – FFC/ Marília – SP), composed of speech therapists, neuropsychologist, and occupational therapist, based on the criteria described in the Statistical Manual for Mental Disorders and of Behavior – DSM-V (APA, 2014; Germano et al, 2014). Students from GII were indicated by their teachers with good academic

performance, with good academic performance being those who presented satisfactory performance in two consecutive two-month periods in the Portuguese Language and Mathematics assessment, with a grade greater than or equal to the average (5.0). Students from GII were paired with GI and their profiles, according to chronological age and school year. As exclusion criteria, students who did not present the Free and Informed Consent Term signature, with the presence of sensory (hearing and/or visual impairment) and cognitive deficits described in school records and/or in neuropsychological assessment findings and who participated in speech therapy and pedagogical remediation.

As procedures, the students were submitted to the following assessments, individually, lasting up to 4 sessions, with approximately 30 minutes, as follows:

- *Phonological skills assessment protocol* (PROHFON- Germano & Capellini, 2016): composed of 12 tests that assess the student's performance in phonological awareness, allowing classification by test and school year.
- *Visual Perception Development Test III* - DTVP III (Hammill, Pearson & Voress, 2014). This protocol consists of a battery of five subtests that measure different visual-motor and visual-perceptual skills.

After applying the assessments, the GI students were separated according to the profiles of the dyslexia subtypes. For the separation in the diagnostic profiles, the following criteria were considered:

- Phonological Profile. To compose the phonological subtype, we considered the classification "under attention" in more than 50% of the phonological skills subtests (PROHFON – Germano & Capellini, 2016) and performed within and/or above average for the visual subtests (Figure – Background; Visual Closing; and Constancy of shape) and for the composite score of reduced motor perception of the visual perception test (DTVP-III; Hammill, Pearson & Voress, 2014). A total of 22 students met this criterion.
- Visual profile. To compose the visual subtype, we considered students who performed "expected" in more than 50% of the metaphonological skills subtests (PROHFON, Germano & Capellini, 2016) and presented below average performance for the visual subtests (Figure – Background; Visual closure; and Shape constancy) and for the composite score of reduced motor perception of the visual perception test (DTVP-III; Hammill, Pearson & Voress, 2014). A total of 17 students met this criterion.
- Mixed. To compose the mixed subtype, we considered students who performed "under attention" in more than 50% of the metaphonological skills subtests (PROHFON, Germano & Capellini, 2016) and presented below average performance for the visual subtests (Figure – Background; Visual closure; and Shape constancy) and for the composite score of reduced motor perception of the visual perception test (DTVP-III; Hammill, Pearson & Voress, 2014). A total of 22 students met this criterion.

4. Results

Figure 1 and 2 show the performance classification for the visual and phonological variables, respectively. The Likelihood Ratio Test was applied for comparison between categorical variables, that is, according to the classification of procedures. All variables showed significant differences.

Figure 1. Distribution of performance classification of visual variables.
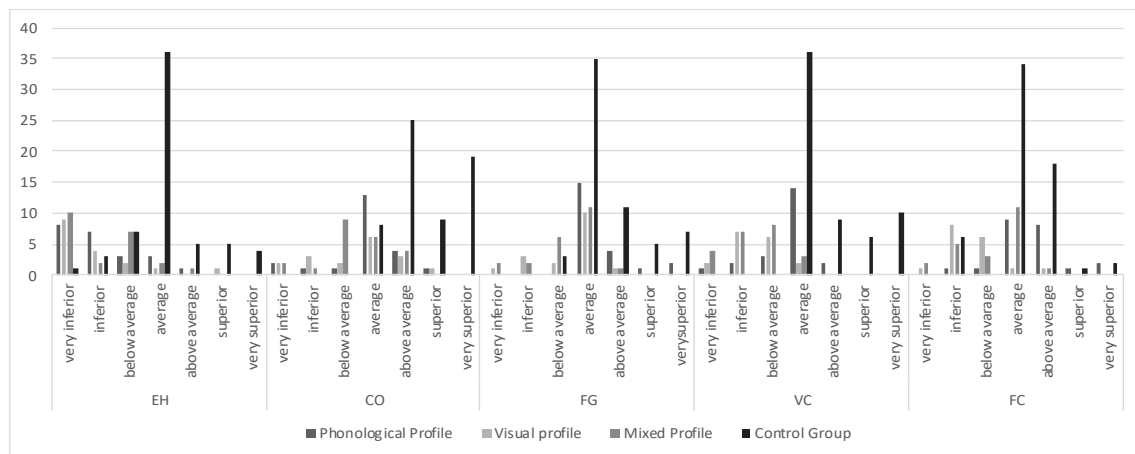
Caption: EH: hand-eye coordination; CO: Copy; FG: Figure –ground; VC: Visual closure; CF Shape Constancy

Figure 2. Distribution of performance classification of phonological variables.
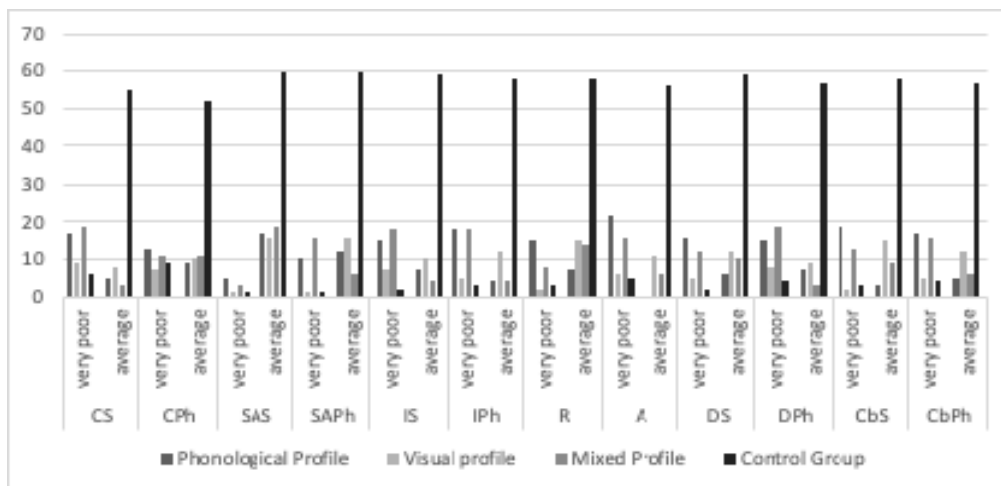
Caption: S: syllable; Ph; C: Count; SA: Synthesis and Analysis; I: Identification; A: Rhyme; A: Alliteration; D: Deletion: Cb: Combination

5. Discussion

The findings of this study allowed us to observe that Brazilian students with dyslexia showed differences in performance regarding phonological aspects and visual perception, indicating the heterogeneity of dyslexic manifestations. Specifically, it was possible to observe that the phonological subtype was characterized by deficits in the phonological skills of syllable and phoneme synthesis and analysis, alliteration, and syllable combination. Phonological deficits primarily affect pseudoword reading, although they also prevent the normal acquisition of lexical orthographic knowledge (Share, 1995, 1999). As for the visual subtype, its characteristics were deficits in visual motor skills, visual figure-ground and constancy of form. Visual figure-ground is a high-level discrimination skill, the student must recognize relevant lines and curves and, simultaneously, disregard unimportant ones. The teaching of visual figure-ground activity can help the student to give adequate and concentrated attention to relevant stimuli, ignoring irrelevant ones (Fusco, Germano, & Capellini, 2015; Frostig, Horne, Miller, & Lorenzo, 1984). Regarding constancy of form, it enables student to develop the ability to generalize in relation to the visual stimulus, as well as the identification of geometric shapes and learned words, regardless of their size, color, shading or positioning (Frostig, Horne, Miller, & Lorenzo, 1984).

The findings of this study indicate that it was possible to identify subgroups of dyslexic children in terms of visual and phonological abilities, and these discoveries clearly document the existence of individual differences in the dyslexic population. Thus, cases of developmental dyslexia with normal phonological processing have been documented (Valdois et al., 2004), despite the use of sufficiently sensitive phonological measures. Another important aspect observed is in relation to phonological skills. When observing the distribution of students regarding performance classification, it is noted that all subtypes had some phonological impairment. That is, we can infer that dyslexic had failures in accessing the phoneme, in some way. This aspect can be related to the current literacy methodology in Brazil, which does not prioritize the systematic and reflective teaching of grapheme-phoneme conversion. This aspect entails not only theoretical implications, but also in terms of clinical and educational practice, as it denotes the need for interventions with phonological remediation programs, even in the case of a visual subtype.

6. Conclusion

The findings of this study allowed us to observe that Brazilian students with dyslexia showed differences in performance regarding phonological aspects and visual perception, indicating the heterogeneity of dyslexic manifestations. These findings contribute to the discussion about the diagnostic criteria used by professionals, in addition to increasing the need to implement intervention programs with visual and phonological approaches. Finally, these findings alert us to the need to better understand the student's profile to improve curricular adaptation policies.

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ABSENCE/PRESENCE IN 'GREEN' IMAGININGS OF INDIAN SCHOOLSCAPES

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Abstract

This paper traces how a modest 'tree' in school premises, previously unnoticed in the public eye, becomes an emblem of pride for a large number of spectators; and how its material erasure makes it present and relevant for diverse groups of people. Physical effacement gives birth to an enacted object, with a new value ascribed to it. The findings from this study offer an effective beginning for a reflection on the construction of pride-objects in schools. This paper follows the narratives of two urban government schools in Mumbai, India that bear images of trees in their schoolscapes in absence of actual trees in or around their compounds due to varying reasons. Through interviews and non-participant observations, the discussion focuses on how different school members have noticed the school spaces and their configurations with respect to the absent/present trees. Instances of absent presence and present presence as well as connections between them are traced to discuss school members' identity work. By way of the school members' participation in the network of events connected to making the absent trees present, emergent valuation of objects in their schoolscape becomes visible. Present presences are found in the way notions of 'green' permeate into classroom talk and exercises such as writing letters to the editor of a local newspaper explaining issues of deforestation and measures to curb it, recitations of quotes in the morning assembly, visual-textual content prepared for celebrations of days of national importance, displays on school walls, artistic interventions and allied activities in informal spaces. Absent presences include invigilation and assessment pressures, maintenance of school status, role of media toward image-making of the school-self, student expression, and local histories. This has implications for understanding questions of representation of green, good and happy schools; and orchestration of environmental (pro)activism as part of curriculum work.

Keywords: Green school image, absent presence, pride objects, school self.

1. Introduction

The frequent invocation of the 'green' exhibits or displays in the schoolscapes for Environmental Education (EE) in scholarly discussion hints at newer interactional entities in the discourse of schoolscapes and also creates an image of the school as a designed nested site. Installations within the school grounds are typically built with certain pedagogical intentions. Place Based Education (PBE) advocates such as David Gruenewald (2003) have emphasised PBE which draws on local cultural, environmental, economic, and political concerns, to transform schools into sites for decolonisation and reinhabitation. This view prioritises a convergence of social and environmental concerns (Hayden-Smith, 2007); and locates teachers and wider communities in place-building for EE, but Gruenwald (2003) mainly talks about how standardised testing procedures rob teachers and students of the opportunities to practise critical pedagogy for EE.

Educationist David Hutchison (2004) explores the philosophy of place in education, current school design trends, and the infrastructure crisis, highlighting the potential impact of declining budgets, competing ideologies, and economic/technological shifts on K-12 education in the US. According to Hutchison (2004), educators can strengthen a sense of place in education by fostering a strong school spirit. Schools with a strong sense of place are more committed to their students and faculty. Maintaining cleanliness, safety, and avoiding bullying are crucial. Academic and athletic successes, along with celebrating accomplishments through concerts, plays, and graduation ceremonies, can deepen pride in place (Hutchison, 2004).

Although, the aforementioned studies contribute to learning about school pride and role of place in education, there is scant research on how installations involving trees take shape in school premises, and what they mean for the school members and school identity creation. Despite widespread presence of tree-based installations in school sites (Song, 2012), there seems to be less attention given to these artefacts. Hence, the aim is to address this gap through our study. The study is located in the government schools of suburban Mumbai in India. The research design is detailed in the following section.

2. Design

This study looks at specific installations in school premises in India to learn about their motivations behind their creation through conversations with school members and school observations. The significance of this study lies in its findings that challenge the common assumptions that schools create such installations only for pedagogical purposes. Our discussion highlights reasons for schools indulging in creation of such installations related to environmental education. The key finding suggests that the school's identity formation is seen as an important goal alongside pedagogical aims. The design of the study is inspired by qualitative ethnographic methodology as the research aim is to uncover subjective perspectives of the school members about the school installations. These results and discussion illuminate the reasons behind the production of these specific schoolscape installations.

3. Objectives

According to Jaworski and Thurlow (2010), schools stand for a particular type of "spatialization", which is the process by which space is organised, experienced, and represented. Harvey (2009) conducted seminal work on this concept. In his writing about the urbanisation process, he notes how social activities shape and depict space, time, place, and nature in relation to one another. Place-making is a complicated social process that incorporates aspects of speech and language, institutions and rituals, beliefs, values, and wants, material activities, social relations, and power all at the same time. Our goal is to interpret space in terms of social practices related to schoolscaping or the development of the schoolscape elements. While schoolscape studies have focused on the visible language by examining language ideologies (Brown, 2012; Laihonen & Szabó, 2018), minority languages (Biró, 2016), or trans-languaging (Straszer, 2017), the current inquiry is more interested in the use of space inside the school building, its premises and school boundaries following Krompak et al. (2020). Within schoolscapes, this paper focuses on what will be referred to as the 'school display' – specifically the installations or landscaping in the grounds of the school premises. The following questions guide this study: What is the purpose behind the installations in the school ground? How are tree-based installations treated in schools? What kind of discourses and marginalisations characterise these installations?

4. Methods

The study is located in two government schools in suburban Mumbai. Data from interviews with six teachers and two principals (school headmasters) are used. The researcher conducted semi-structured interviews with all participants as well as performed observations that were recorded through journaling and note-taking. This paper is based on the data from an eight month long study. The study is inspired by ethnographic approaches under the constructivist paradigm (Denzin & Lincoln, 1994), through which this inquiry seeks to understand the school members' perspectives to discover their subjective realities. Most constructivism-based research projects start with an open-ended investigation using research questions. Interviews were conducted in Marathi, Hindi and English language. All interviews were transcribed and translated to English before analysis. Data analysis was done through inductive coding until data saturation was achieved. After coding, an inductive-deductive method for analysis was followed (Fereday & Muir-Cochrane, 2006).

5. Discussion

One of the schools had a patch of grass maintained in the shape of the Indian map, lined with bricks and a fence all around. This was the only grass patch in the school, while the rest of the ground had sand and mud cover where children played. This patch was initially larger, had a tree, and was open for student access. The other school used to have a lawn but now had tree stumps and debris in the lawn space. In recent years the new principal had initiated the renovation of this area during which one of the older tree trunks was carved into the shape of a pencil to signify the school's dedication to the national

literacy mission campaign. The pencil became an iconic pride-object associated with the school's identity, and the area where it was erected became a guarded space, thus restricting student access to the area. The school principals in the above schools maintained that the presence of the green patches was needed for increasing the visibility of the schools as their building had been surrounded by dumping grounds which affected the school admission rates negatively. In addition to this, the principal of the school that had the green-India map structure explained its role in the following manner: 'Here we teach children about our country, and what is cultivated in different parts of India. Children assemble around the map, and the teacher explains about crops grown in different parts of India by standing in the middle of the structure. It is important for the students to know about the country and keep its heritage clean and green. It is the symbol of our school.' The school organised a specialised training session centred around utilising the map. The training sessions, conducted by external non-governmental organisations and other entities, aimed to acquaint the teachers to demonstrate how the map could be included into the curriculum across Science, Art, Mathematics, and English. The head teacher was eager to underscore the significance of the green map not merely serving as a symbolic area, but rather being completely included into the curriculum and broader school community. In this narrative, the need for greening is framed by pedagogical goals and citizenship goals; as well as linked to school identity.

5.1. Present presences

Present presences are found in the way notions of 'green' permeate into classroom talk and exercises such as writing letters to the editor of a local newspaper explaining issues of deforestation and measures to curb it and recitations of quotes in the morning assembly. This was done as an extension to the principal's event of talking about the 'pencil tree' with a large group of parents. The discussion about the tree that was transformed in the shape of a pencil was discussed with children in the classroom by teachers. The tree in its new form became present through discussions about saving trees. Children were asked to write notes to the local municipality about tree-cutting that had been taking place in the forests of the city. The morning assembly was a space for singing songs about trees and the way students were required to become good stewards of the environment. Through this process, the school members asserted that they were 'mending' the school's lost identity.

5.2. Absent presences

Absent presences include invigilation and assessment pressures, maintenance of school status, and role of media toward image-making of the school-self. The green space in the school ground which used to have a tree initially and now had a landscaped grass-filled India-map was being used as a place for learning. The children were restricted from going close to the installations to keep the installations safe, thus curbing children's freedom. Thus, assessment pressures which were not usually talked about and remain absent otherwise, became present in the way the green space was used for coordinated and managed pedagogical aims rather than free exploration. The school had gained popularity among the neighbourhood due to the presence of the map and the interest of local media in documenting the endeavor. One of the teachers mentioned that the tree that used to be present on the patch was cut down because some electric wires were to be installed in the area and the tree's presence was an obstacle. Another teacher said that this story was not true and that the tree had been burnt due to lightning bolts during heavy thunderstorms. Yet another teacher shared a different story. She said that the tree had been cut as it was prone to collapsing during high winds. The school principal mentioned that the tree stump's placement at the 'heart of India' was to serve as a reminder to the children and everyone else about the importance of saving trees and that this is how 'humans can mend their mistakes'.

6. Conclusion

Teachers position green schoolscaping as mending. Teachers and school leaders engage with 'mending' discourses because it helps situate the 'greening' within the government school image and government school teacher identity. 'Greening' for urban government school members is a response to the negative public image of government schools. This response is manifested in the school member's mobilisation of the 'mending' discourse. Hence, green schoolscaping is rationalised through the mending discourse. The teacher and school leaders narrate accounts of mending to construct a 'green' school-image. The teacher as a mender repairs, heals, tends to, cares for and keeps. Simultaneously larger narratives of Environmental Education; assessment and audit culture (Apple, 2005; Power, 1997) feed the mending process contributing to image-making processes. The metaphor of mending helps in understanding what is perceived as in need of care by the school members beyond lesson plans. Studies in schoolscapes tend to ignore the notion of repair/mending mobilised by school members. A rare instance has noted schools positioning themselves as 'carers' through the 'art of display' (Thomson et al., 2007).

Another study talks about how tour guides take the role of activists to 'repair' the linguistic landscape of a city by proposing or displaying alternatives (Waksman & Shohamy, 2015). Mending as a conceptual-analytical lens has not found focus in studies on EE schoolscapes/schoolscaping. Forms of adherence or resistance to instrumental, gradual and participatory perspectives of mending might help explain presence/absence of particular voices in schoolscapes.

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NAVIGATING THE TEACHERS' AND THE SUBJECT'S IDENTITY: A CASE OF SOCIAL SCIENCES

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Abstract

This paper explores how out-of-the-field Social Sciences teachers negotiate the Social Sciences teacher's identity without the requisite professional training in the Social Sciences. Teachers' professional identities as subject experts are shaped and reshaped by their PCK, agency, and context. The placement and allocation of teachers with random subjects, regardless of their specialization areas, has ramifications for their identity as teachers and professional development. With the increasing educational inventions and developments emerging daily in the education realm, teachers must have a nuanced comprehension of who they are when teaching the subjects they have been assigned. While there is a plethora of studies on teacher identity, particularly that of novice teachers, it is equally important to comprehend how the out-of-the-field teachers (novice and experienced) negotiate their teacher's identity in relation to the subjects they are compelled to teach without professional training to do so. Accordingly, the paper explores the challenges encountered by out-of-the-field teachers teaching Social Sciences in negotiating a Social Sciences teacher's identity. The study used James Gee's concepts strands/perspectives on identity formation as a theoretical framework. Data was gathered through semi-structured interviews with participants and processed through a thematic data analysis approach. The findings revealed that out-of-the-field teachers face challenges with content knowledge, pedagogical content knowledge, interpretation of Social Sciences CAPs, and innovation in their Social Sciences classrooms. Thus, these factors have detrimental effects on the formation of a Social Sciences identity teacher, which is formed on the basis of strong content knowledge, as well as other factors. Instead, these teachers' identities are developed and sustained through the institutional identity.

Keywords: Teacher's identity, out-of-the-field teachers, social sciences, social sciences CAPs.

1. Introduction and background

In the teaching profession, 'identity' is paramount for many reasons, including its association with several practices and discourses. The teacher's and subject's identities serve as a cornerstone of teaching; they give the subject an essence and guide the teacher on how to deal with the subject matter. Brooks (2016) asserts that if teachers can be seen as working in a professional knowledge landscape, they need a professional compass to navigate it. In this sense, identity is a north star, guiding teachers in navigating the profession. In this way, identity is not an option but a prerequisite aspect of the teaching profession. Many studies on teacher identity focus on the evolution of teachers in the teaching profession, their narratives about themselves and their teaching, discourses, and other activities they engage in to gain guidance in their teaching and contextual factors (Beauchamp & Thomas, 2009). These studies have contributed to elucidating the concept of a teacher's identity and the nature thereof.

A teacher's identity is multifaced and associated with many definitions. Welmond (2002, p. 42) perceives a teacher's identity as "…both the personal experience and role of teachers in a given society. It includes the subjective sense of individuals who engage in teaching and how others view teachers." A similar view by Vokatis and Zhang (2016) positions a teacher's identity with self-image, asserting that it alludes to how teachers identify with themselves as teachers, what they are expected to do, and who they strive to become within the teaching profession. Hence, Gee (2000) persuasively claims that a teacher's identity is what the teacher does. In other words, the professional space reveals the identities of teachers. In the same way, Richards (2021) considers teachers' identities imperative in shaping their selection of teaching and learning approaches. Hence, Brooks (2016) asserts that a teacher's identity is a value and emotion-based compass that guides the teacher in their teaching practices. As teachers evolve and constantly negotiate their being in the ever-changing world, Beauchamp and Thomas (2009) maintain that it is crucial to understand that identity is dynamic and constantly evolving.

However, there cannot be a teacher's identity without the school subject identity, as it is at the center of a teacher's identity formation. Although literature rarely defines subject identity, Brooks's (2016) work provides some insights into subject identity. According to Thompson (2023, p. 863), "Subject discipline identity development involves a process of continuous and evolving transition from being a subject specialist in the sense of knowing a defined area of a subject to becoming a schoolteacher

in command of the pedagogical tools needed to mediate a subject discipline for school-aged learners." Although this relates more to how a teacher's identity develops than a subject identity, one can define a subject identity as the attributes, principles, and organization that distinguish the subject and its curriculum from other school subjects. In this well, the identity of a subject provides the teacher with fundamental foundations from which the teacher can understand the subject and her/himself as a teacher who is teaching that subject. Brooks (2016) contends that the values and principles derived from the subject identity are imperative in developing the teacher's identity and helping to sustain it. Likewise, Rosa and Ramos (2015) argue that school subjects protect teachers' identities. The study conducted by Rushton, Smith, Steadman, and Towers (2023) reveals that the teacher's area of specialization plays a vital role in identity development; hence, it is always important to understand the positionality of different subjects.

Considering the positionality of a teacher's identity in the teaching profession, the placement and allocation of teachers within certain subjects becomes a sensitive process because this has ramifications for the teacher's professional identity. Thompson (2023) and other studies claim that context is important in the teacher's identity. Given the rapidly increasing pace of educational inventions and developments, teachers must have a nuanced understanding of who they are when teaching all subjects they have been assigned.

While there are many studies on teacher identity, particularly that of novice teachers in different subject areas, how out-of-the-field teachers negotiate their teacher's identity concerning the subjects for which they have not been trained is underexplored. The empirical work upon which this article draws was based on an investigation into the challenges and opportunities faced by the out-of-the-field teachers teaching Social Sciences and how they negotiate their 'Social Sciences identity.'

2. Theoretical framework

Gee's (2000) theory of identity provided the study with a theoretical framework. Essentially, Gee (2000) understands identity as an ongoing process where an individual constantly re-establishes who they are in a particular context. Understood in this way, although context may be important in the formation of identity, identity is not fixed to a particular place or time. In the case of the teaching profession, a teacher's identity changes as the world, educational settings, subject matter, educational policies, and learners change. Thus, Gee's (2000) four ways of viewing identity in different contexts of the individual (I-identities), institutions, discourse (D-identities), and affinity (A-identities) process are used in this study as a theoretical framework to understand how out-of-the-field teachers who are teaching Social Sciences negotiate their Social Sciences identity in different contexts. The framework positions identity as a social construct, making it an external process instead of an internal one.

3. Research methodology and context

The research was conducted through qualitative research methods. As Creswell & Poth (2016) state, qualitative research appreciates the meanings and interpretations the participants associate with their contexts and experiences. Interpretivism was employed as a research paradigm to interpret the experiences of out-of-the-field teachers teaching Social Sciences.

4. Data collection and analysis

Semi-structured telephonic interviews were conducted with participants involved in Social Sciences in the senior phase grade 7-9: twelve teachers who are teaching Social Sciences, four participants from the Social Science supporting team (two subject advisors, one Head of Department, and one provincial coordinator) as well as the Social Sciences Curriculum Assessment Policy Statement (CAPs) were used to collect data. All participants are based in Gauteng, and the twelve teachers teach in different schools in the South and East of Johannesburg. The research came from my Master's thesis and complied with the required ethical standards.

The data was analysed through Braun and Clarke's (2019) model, which comprises six data analysis phases. The first phase is becoming acquainted with the data collected through the semi-structured interviews, the second phase is producing the initial codes from this data, the third phase key themes were searched, the fourth phase is reviewing themes, the fifth step is defining the themes, and the last step was writing up the findings. The article is grounded in one of the themes that emerged through this process.

5. Findings and discussion

Identity as a broad theme emanated within the themes established for the master's research, as indicated above. Essentially, the key findings around identity were the conundrum around the negotiation of a Social Sciences teacher's identity, and this is understood within Gee's (2000) four perspectives on the formation of identity.

5.1. The nature perspective (N-identities)

The nature perspective is grounded on the nature of individuals. This perspective holds that individuals' identities are shaped by their state of being, which may include neurological conditions (amongst other things) (Gee, 2000). The state in which someone is not influenced by society or achievements. Instead, it is driven by genes, which means that individuals do not have control over it. "Thus, N-Identities must always gain their force as identities through the work of institutions, discourse, and dialogue, or affinity groups, that is, the very forces that constitute our other perspectives on identity" (Gee, 2000, p. 102). The N-identity follows an essentialist approach to understanding identity formation because it points to the identity being innate instead of extrinsic. Although the data might not explicitly provide some insights that align with the natural perspective, it is important to understand that all the out-of-the-field Social Sciences possess an innate identity that is not associated with teaching Social Sciences or any other external factors that may consciously or unconsciously influence the way they teach Social Sciences.

5.2. The discursive perspective (D-Identities)

The discursive perspective is grounded upon discourse or dialogues. In this perspective, individuals work hard through social interactions to develop and sustain their traits (respectful, charismatic, humble, and so on) (Gee, 2000). These are individual accomplishments that are recognized by others through discourses. In the case of Social Sciences, the D-Identities could be other colleagues recognizing the out-of-the-field Social Sciences teachers as Social Sciences teachers. The discursive perspective also provides insights regarding how the out-of-the-field Social Sciences teachers discuss and enact Social Sciences in practice. However, developing a D-identity is controversial; not everyone will recognize the same thing. Following this, while it could be argued and supported that the out-of-the-field teachers should be recognized as such because they lack certain traits for Social Sciences teachers, others may argue that these teachers should be recognized as Social Sciences teachers because they are recognized as such in schools.

Nonetheless, negotiating and sustaining identities within the discursive perspective also requires individuals to be associated with an affinity group with common practices and experiences. Considering the scarcity of social science-trained teachers in South Africa, perhaps affinity groups could be developed by the current cohort of out-of-the-field and social science-trained teachers. Groups such as subject content workshops may be inadequate because Social Sciences issues are discussed in categories of Geography or History.

5.3. The affinity perspective (A-Identities)

The discursive perspective overlaps with the affinity perspective because discourses are grounded upon particular affinity groups. From the affinity perspective, identity is acquired based on individual practices and experiences within certain affinity groups. The affinity group is grounded on the common practices, shared culture, and traits of the individuals within it (Gee, 2000). Similar to the discursive perspective, interaction is at the center and serves as a tool through which individuals can acquire experiences.

In the views below, the participants shared their understanding of Social Sciences. The conceptualization of Social Sciences under the affinity perspective could provide some insights regarding the critical attributes of Social Sciences, which are the out-of-the-field Social Sciences teachers and Social Sciences teachers, so that it could be decided whether or not there are affinity groups that contribute towards these teachers' identity.

the Social Sciences curriculum it is sciences. Right! It is a type of science of science for the learners because they are learning about how human societies are working so they work on … uhm it is a science that focuses on human interaction and the relationship that people have with each other. So, that's what I understand when we talk about Social Sciences. It is a type of science that studies human societies and their relationships with one another.	*Sometimes, you do not see the topics to be integrated because when I am teaching the Geography part, I wear a Geography cap and when I am teaching History, I wear the History cap. I am not wearing one cap, like a Social Sciences cap……*

The first part of the data indicates an understanding of Social Sciences within the social context (excluding the physical and economic context). At the same time, the latter brings in the element of integration and alludes to issues of identity through positionality. Following the data, the affinity groups upon which Social Sciences issues could be deliberated must be grounded on what Social Sciences is and the challenges around juggling the different hats (identities) when teaching Social Sciences. From an integration point of view, wearing different hats is advantageous because integrating the different insights from the different subjects in the teaching of Social Sciences ensures holistic learning.

5.4. The institutional perspective (I-Identities)

The institutional perspective argues that identity is formulated by the positions that we occupy in a society. Institutional authorities drive institutional identities based on a particular institutional position's principles, laws, and traditions (Gee, 2000). In this way, the I-identity differs from the nature perspective because the nature perspective is grounded on natural or biological principles. However, the two perspectives may connect in a situation wherein the state of an individual leads them to be

institutionalized. Gee (2000) explains that N-identities can either be sustained or discontinued based on the occupant's position. In this way, while there may be people who happily carry out institutional duties because they love these duties, on the other hand, some people may feel like the duties that they have to carry out are imposed on them because of their position in that institution.

In the case of the data, there is evidence that the institutional perspective plays a prominent role in developing and sustaining the identity of out-of-the-field Social Sciences teachers.

Principals do not look at the CVs and sometimes, some of them, when you ask, they tell you that they look at the needs of the school.	*it is a bad assumption for people to think that Social Sciences can be taught by anyone.*	*The name is just there for a show. Social Sciences is just a show [emphasized with a high note], but actually, it's just a Geography time or a History time…*

Sometimes, you do not see the topics to be integrated because when I am teaching the Geography part, I wear a Geography cap, and when I am teaching History, I wear the History cap. I am not wearing one cap, like a Social Sciences cap. If there was integration, I should be able to bring a History topic to the Geography topic that I am teaching".	*If you can ask me right now, 'What does it mean to be a Social Sciences teacher?', I would not know how to answer because I was trained to teach Geography, not Social Sciences. I know what it means to be a Geography teacher, not to be a Social Sciences teacher, but I do teach SS (Social Sciences)."*

The employment of out-of-the-field Social Sciences teachers follows the institutional perspective in that principals (authorities) in schools (institutions) hire these teachers because there is a vacancy that needs to be filled instead of considering the qualifications and experience of these teachers. Hobbs and Porch (2021) define teaching out-of-the-field as a situation wherein teachers are allocated subjects they are not qualified and trained to teach. The data indicates that there is danger in hiring out-of-the-field Social Sciences teachers because the Social Sciences subject requires trained teachers equipped to impart Social Sciences subject matter. Some of the out-of-the-field teachers specialize in either History or Geography and, in some cases, both subjects, but they are trained as Social Sciences teachers. As such, these teachers often struggle to identify and show links and relationships between History and Geography so that Social Sciences can be realized.

Hobbs and Porch (2021) argue that teachers must be warned during the initial teacher education training about the realities of being hired as an out-of-the-field teacher. "While out-of-field teaching has become part of 'what teachers do,' that is, it has become normalized, we need to be honest and decide as a profession whether it is OK to expect teachers to work outside of school hours and in their own time to learn new content, to continue to teach out-of-field without expecting that teachers upgrade their qualifications, and how continued teacher learning and expanding expertise needs to be acknowledged and remunerated" (Hobbs & Porch, 2021,p.607). Also, although it could be argued that out-of-the-field teachers navigate their identity for Social Sciences through the institution, the basis for these teachers' affiliation with the Social Sciences identity is misleading. Although many factors may contribute to the N-Identity in the case of teaching, the subject matter and the pedagogical content knowledge should be at the core. Shulman's (1987) seven categories of teacher knowledge and the minimum requirements for teachers outlined in the Draft Policy on Minimum Requirements for Teacher Education Qualifications (DHET, 2010) must be met to ensure justice and holistic learning for the learners.

The other issue that emerged was the name 'Social Sciences.' All the teachers, both Social Sciences and the out-of-field Social Sciences teachers, felt that the name 'Social Sciences' in the Curriculum Assessment Policy Statement and the subject are illusive. The first point of departure is the name "Social Sciences" and how it is interpreted in the CAPS. The curriculum policy does not clearly define what Social Sciences is. Instead of defining the subject, the policy states that Social Sciences comprises Geography and History. The division between History and Geography as the primary elements of Social Sciences raises questions about what Social Sciences is. The issue within the conceptualization of Social Sciences is not new. Kgari-Masondo (2017) identified the misalignment between theory and practice in social science, arguing that the Social Sciences are not reflected in the pedagogical practices used in social science classrooms because they are taught in a fragmented way.

Most of the out-of-the-field teachers in this study were concerned about how much time they spent preparing for Social Sciences lessons. They argued that teaching Social Sciences felt like teaching two subjects, Geography, and History, are treated as entirely different subjects in the Social Sciences CAPS. The issue of lesson planning stems from the fragmentation of Social Sciences and simultaneously highlights these teachers' lack of knowledge and skills in teaching the subject. Teachers need to understand how to handle the subject with which they are unfamiliar. This shows that it is problematic to assign hybrid subjects because some aspects may be familiar to teachers. This is why Kgari-Masondo (2017) argues that the Social Sciences curriculum policy must be reconsidered.

Above everything, the issue of out-of-the-field Social Sciences teachers provides valuable insights regarding the identities of these teachers. The data indicates that these teachers often struggle to understand who they are when teaching Social Sciences. At the same time, the data also indicates that these teachers identify with the other subjects that they were trained to teach. While Badley (2009), Lam and Lidstone (2001), Manyane (1999), and Greenwood (2013) have argued that the struggle in the construction of Social Sciences teacher's identity may result from attempts to protect the subjects that these teachers are trained to teach, Gee (2000) and other studies have shown that it is possible to have several identities. In this case, perhaps the out-of-the-field Social Sciences teachers need support to help them forge a Social Sciences identity. Moreover, Manyane (1999) shows that some subjects (such as History) can function as interdisciplinary subjects and retain their identity. Similarly, Geschwind and

Melin (2016) explain that people have different identities and that teachers from other disciplines can develop a Social Sciences identity. This is in line with Gee's (2000) claims that the identities possessed by individuals are context-bound, as Saunders (1982) posits that identity is not fixed; it evolves and changes over time.

6. Conclusion

The paper explored how out-of-the-field Social Sciences teachers navigate and negotiate their Social Sciences teachers' identities. Analyzed within the four perspectives by Gee (2000), the data has shown that the navigation and negotiation of the teacher's Social Sciences identity are aligned with the constitutional perspective. However, there are limitations within the constitutional perspectives, which make the navigation and negotiation process questionable. The limitations include the teachers' lack of the requisite social sciences training, which includes content knowledge, making it difficult for the teachers to understand who they are in the Social Sciences classrooms. Therefore, there is a need to support the out-of-the-field Social Sciences teachers because regardless of being qualified by the school to teach Social Sciences, the teachers still struggle to teach and identify with the subject effectively. Without a doubt, this conundrum may also affect how the learners learn and think about Social Sciences. This is problematic because learners are deprived of the fundamental knowledge and skills in Social Sciences that are important in this ever-changing world.

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CUSTOM-MADE COURSE ADMINISTRATION SPREADSHEETS AS AN ELECTRONIC GRADEBOOK ALTERNATIVE

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Abstract

Instructors at all education levels are responsible for a variety of course-centric administrative duties. These typically include the taking of attendance, lesson planning, the marking of submitted homework and other assignments, and the calculating of students' final grades. Although many commercial and open-source electronic gradebooks are available to aid them with such duties, some may find such software intimidating or off-putting, as they may be time consuming to learn, expensive, inflexible, or lack certain desired features. While there is no one-size-fits-all electronic gradebook solution, one often overlooked alternative is the custom-made course administration spreadsheet. The current paper aims to introduce by explanation and example why and how such spreadsheets can provide instructors with robust and flexible ways to manage course-related administrative requirements.

Keywords: *Electronic gradebooks, spreadsheets, teacher administrative duties, tracking student progress and performance.*

1. Introduction

Educational instructors are tasked with more than just teaching lesson content. They are typically required to keep meticulous records of student data (e.g., attendance, homework scores) and make calculations (e.g., of final grades). Such data are often required by educational institutions as a matter of course, but by analyzing them stakeholders can better understand student academic achievement, educational outcomes, and the effectiveness of teaching methodologies. Ideally, such data handling—which includes collecting, organizing, calculating, and analyzing student data—should be carried out in the simplest, most efficient, and most stress-free ways possible.

Traditionally, data handling was strictly a pencil-and-paper affair, with all record-keeping and course-outcome-calculating activities done in paper-based gradebooks. The rise of the personal computer revolution brought with it arguments in favor of digital data handling solutions, or DDHSs (Hafner, 1992; Vockell & Fiore, 1993). Because of advances in technology and the popularization of digital devices (e.g., iPads), these arguments continue to be made via both academic articles (e.g., Shaw et al., 2013; Vegel, 2021; Zach, 2005) and the Internet's many teacher-centric websites that recommend or even sell such solutions. As explained by Vegel (2021), the main advantage of electronic gradebooks as a DDHS comes from their ability to store and calculate data, with the ultimate goal being to share that data either immediately with others online or for final grade reporting. Because their use allows data preparation, calculation, and analyses to be automated, instructors can spend less time on non-teaching duties and more time on improving the quality and quantity of their instruction (see Jasińska-Maciążek, 2020).

2. Method

There are various types and use scenarios of such DDHSs, and which an instructor selects depends on factors that include but are not limited to purpose, cost, features, intuitiveness, ease of use, and academic institution directives. An inspection was made of common DDHSs (e.g., Gradekeeper, iDoceo, ThinkWave, Google Classroom, Microsoft Excel spreadsheet templates). These and other commercial and open-source software programs and spreadsheets have been created by software developers (and instructors themselves) specifically with instructors' typical duties and needs in mind (e.g., attendance taking, seating charts, final grade calculations). Even so, considering various educational situations and specific instructor requirements, none could possibly provide a one-size-fits-all solution. From this inspection, however, one DDHS stands out: the spreadsheet. Although it may not be readily

apparent, as it may seem relatively low-tech compared to other alternatives, instructors need not turn to other, more complicated or even more feature-rich DDHSs for their electronic gradebook requirements. Depending on their own specific needs and use cases, they may find much benefit in the often-overlooked option of constructing their own electronic gradebook spreadsheets.

3. Commercial versus custom-made

Each type of DDHS comes with its own benefits and drawbacks. To illustrate the rationale behind instructors potentially turning to constructing their own electronic gradebooks, presented here is a brief non-exhaustive list of such benefits and drawbacks.

The benefits of commercial software and open-source electronic gradebooks or spreadsheets include (a) common tasks being built in (e.g., attendance charts, final grade calculation formulas), (b) the wide selection to choose from, and (c) the possible availability of troubleshooting assistance. However, the drawbacks are many. For specific commercial software, the drawbacks can include their (a) lacking timely updates, (b) being discontinued (sometimes without warning), (c) limited platform availability (e.g., no iOS version), (d) upfront or hidden costs (e.g., when free software switches to a pay-based system), (e) customizability limitations, (f) numerous confusing checkboxes and pull-down menus, many of which influence how data is ultimately (and sometimes unexpectedly) calculated, (g) overly concise or overly exhaustive manuals (see Vegel, 2021), and (h) features that are unsupported outside country of origin. Other general drawbacks to such software also include (a) the time needed to fully investigate functions/applicability before committing, (b) users repeating the familiarization process if they switch to a new DDHS for whatever reason, (c) the interface may lack intuitiveness or clash with the user's sense of aesthetics, and (d) their often being constructed for data (i.e., numbers) input only without space for memos or notes, which may be necessary in some cases, or at least be found useful.

For custom-made spreadsheet electronic gradebooks, the benefits include their (a) being fully customizable (e.g., for type of data collected, data calculation method, data display), (b) being made intuitive and/or aesthetically pleasing, (c) flexibility in terms of visual elements (e.g., color and size adjustments to text/cells), (d) nearly guaranteed non-obsolesce (e.g., Apple and Microsoft spreadsheet applications will continue to exist indefinitely), (e) technical support being usually unnecessary, and (f) being free spreadsheet templates available online. The drawbacks include (a) their possibly being time-intensive when either creating or altering templates, (b) their possibly being intimidating/challenging for first-time users, (c) they may require time/energy to learn spreadsheet functions (e.g., how to input formulas), (d) their inherently/initially lacking desired features (e.g., collaboration tools, student or parent online access, visually pleasing elements), and (e) being unappealing to non-tech-savvy instructors or those otherwise experiencing teaching burnout.

As can be seen, DDHSs come with tradeoffs, which is a point that must be emphatically stressed. Instructors must carefully consider and weigh their needs and personal preferences. However, as data collection and calculation are prerequisites in nearly all educational situations, it behooves instructors to assess their DDHS options and begin utilizing that which would benefit them the most as soon as possible. Thus, instructors should be as informed of their DDHS choices as possible before committing to one.

4. The Spreadsheet

4.1. Spreadsheet background

Before discussing several details of a custom-made course administration spreadsheet (hereafter, CMCAS) to be used for explanation purposes, several points must first be made. First, the CMCAS explained here is specifically meant for instructor-use-only scenarios, for example, at the university level where grades and other course progress factors need not be shared immediately online with students or parents. This does not, however, preclude some student data from being shared or uploaded via other means. Second, readers are expected to have some basic familiarity with spreadsheets, as their details (e.g., menu bar items, toolbars) are simply beyond the scope of the current paper. Third, only basic functions (i.e., formulas used for making automatic calculations) are used/explained here. The reasons for this include (a) a simple spreadsheet example is being presented, (b) effective CMCASs only require basic functions, (c) some functions are complicated and require explicit explanations for use, (d) CMCASs are inherently customizable, allowing for later function inclusion, (e) there is natural disparity in instructors' CMCAS needs/technology skills (Bennett et al., 2008), and (f) being for illustrative purposes, the CMCAS explanations here—as well as the spreadsheet template (see below)—should be as brief, simple, and transparent as possible.

Naturally, readers who decide to adopt CMCASs for use should explore how such spreadsheets can provide them maximum utility, for instance, by including functions to have their spreadsheets

automatically calculate descriptive statistics (e.g., averages, minimum and maximum scores), drop a student's lowest score, or convert number grades to letter grades. These functions may require some investigation and practice on the part of individual instructors, but there is ample information about spreadsheet functions, including tutorials, on the Internet.

Fourth, the current paper explains the construction and use of a simple CMCAS **<u>for example purposes only</u>**. It depicts a simulated CMCAS that mimics in part one typically used to great effect previously by the author. The author is cognizant of the fact that its look and utility as explained here may not fully meet readers' expectations, preferences, or requirements. This is not a concern, as readers are encouraged to use the explanations provided here to either (a) develop CMCASs most appropriate for them or (b) examine commercial and/or open-source gradebook solutions with a more critical eye.

The CMCAS described in this paper is found at the author's website, the address of which is located in the following brackets: [https://www.isc.meiji.ac.jp/~rubrecht/index.html]. Readers are encouraged to view the CMCAS there to fully understand the explanations below. Readers are also granted free use of the example CMCAS template and may make changes to it as they deem necessary.

4.2. Spreadsheet programs

Next, instructors have spreadsheet program options. Considering the benefits and drawbacks of each, many have strong preferences for one over another. Several common choices are:

- Excel (Microsoft): most common spreadsheet type; available on Mac and Windows, but requires purchase (though often free to instructors through their academic institution)
- Numbers (Apple): free, but Mac only; easy to use for simple spreadsheets; attractive visuals; not as fully functional as Excel
- Google Sheets (Google): free; can be made collaborative; not suitable for offline work; some scalability and functionality limitations
- OpenOffice Calc (Apache): free; not optimal for large complex documents; users may encounter some interoperability/sharing/collaboration issues

The current article presents a basic Numbers spreadsheet that contains multiple sheets (worksheets). Reasons for this choice include its pleasing visuals, its "futureproofness," its automatic syncing available through iCloud, and there being no need to utilize open (online) gradebooks.[1]

4.3. The basics

Before presenting the example CMCAS, a few spreadsheet basics will first be discussed. The first is *sheets*. Generally speaking, a single CMCAS should contain multiple sheets, with each sheet containing specific student data (e.g., attendance, homework scores). Next are *headers*. Column and row headers should be "frozen" or "locked" to ease viewability. The information each contains will depend on instructor preferences and course requirements. Most instructors will find it intuitive to have the left-hand column headers contain student information (e.g., student names and ID numbers, which can often be easily copied or imported from an XLS or CSV file) and the header rows contain sheet categories (e.g., lesson dates, homework assignment names). *Fonts, lines, and cells* must also be considered. To increase efficiency and overall viewability, CMCASs and the sheets within should follow a standardized format (e.g., uniform font type, font size, border style). To reduce time and energy expenditures, it is strongly recommended that cell information differentiation be limited to font/cell color changes only, not to cell or line width or height.

Finally, there is the matter of *printing, uploading, and sharing*. Instructor preferences and unique teaching situations will dictate whether or not CMCAS sheets should be printed for in-classroom use, uploaded to the cloud, or made collaborative with other stakeholders. As is to be expected, benefits and drawbacks regarding these matters abound. To provide some perspective on the matter, CMCAS online-only storage include the instructor benefits of (a) being potentially accessible on any device (e.g., via a classroom desktop computer or the instructor's iPad if using a service like iCloud) and (b) not requiring data duplication, that is, the transfer of the handwritten data to the electronic gradebook. However, the drawbacks include (a) personal and technical issues may hamper online-only CMCAS use (see Shaw et al., 2013), (b) constant attention being paid by the instructor to digital devices often distracts all classroom participants, and (c) no physical backup means data loss is possible.

A hybrid digital/printed CMCAS configuration, on the other hand, includes the benefits of (a) printed sheets that allow for quick and easy marking, which is advantageous when there are time constraints or multiple classroom activities occurring simultaneously, (b) eliminating technical issues, and (c) the mitigation of data loss. The drawback is that data duplication is necessary, thereby introducing later time/energy costs as well as additional opportunity for input error.

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[1] While advantageous in many respects, such "open gradebooks" have their own drawbacks (see McKenna, 2016).

5. The example CMCAS

5.1. Attendance sheet

By way of preliminary explanation, the author takes the hybrid approach and routinely prints this first sheet at the beginning of a term. This is done for several reasons. First, given the perceived importance of and repetitive nature of attendance taking, especially for remote teaching and learning during the COVID-19 pandemic (see Rubrecht, 2020, 2021a, 2021b, 2021c), a simple, low-tech, and unobtrusive method of marking attendance (and other common grading criteria) is advisable. Attendance taking must be done each lesson, so such sheets should be made available for immediate marking free from potential complications (e.g., no Internet access, technological issues, keystroke errors). This is especially true in cases where criteria (e.g., attendance, punctuality) have grading components attached to them. Second, there is no need to divert attention or switch a computer in use (e.g., during a PowerPoint slideshow presentation) to a different screen just to input attendance markings, for instance, when students arrive late to class every few minutes. Third, a printed sheet allows for quick, easy, and accurate sharing of attendance data, especially as students often wish to confirm their absences near a term's end.[2]

As can be seen on the CMCAS template for a fictional course, the first sheet is the attendance sheet.[3] It includes student identification information, lesson information (e.g., dates and lesson numbers), and grading criteria with maximum grading points for each. Of note is that students are given full marks in the sheet for each grading criteria each lesson at the start of a term. Changes are only applied if a student performs less than satisfactorily. These changed are done by copying the color-coded values in the lower-left section of the sheet to the appropriate cell. This method drastically eases the instructor's workload, as numerical values do not need to be input for each student each lesson for each criterion, and makes criteria with reduced marks easily identifiable.

Also of note are the (a) columns and cells that can be used for lesson note spaces (e.g., for individual student progress or noted problem areas), (b) check spaces to indicate that the instructor has confirmed the accuracy of input data after the duplicated date has been input, and (c) simple sum formulas at the far right of the sheet that first individually calculate each student's individual criterion scores and then calculate each student's final attendance sheet score.

5.2. Lesson plan sheet

The constructing and refining of lesson plans must not be overlooked, as instructors should keep track of what they aim to accomplish over the course of a lesson or a term and record what was actually achieved. This practice both informs instructors about their teaching decisions and aids them in keeping track of lesson progress, which is needed when absent students need to know what they missed in a lesson. Additionally, educational institutions (and their funding governments demand accountability, especially with the proliferation of online-only courses and hybrid lessons brought about from the recent pandemic.

The benefits to a spreadsheet lesson plan sheet include (a) lesson activity rows can be moved by drag-and-drop to change their order, (b) completed lesson activities can be marked with a check, and (c) such sheets can be easily inspected and reused in later terms, with alterations made as needed. This sheet need not be printed. If accessed digitally on a device, (a) checks or notes can be quickly and unobtrusively added as the lesson switches between activities, and (b) one need not be concerned about row height, column width, or overall sheet size.

5.3. Homework, final exams, and final calculations sheets

Just as there is an attendance sheet, there should be applicable sheets for other important course areas such as homework and final exams. At the end of a term all criteria must be gathered, given their appropriate weighting, and summed to provide students with their final score and/or grade for the course. A sheet dedicated to calculating students' final scores should be made. Tallied scores are simply copied from their respective sheets, multiplied by their weighting or percentage, and then added together. The use of (simple) functions in this final calculations sheet is strongly recommended.

6. Discussion

It understood that the CMCAS explained here is not suitable for all instructors in all teaching situations. The takeaway here is that instructors should consider both the elements extant in any particular DDHS and their particular DDHS needs and find a match that works best for them.

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[2] While advantageous in many respects, such "open gradebooks" have their own drawbacks (see McKenna, 2016).

[3] For the sake of brevity, not all details of this and other sheets are explained.

A few final pieces of advice regarding CMCAS creation and use may now be proffered.

- Consider your gradebook needs *before* committing to a gradebook system.
- Electronic gradebooks should be easy to use and understand. Avoid complexity whenever possible.
- If using a CMCAS, make a trial one first. Inspect it very carefully (e.g., its required number and type of sheets, embedded functions, colors and layout) before making it a template for other courses.
- Make a backup of this CMCAS (for both recovery and template purposes).
- Avoid complex functions (or overly complicated functions) for calculations.
- Relatedly, avoid creating sheets that automatically construct graphs or charts (e.g., bar charts indicating students' overall grades) unless necessary (e.g., for specific pedagogical purposes).
- Remember that a CMCAS should be dynamic. Occasional updates and tweaking (e.g., by the including or removing of features) will result in a customized gradebook that works as intended.

As with any digital format containing vital and sensitive information, users are strongly encouraged to make regular backups and utilize security features. Readers may also wish to print all CMCAS sheets to mitigate disaster (see Warren, 2012).

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DRAMATIC ARTS' ROLE IN SUSTAINING IMPACTFUL EDUCATION FOR COMMUNITY DEVELOPMENT AMID 4IR CHALLENGES: A TEACHER'S PERSPECTIVE

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Abstract

Like many nations, South Africa grapples with challenges stemming from the Fourth Industrial Revolution (4IR). The rapid evolution of technology and societal dynamics necessitates an education system that adapts and actively contributes to community growth. Against this backdrop, this study investigates the symbiotic relationship between dramatic arts and community development. It focuses on their interplay in the context of the evolving South African education system during the 4IR. Utilizing a qualitative research design allowed for an in-depth exploration of teachers' experiences, perceptions, and insights. Data collection was interviews and surveys, providing a rich understanding of the subjective aspects involved in teaching dramatic arts. The research design employs purposeful sampling by specifically selecting Dramatic Arts teachers. This intentional selection ensures that the participants have direct experience in the subject matter, making their insights particularly relevant to the study. The research sample was made up of 15 Dramatic Arts teachers who were purposively selected as the researcher was teaching the subject. Themes were drawn from this study from the research questions. Social constructivism theory was adopted for this study. Literature was reviewed from Europe, Asia, Africa, and South Africa. The study advocated for a paradigm shift towards inclusive, participatory pedagogical methods that empower learners as active contributors possessing critical skills. The integration of technology in teaching dramatic arts was recommended, workshops for teachers and specialized training in rural areas. The findings were that the transformative potential of dramatic arts is scrutinized through their influence on cognitive development, emotional intelligence, and social cohesion. Relying on empirical evidence and case studies, the research suggests a compelling argument for the integration of dramatic arts into education. The study recognizes the unique qualities of dramatic arts – its ability to engage, inspire, and foster empathy – as essential components in nurturing a holistic and community-centric education. The study recommends facilitating and integrating technology in teaching dramatic arts. Provide training and resources to teachers to effectively incorporate digital tools, enhancing the engagement and relevance of dramatic arts in the modern educational system. Central to the research was the exploration of the role of community development in dramatic arts education. It was recommended that community engagement and dramatic arts emerge as a catalyst for positive social change. Successful collaborative models between educational institutions, artists, and communities are proposed to create dynamic learning environments extending beyond conventional classrooms.

Keywords: *Curriculum, dramatic arts, fourth industrial revolution, transformative, impactful.*

1. Introduction

This research examines dramatic arts' significance in sustaining meaningful education amid Fourth Industrial Revolution (4IR) challenges (Letuma, 2023). The transformative power of theatrical pedagogy aids educators in preparing students for a changing global world (Horasan-Doğan, & Cephe, 2020). Teachers recognize dramatic arts' role in fostering critical thinking, empathy, and creative expression. Through interactive storytelling and theatrical productions, dramatic arts create immersive learning environments resonating with diverse student backgrounds. Integration of dramatic arts enhances social competence, emotional intelligence, and cognitive abilities supporting interdisciplinary connections (Schneider & Rohmann, 2021). Dramatic arts empower students to be adaptable, empathetic, and socially conscious, addressing 4IR challenges and contributing meaningfully to communities (Letuma, 2023).

2. Literature review

Teachers increasingly recognize dramatic arts' vital role in fostering relevant education amid Fourth Industrial Revolution (4IR) challenges. Dramatic arts cultivate critical thinking, empathy, and creative expression essential for navigating the 4IR era. Through theatrical productions and interactive narratives, educators create immersive learning experiences resonating with diverse populations, fostering social responsibility. Letuma, (2023) highlights the dramatic arts' role in nurturing empathy and creativity, especially in the 4IR context. Integrating dramatic arts enhances students' social skills, emotional intelligence, and cognitive abilities promoting interdisciplinary learning (Schneider & Rohmann, 2021). This equips students with flexibility, compassion, and social consciousness, enabling meaningful contributions to communities and beyond.

2.1. Theoretical literature

Teachers find theoretical literature insightful in understanding the role of dramatic arts in effective education for community development amid Fourth Industrial Revolution (4IR) challenges. Studies extend Boal's (1979) "Theatre of the Oppressed," focusing on participatory theatrical practices for marginalized communities (Gonçalves, 2018; Prentki & Preston, 2020), fostering critical thinking, empathy, and collaborative action. Vygotsky's (1978) sociocultural theory highlights social interactions and cultural contexts in dramatic arts education (Burnard & Dragovic, 2018; Kusarbaev, 2018), aiding multicultural awareness, emotional intelligence, and cognitive growth in immersive theater environments.

2.2. Empirical literature

Recent studies highlight the positive impact of integrating dramatic arts into school curricula on children's social, emotional, and cognitive development (Chang & Jang, 2020). Walsh (2019) suggests that theater-based activities enhance community engagement, creativity, problem-solving, and self-confidence. Research emphasizes how dramatic arts cultivate intercultural understanding and empathy among diverse student populations (Rapanta, & Trovão, 2021). Participatory storytelling and role-playing foster multi-perspective awareness, fostering inclusive communities. Drama-based pedagogies also promote civic engagement and critical thinking, addressing contemporary challenges such as environmental sustainability and digital literacy (Booth & Bolton, 2022).

3. Methodology

Investigating the function of dramatic arts in maintaining meaningful education for community development in the face of 4IR problems from a teacher's viewpoint requires the use of a variety of methodologies. The study's use of a qualitative research approach made it possible to examine instructors' experiences, viewpoints, and insights in detail.

3.1. Research design

Qualitative methods, including a case study approach, were utilized to explore classroom dynamics, student engagement, and community collaboration in dramatic arts pedagogy (Hlatshwayo, 2023.; Lee & Johnson, 2020). These analyses assessed the effects of dramatic arts interventions on academic, socio-emotional, and civic outcomes (Garcia & Wong, 2022; Johnson et al., 2018).

3.2. Methodological design

The present investigation employed a case study research approach to examine educational fairness and inclusion in the South African setting. The main goal was to examine, from the viewpoint of the teacher, the role that dramatic arts play in maintaining meaningful education for community development in the face of four problems. Furthermore, supporting the removal of digital obstacles and the requirement for curriculum flexibility (Hlatshwayo, 2023; Spiegel, & Parent, 2018).

3.3. Population and sampling

To guarantee a comprehensive examination of viewpoints, a purposive sampling approach was implemented, incorporating three high schools and fifteen educators (Creswell & Creswell, 2017). This approach made it easier to carefully choose participants based on their knowledge of and experiences with the South African educational system, guaranteeing a variety of perspectives from important stakeholders including teachers. Surveys and interviews were used to gather data, which gave researchers a deep insight into the arbitrary elements of teaching dramatic arts. The study design uses a deliberate sample technique, with 15 teachers of dramatic arts chosen.

3.4. Research instruments

Surveys and interviews were used to gather data, which gave researchers a deep insight of the arbitrary elements of teaching dramatic arts. This study's main tool for gathering data was a structured interview designed to elicit views from teachers working in the South African educational system.

3.5. Data collection procedure

The researcher hand-delivered the interview questions in hard copy format to participants to guarantee accessibility. Measures to protect privacy and reduce prejudice were put in place, along with clear instructions. It was made easier to include people with a range of experiences and viewpoints by using purposive sampling. The questionnaire's validity and reliability were improved through a pilot test, which also improved the questionnaire's relevance and clarity. Participants completed surveys were gathered (Creswell & Creswell, 2017).

3.6. Data treatment and analysis

The gathered information was processed and analysed to look at how the dramatic arts and teachers' perspectives affected curriculum adaption. To guarantee accuracy and completeness, methods for data organization and cleansing were put in place. The process of classifying open-ended replies yielded insights into participant viewpoints and enabled an all-encompassing investigation of the South African educational system.

4. Findings and discussions

Findings from this study revealed that teachers increasingly recognize the significance of dramatic arts in fostering meaningful community development amidst Fourth Industrial Revolution (4IR) challenges.

Figure 1. Dramatic Arts Develop Critical Thinking.
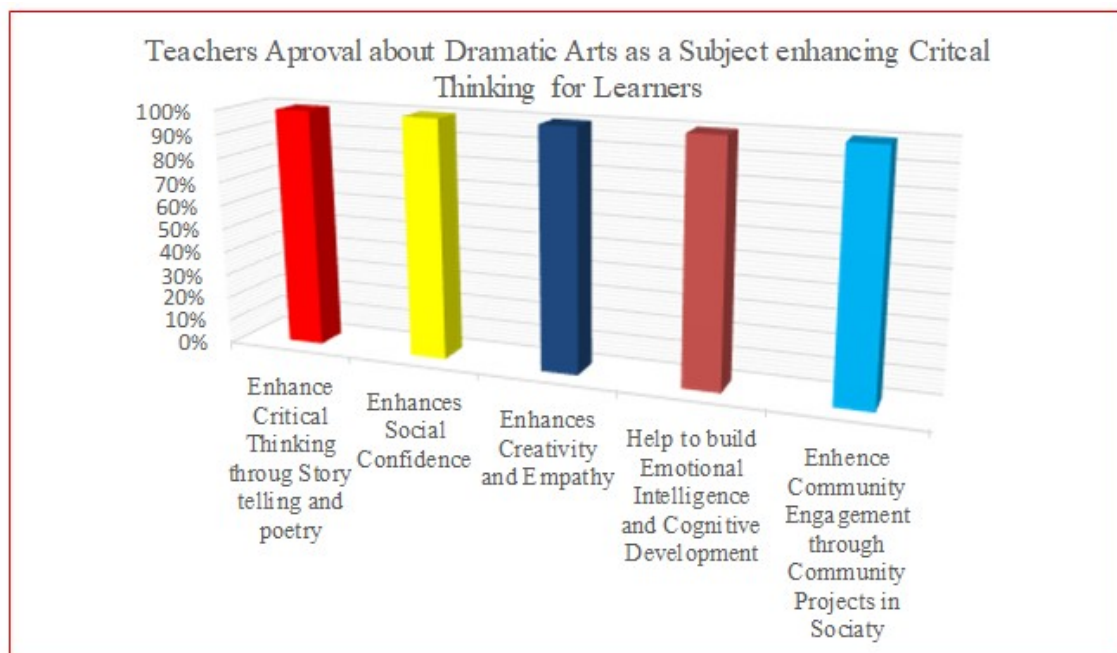
Figure 1 shows the many talents that are improved when a youngster learns dramatic arts. According to it, 98 percent of participants said that dramatic arts improved their critical thinking skills through storytelling; 97 percent said they improved their social confidence; 95 percent said they encouraged creativity and enhanced empathy; 98 percent said they improved their emotional intelligence and cognitive development; and 98 percent said they improved community engagement and project management in society. Integrating diverse research findings revealed the multifaceted potential of dramatic arts in education, informing theory, practice, and policy (Hlatshwayo, 2023; Kriezi, 2023).

Figure 2. Dramatic Arts teachers need training.
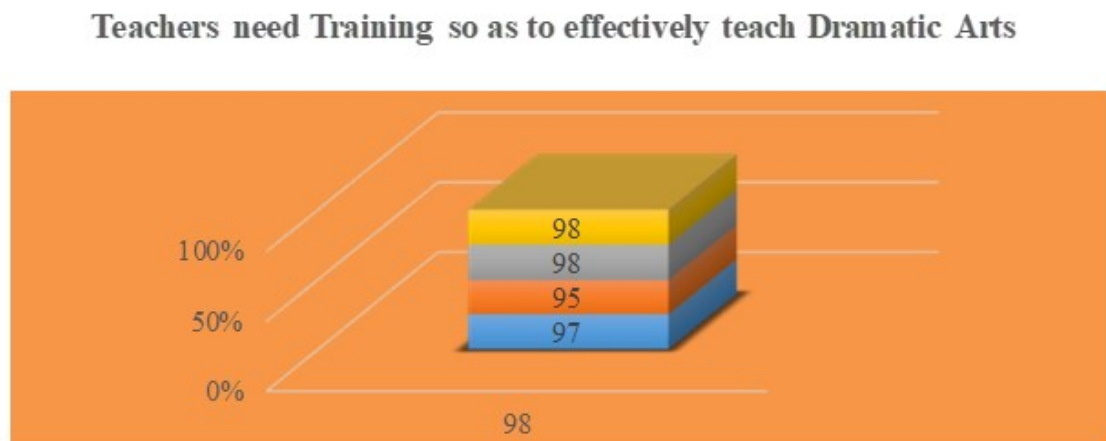
Figure 2 illustrates the responses from the participants, who stated that 98% of them would need workshops, 98% would need special training in rural areas to teach dramatic art, particularly theatre, 95% would want online training, 97% said they would need transformative training before even considering teaching an art subject, and 98% supported university training to teach dramatic art.

Researchers emphasize how dramatic arts offer immersive experiences fostering critical thinking, empathy, and creative expression (Brown & Miller, 2021; Spiegel, & Parent, 2018). Through theatrical productions and participatory storytelling, teachers cultivate civic consciousness and adaptability crucial for addressing contemporary issues (Garcia & Wong, 2022; Kriezi, 2023). Integrating diverse research findings revealed the multifaceted potential of dramatic arts in education, informing theory, practice, and policy (Hlatshwayo, 2023; Kriezi, 2023).

5. Research conclusion and recommendations

The study highlights dramatic arts' importance in meaningful education for community development amid Fourth Industrial Revolution challenges (4IR). It catalyses fostering critical thinking, creativity, and empathy, empowering holistic development, and addressing socioeconomic inequality. Recommendations include integrating dramatic arts across curricula, providing teacher training, fostering community engagement, and allocating resources. By implementing these suggestions, educators and stakeholders can leverage dramatic arts to navigate 4IR challenges and foster positive community change effectively.

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ENHANCING FOREIGN LANGUAGE TRANSLATION PEDAGOGY THROUGH TOPOLOGY-IMAGERY COGNITIVE APPROACHES

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Abstract

This study investigates the application of topology-imagery cognitive strategies in the realm of foreign language translation teaching, aiming to enhance proficiency. Focusing on the intricate aspects of translating lexical semantics and grammatical constructions, it employs a novel method that integrates theoretical insights with practical translation examples. This approach validates the feasibility and effectiveness of using imagery-topology techniques in translation instruction. Results indicate significant improvements in students' abilities to comprehend and translate complex linguistic structures. The application of imagery-topology not only strengthens translation teaching methods but also contributes to the broader field of cognitive development in language education, offering promising implications for future pedagogical strategies.

Keywords: Topology, translation, teaching, lexical meaning, grammar.

1. Introduction

The relevance: One of the crucial tasks in translation pedagogy is the effective transformation of sentence structures from a native language into a target language, while preserving the intended meaning and stylistic nuances. This transformation process is not merely a linguistic challenge but also a cognitive one, as it requires an understanding of the underlying cognitive patterns that govern language structures. By adopting a cognitive approach to translation, it becomes possible to develop strategies that reduce structural and expressive errors commonly encountered in language translation. Through an exploration of sentence cognition and structure in linguistics, the study investigates how the relationship between topology-imagery and syntactic structure can be harnessed to facilitate a more effective translation process. By providing translators with tools to visualize and understand the structure of sentences in both the source and target languages, this approach aims to foster a deeper understanding of linguistic nuances and reduce the cognitive load involved in translation. Ultimately, this research contributes to the field of translation teaching by offering a cognitive framework that can be applied to various language pairs, with a particular focus on the translation challenges posed by languages with abstract structures like Chinese.

Theoretical framework: This study is anchored in the theoretical understanding that language reflects cognitive processes. Groundbreaking research by scholars like Lakoff (1980, 2014), Kövecses (2005, 2010) and Tendahl & Gibbs (2008) have demonstrated that human thought is fundamentally metaphorical in nature. This perspective has led to the identification of three primary metaphorical modes of thought, revealing the innate, metaphorical processes at play in human cognition. These metaphorical processes are mirrored in language, offering insights into the way humans think and communicate. Among these metaphorical modes, spatial representation is considered the most fundamental. Scholars (Levinson, 1996; Regier, 1995) in the field argue that humans inherently conceptualize and articulate thoughts in spatial terms. The role of spatial relationships and imagery in cognition is pivotal, significantly influencing cognitive development. This spatial-imagery cognitive approach is crucial not only in language learning but also in translation activities, as it aligns with natural cognitive processes. Sentence structures in translation are shaped by these cognitive patterns. The study posits that such cognitive logic can be applied across languages, allowing for a comparison of cognitive models across different linguistic systems. This approach has significant implications for teaching translation methods between various languages, particularly when dealing with languages that have abstract structures, like Chinese. Chinese, recognized as one of the more challenging and abstract languages in the world, often poses considerable difficulties in translation. When translating from other languages (such as Russian, English, Japanese, French, and Korean) into Chinese, numerous issues commonly arise. This paper focuses on translations where these languages serve as the source languages and Chinese as the target

language. By employing and showcasing this translation method, the study aims to enhance its applicability in teaching practices, thereby facilitating a more nuanced and cognitively aligned translation process. This approach underscores the importance of understanding the inherent cognitive structures that underlie language translation, especially when dealing with complex and abstract linguistic systems.

Research questions: The exploration of cognitive patterns in translation, specifically through the lens of topology-imagery, forms the cornerstone of this study. The research questions are designed to dissect and understand the intricate relationship between cognitive models and language translation, particularly from various languages to Chinese. These questions aim to bridge theoretical cognitive linguistics with practical translation and teaching methodologies. The study is structured around the following key research questions: 1) what are the various cognitive models of sentence topology-imagery?; 2) How can these cognitive models be applied to translation activities from various languages to Chinese?; 3) how can these methods be incorporated into teaching practices?

Hypothesis: The central hypothesis of this study is predicated on the notion that the cognitive patterns of sentence topology-imagery significantly facilitate the transition between cognitive models across different languages, thereby enhancing both the quality of translation and the efficacy of translation teaching.

2. Method

In this research, a multifaceted methodological framework that amalgamates both qualitative and quantitative research paradigms is employed to explore the cognitive models of sentence topology-imagery and their implications in translation accuracy and pedagogy. The qualitative component encompasses a systematic classification of cognitive models inherent in sentence structures across a diverse range of languages, alongside an in-depth categorization of prevalent translation errors. This analysis aims to elucidate the underlying cognitive patterns that govern linguistic constructs and their impact on translation fidelity. Complementing this, the quantitative aspect of the study involves an empirical analysis using the corpus from the Hanyu Shuiping Kaoshi (HSK) (Chinese Language Test Corpus: http://hsk.blcu.edu.cn/). This entails a statistical examination of word order errors across translations executed by native speakers of various languages into Chinese, thereby facilitating a comparative linguistic analysis.

3. Results

The results of this study reveal significant insights into the cognitive patterns reflected in sentence structures across different languages and the challenges encountered in translating these structures into Chinese. A key finding is that the structural arrangement of sentence syntax in various languages mirrors specific cognitive models, which can lead to difficulties in the translation process when these models are misaligned with the cognitive patterns inherent in Chinese. A crucial aspect of this research was the analysis of word order errors in translations into Chinese from different source languages. The results (Fig. 1) found a notable variance in error rates among translators from different linguistic backgrounds. The highest error rate was observed in translations from German, with a significant 54.72% of sentences exhibiting word order errors. In contrast, translations from English demonstrated the lowest error rate, at 36.84%. These results indicate a substantial impact of the native language's cognitive model on the accuracy of translation into Chinese. The disparity in error rates suggests that certain linguistic backgrounds align more closely with the cognitive patterns of Chinese, resulting in fewer translation errors. This finding underscores the importance of considering cognitive models in translation and translation teaching, particularly when dealing with languages that have structurally and cognitively diverse characteristics.

Figure 1. Percentages of word order errors from different countries.
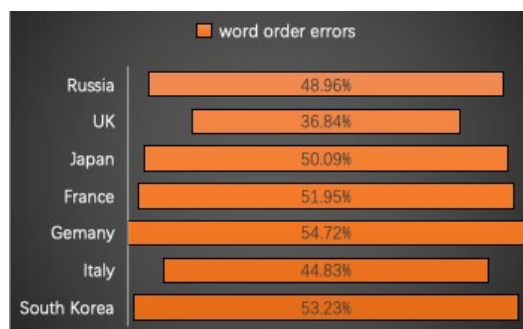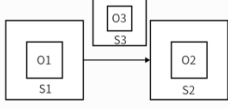
4. Discussion

4.1. Topology-imagery patterns in syntactic structures

The study explores the foundational cognitive illustrations in sentence structure through three forms of topology-imagery, encompassing essential elements of sentence construction: OBJECT (the entity described), SURROUNDING (location and characteristics of the object), and TRAJECTORY (movement aspects of the object).

These elements form the basis of three primary sentence structure types (Table 1), each representing different event descriptions. The first type, the single container, symbolizes stationary events, akin to the concept of "OBJECT in a CONTAINER." This structure is used to depict scenarios where the object's position or state remains constant within a specific context. The second type, prevalent in comparative sentences, is metaphorically represented as "CONTAINER compared to another CONTAINER," highlighting juxtapositions for comparative analysis. The third and most intricate type portrays dynamic events with clear movement, analogous to "OBJECT moves from one CONTAINER to another." This structure often includes interactions or transfers between agents (O1) and recipients (O2), involving direct objects (O3) or the exchange of forces. These complex patterns reflect a deeper cognitive interpretation of actions and interactions within language. Understanding these topology-imagery patterns is vital for translation and language education, offering insights into the cognitive mechanisms underlying language usage and interpretation.

Table 1. Topology-imagery patterns in syntactic structures.

i object in a container	
ii container is compared to another container	
iii object moves from one container to another	

4.2. Recombination elements of TIP from source languages to Chinese

The study's findings on the recombination of Topology-Imagery Patterns (TIP) from source languages to Chinese as the target language have provided noteworthy insights into the translation process. It is evident that in translations to Chinese, the cognitive models of sentences from the source languages are often carried over, resulting in specific patterns of errors that are reflective of these models.

One striking observation pertains to translations from Russian. The relative flexibility in word order in Russian, coupled with a strong emphasis on logical relationships, often leads to errors in the positioning of adverbs and adjectives in Chinese translations. This suggests a cognitive dissonance between the two languages' TIP. In Russian, the use of adverbial forms to establish sentence meaning is common, while Chinese relies more heavily on attributive forms. This difference in the use of sentence elements reflects the disparity in TIP between the two languages. Furthermore, Russian translators exhibit additional types of errors, such as the omission of sentence components. This indicates a broader range of translation challenges beyond mere word order, encompassing aspects of sentence structure and element inclusion. For instance：

Source Text：*По-моему (in my opinion), песни (songs) помогают (help) людям (people) выражать (express) их (their) самые (most) глубокие (deep) чувства (feelings).*

Target Target：**在我看来 (In my opinion), 歌曲(songs) 帮(help) 人们(people) 表达(express) 他们(their) 最深的(deepest) 心里(inner) 感情(feelings).*

In the case of translations from English to Chinese, the study reveals distinct challenges pertaining to the placement of adverbial and conjunction markers. This issue reflects a fundamental difference in the Topology-Imagery Patterns (TIP) between English and Chinese, particularly in terms of the relationship and positioning of surroundings (S) and objects (T) in sentence structures. In English, the typical sentence structure often showcases a surrounding-marker-target (S-Marker-T) pattern, where the surrounding context or elements play a pivotal role in modifying the target concept. This reflects the

cognitive approach in English where the surrounding context is crucial in framing and interpreting the sentence's meaning. Contrastingly, in Chinese, the prevalent pattern tends to be marker-surrounding-target (Marker-S-T), indicating a different cognitive flow in sentence construction. In this structure, the surrounding context is modified by a marker, leading to a different interpretation and emphasis of trajectory in the sentence. The disparity in the treatment of surroundings and their relationship with other sentence elements between English and Chinese poses significant challenges in translation. For instance：

> **Source Text:** *What exactly is pop music?*
> **Target Text:** **什么[What]到底[exactly]叫[is called]流行[popular]歌曲[songs]呢?*

In the translation from French to Chinese, significant differences in the Topology-Imagery Patterns (TIP) are observed, particularly in the placement of adjectives and the arrangement of sentence elements such as agent-recipient and instrument. French typically follows an Object-Surrounding (O-S) structure where adjectives come after nouns, contrasting with the Chinese Surrounding-Object (S-O) pattern. Furthermore, the sequence of trajectory (T) in sentence units also differs, with French often using an Object3-Trajectory-Object2 (O3-T-O2) pattern, while Chinese adheres to a more rigid Object3-Object2-Trajectory (O3-O2-T) sequence. These variations highlight the importance of understanding distinct cognitive sentence construction models in enhancing translation accuracy between languages with divergent linguistic structures. For instance：

> **Source Text:** *tJe (I) ne (not [part of negation]) sais (know) pas (not [completes negation]) non plus (either/neither) **comment** (how) **décider** (to decide) **à** (for) **sa** (his/her) place (place).*
> **Target Text:** **我(I) 也(also) 不(not) 知道(know) 替(for) 他(him) 怎么(how) 做决定(decide).*

In translations from Italian to Chinese, notable differences arise in Topology-Imagery Patterns (TIP), particularly in adjective positioning and conjunction placement. Italian typically follows an Object-Surrounding (O-S) structure, placing adjectives after nouns, unlike the Surrounding-Object (S-O) pattern in Chinese. Additionally, there is a variation in the placement of conjunction markers, with Italian commonly using a Marker-Object-Trajectory (Maker-O-T) sequence, in contrast to the Object-Marker-Trajectory (O-Maker-T) pattern in Chinese. These disparities underscore the importance of understanding distinct cognitive sentence construction models to enhance translation accuracy between languages with different linguistic structures. For instance：

> **Source Text:** *Con (With) meno (fewer) persone (people), **perciò** (therefore) il (the) livello (level) di (of) vita (life) di (of) ognuno (everyone) aumenta (increases).*
> **Target Text:** **有了(With) 更少的(fewer) 人(people)，**就**(therefore) 每个人(everyone's) 的(of) 生活(life) 水平(standard) 提高(improves) 了(has been).*

In translations from Japanese and Korean to Chinese, a significant difference is noted in the placement of verbs, reflecting contrasting Topology-Imagery Patterns (TIP) in sentence structures between these languages. Japanese commonly employs an Object-Trajectory (O3-T) pattern, placing the verb at the end of the clause, whereas Chinese typically follows a Trajectory-Object (T-O3) structure, with the verb preceding the object. This divergence in sentence construction highlights the importance of understanding and adapting to the different cognitive patterns in each language to ensure accurate and coherent translation. For instance：

> **Source Text:** *もちろん(Of course)、誰も(no one) 電話(the phone)の('s) 音(sound)が(subject marker)聞こえない(cannot hear).*
> **Target Text:** **当然(Of course) 电话(the phone) 响(ringing) 也(also) 谁(who) 都(all) 听不见 (cannot hear).*
> **Source Text:** 여러분(everyone), 몸(body) 잘(well) **돌보세요(take care of)**.
> **Target Text:** ** 请(please) 你们(you all) 身体(body) 好好儿地(well) **保重(take care)**.*

4.3. Methodologies for teaching translation

A prevalent challenge in translation is the asymmetry between source and target languages, particularly in their structural expressions. This misalignment often results in inaccuracies in sentence translation. Addressing this issue requires a comprehensive approach that considers the cognitive models pertinent to both the source and target languages. A key solution lies in the application of topology-imagery patterns (TIP) in translation teaching methodologies.

The process starts with the deconstruction of sentences from the source language based on their TIP cognitive structures. This involves breaking down the sentences into their fundamental components, examining how elements are arranged and interconnected (topology), and understanding the mental imagery associated with these structures (imagery). Once deconstructed, these elements are then

reassembled following the structural and cognitive patterns of the target language. This reassembly process is not a mere linguistic translation but a cognitive realignment to fit the target language's patterns.

In the context of translation teaching, it is crucial for educators to provide students with a framework that encompasses general linguistic methods, enabling them to effectively navigate the complexities of different languages' cognitive models. This includes training in the identification and application of TIP in both source and target languages, as well as exercises in deconstructing and reconstructing sentences to conform to the target language's cognitive patterns. By incorporating these methodologies into the translation curriculum, educators can equip students with the necessary tools to tackle the inherent challenges of translating between asymmetric language structures, thereby enhancing their translation accuracy and overall linguistic competence. This approach not only addresses the immediate practical needs of translation but also fosters a deeper understanding and appreciation of the cognitive aspects of language processing.

5. Conclusions

This study has successfully identified three primary categories of sentence topology-imagery patterns: single container, dual container contrast, and multiple container with trajectory. These cognitive models play a crucial role in understanding the structural and conceptual aspects of sentence construction in various languages.

In the context of translation, particularly from diverse languages to Chinese, a clear comprehension and application of these topology-imagery patterns are imperative. The study demonstrates that effective translation involves more than linguistic proficiency; it requires a deep understanding of both the source and target languages' cognitive models. By aligning the source language's sentence structure with the cognitive patterns of the target language, translations can achieve greater accuracy and coherence.

Furthermore, the study has explored how these cognitive models can be integrated into translation teaching practices. The approach emphasizes the application of fundamental linguistic principles, guiding students to deconstruct and reconstruct sentences based on topology-imagery patterns. Teachers play a pivotal role in facilitating students' understanding of these patterns, enabling them to compare and contrast cognitive imagery across languages. This method is shown to be effective in reducing error rates in translation by fostering a deeper understanding of the cognitive aspects of language processing.

However, the study acknowledges its limitations, primarily in the scope of languages analyzed. The investigation was confined to a relatively small number of languages, which may not fully represent the wide range of linguistic structures and cognitive models present in the global linguistic landscape. Future research could expand upon this foundation by exploring a broader array of languages, thereby enhancing the generalizability and applicability of the findings. Such expansion would not only enrich the understanding of sentence topology-imagery patterns across languages but also provide more comprehensive insights into effective translation and teaching methodologies.

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FACULTY DEVELOPMENT FOR EMERGENCY ONLINE TEACHING AND LEARNING: A CASE STUDY

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Abstract

The University of Central Florida transitioned to remote online instruction in the Spring of 2020, revealing a substantial gap in emergency response to faculty development online teaching needs. This study aimed to examine the response to faculty development needs during the COVID-19 pandemic determining how a large four-year public university leveraged its online pedagogy experiences, instructional designers, and resources to respond to COVID-19 with an emergent online faculty development program for online teaching, ensuring quality online instructional practices. Eight participants from the university participated in the study and semi-structured interviews were conducted in the Spring of 2022. The findings of this case study revealed that instructional designers felt a sense of connectedness and collaboration while working amongst colleagues, key factors of defining the purpose and intent of the training and use of material already in existence were the most important and influential elements of the design and development, and barriers that existed included an absence of leadership direction and limitation of faculty time commitments. Recommendations for further study include further exploration of the impacts of the faculty development programs and how effective the practices taught were for students and their learning outcomes and learning experiences.

Keywords: Online learning, faculty development, pandemic.

1. Introduction

In the Spring of 2020, colleges and universities responded to the most disruptive global health crisis since the Spanish flu epidemic of 1918, transitioning to remote instruction in response to COVID-19 (Centers for Disease Control and Prevention, 2020). Preparing faculty to transition rapidly to remote instruction through en-masse faculty development was challenging for learning management systems support staff, faculty developers, and instructional designers, especially supporting faculty moving online courses that required in-person activities (e.g., laboratory activities, cooking demonstrations). The transition to remote online learning was immediate and unexpected, forcing instructors to simultaneously learn and implement online teaching and learning strategies (Dvir & Schatz-Oppenheimer, 2020). Limited knowledge about online remote teaching and the different implications associated with the delivery and communication in online remote instruction disadvantaged instructors and students alike (Gillis & Krull, 2020). The students' lack of digital competence and the limited faculty experience in developing and delivering online instruction negatively affected communication between students and faculty instructors. Despite these challenges, some faculty reported high satisfaction levels and approval of the technological opportunities and platforms they learned and used for instructional purposes; faculty appreciated new opportunities to teach in new and innovative ways that maximize student learning (Dvir & Schatz-Oppenheimer, 2020). The instructional faculty also experienced tensions regarding instructional goals and the effectiveness of teaching methods (Dvir & Schatz-Oppenheimer, 2020).

Adapting to new situations without the support of institutions or mentors can be daunting for faculty. The rapid transition to remote online learning has surprised instructional faculty and forced them to solve problems not previously encountered (Flores & Swennen, 2020). Van der Spoel et al. (2020) compared faculty attitudes about online teaching expectations before transitioning to remote online teaching. The researchers conducted two surveys of two hundred Dutch instructors (Van der Spoel et al., 2020); the results showed that prior experience significantly influenced a smooth transition. Instructional faculty who had experience with learning management systems and other online teaching technologies conducted remote online instruction more positively than initially expected (Van der Spoel et al., 2020). Most of the instructional faculty underwent an increased sense of urgency to transition to the remote

online modality. The instructional faculty also reported the lack of interaction with students and colleagues as one of the negative aspects of remote online instruction (Van der Spoel et al., 2020).

However, remote online instruction did bring about benefits in other ways. For instance, the instructional faculty also reported that more introverted students benefited from online learning as they were more engaged than in regular classroom contexts (Van der Spoel et al., 2020). Van der Spoel et al. (2020) also found that instructional faculty looked forward to integrating technology into their teaching after the threat of COVID-19 subsided, indicating that they wanted to improve or enhance active and collaborative learning, feedback, and overall instruction (Van der Spoel et al., 2020). Instructors also reported that technology increased efficiency and enhanced students' motivation by providing personalized educational experiences (Van der Spoel et al., 2020). Essentially, the researchers concluded that the urgency created by the COVID-19 pandemic shifted instructional faculty's intentions to incorporate technology in their lessons even after the pandemic (Van der Spoel et al., 2020). It is also important to note that these motivations emerged even without professionalization programs to support remote online instruction (Van der Spoel et al., 2020). Nonetheless, instructional faculty must be motivated to use online technology even after transitioning to face-to-face modalities.

The OECD and UNESCO stress the importance of preparing students for an uncertain world (Hadar et al., 2020). The COVID-19 pandemic provides a unique opportunity to assess the impact of faculty development programs on teachers' social-emotional competencies (Hadar et al., 2020). Evaluating 54 student teachers and 24 educators, Hadar et al. (2020) found many struggled with remote instruction and lacked essential teaching skills. Addressing instructors' social-emotional needs is crucial, considering their potential stress and burnout. To enhance faculty competencies, institutions should integrate stress management, mindfulness, and teamwork strategies into faculty development programs (Hadar et al., 2020).

Public institutions must not overlook the significance of faculty development programs in preparing instructional faculty for emergencies. The COVID-19 pandemic has presented circumstances that will not always remain stable. The unpredictability of crises could cause disruptions in daily processes. Thus, faculty development programs prepare teachers to transition during unpredictable events.

2. Objectives

In March 2020, educational institutions worldwide confronted the necessity of transitioning to remote learning due to the COVID-19 pandemic. Faculty development for online teaching, previously important, became even more critical for ensuring the quality of online education. Known as educational development, faculty development, or professional development, this area has evolved to meet institutional and educational needs. However, defining faculty development remains a challenge amidst its importance. Higher education institutions also grapple with financial and logistical constraints, exacerbated during the pandemic (Adedoyin & Soykan, 2020). These challenges include selecting, purchasing, and training on new technology and instructional practices suitable for online or remote learning.

Current research on faculty development in online pedagogy, especially in response to the global pandemic, is scarce. To address this gap, the researchers aimed to investigate a public state university's response to the pandemic by creating an effective faculty development program for online teaching. Following Creswell's (2015) recommendation, the study utilized a case study approach, collecting data from various sources to analyze the institution's response comprehensively. This study seeks to provide a detailed account of how the university adapted to the pandemic and addressed online faculty development needs. Additionally, it aims to explore the program's development process from the perspective of instructional designers. By employing qualitative case study methodology, the researchers aim to offer a holistic understanding of instructional designers' experiences during the pandemic, as recommended by Yin (1994).

The following research questions were considered to prompt an intensive analysis of the phenomenon: RQ1: According to instructional designers involved in the development of EOT, what key factors influenced the design and development of a large-enrollment faculty development program? RQ2: According to instructional designers who participated in the development of EOT, what were the primary challenges and urgent obstacles encountered during the rapid implementation of the faculty development program aimed at serving a substantial number of faculty participants?

3. Methods

The University of Central Florida, a leader in online teaching and learning, boasts a student body exceeding 70,000 individuals. Renowned for its diverse academic programs, the institution offers

numerous bachelor's, master's, and doctoral degrees. Its online programs consistently rank among the top institutions surveyed by U.S. News & World Report. Spearheading these efforts is the university's distance learning department, which oversees online faculty credentialing and training. This department also provides comprehensive support services, including an online help desk, Learning Management System administration, instructional development, multimedia resources, and instructional design. These resources aim to enhance the quality of online instruction university-wide.

This study occurred in the 2021-2022 academic year following the start of the global COVID-19 pandemic. Eight stakeholders were part of this study, including the instructional designers and administrative personnel. Of the eight participants, two focused on the course design, two led the implementation and development, two designed and developed evaluations, and two facilitated the program. To protect anonymity, interview respondents are only identified by pseudonyms.

Data collection involved interviews as the primary data source, complemented by document analysis. Approved by the Institutional Review Board, planned interviews followed a semi-structured protocol, using closed and open-ended questions to address research inquiries. Conducted via Zoom, audio files were transcribed within the platform. Document analysis provided detailed insights, leveraging publicly available documents from the development team and stakeholders. These artifacts encompassed institution needs, COVID-19 concerns, student barriers, faculty development plans, and meeting agendas. This analysis furthered the evaluation process.

The researchers employed deductive analysis to interpret interview data initially, using constructivism to conceptualize the study. Coding and clustering mechanisms were utilized to break down significant themes, such as attitudes, beliefs, and values, aligned with constructivist practices. Dedoose, a qualitative software analysis tool, ensured accuracy during data reduction. Clustering occurred during the fourth coding cycle, forming themes that answered the research questions. Document analysis, following Bowen's systematic procedure, provided additional insights into the faculty development program's design and development. Publicly accessible documents were examined to identify emerging patterns, themes, and trends.

4. Findings

Each of the eight participants shared similar backgrounds despite varying levels of involvement and past experiences. Despite some differences amongst the responses received by the researchers, five main themes emerged through the extensive data analysis of the transcribed interviews. Six participants were instructional designers, both serving on the design and development team and serving in a facilitating role supporting assigned faculty participants. Two participants served in administrative-supervisory roles overseeing the team designing and developing the faculty development training.

ID1 has seven years of instructional design experience in higher education, collaborating with the faculty development team during the pandemic. ID2, with twelve years in higher education, contributed to the flagship faculty development course, informing the new online course for remote instruction. ID3, with nine years of experience, promoted adaptive learning strategies. ID4, with eighteen years in higher education, incorporated instructor perspectives into course design. ID5, with twenty-two years of experience, focused on participant engagement. ID6, with fourteen years of experience, served as the main liaison to university leadership. ID7, with six years of experience, handled more administrative tasks. ID8 has twenty-one years of experience and acted as a content expert, supporting faculty post-course completion.

All IDs defined how they felt challenged to find a starting point in the faculty development program they were building and facilitating. The participants explained that the challenge of finding a starting point stemmed from a lack of direction from the university's leadership team. Several of the IDs claimed they lacked direction from their leadership team, and several participants felt "overwhelmed" in getting started in the design and development of this faculty development program. This commonality amongst all responses led to the discovery of the second theme: defining the purpose and intent of training.

The participants emphasized the reliance of the faculty development program on existing resources and practices. Prior to the pandemic, faculty engaged in a semester-long credentialing process focused on online or blended course development, centered on pedagogy, technology, and collaboration with instructional designers. ID1 underscored the importance of preserving these foundational principles. The instructional designers shared a collective commitment to ensuring "quality" in the program's courses, drawing from their expertise in online pedagogy and repurposing existing materials. Leveraging the university's flagship blended program, they adapted content to meet the urgent demands of remote instruction during the pandemic. ID1 highlighted this approach, emphasizing the utilization of existing

resources to maintain quality in the transition to online modalities. Despite vague initial instructions, the team prioritized key objectives: LMS utilization, Zoom best practices, and meeting credentialing goals for a large faculty cohort. These objectives informed their development process and future actions.

Participants referenced an existing self-paced tutorial introduction for the usage of the learning management system (LMS) based on a minimum of forty hours required for completion. According to ID4, this existing self-paced LMS tutorial was not focused on designing and building a course in the Canvas LMS but more on how to navigate through an existing course. ID2: "We had to have everyone start somewhere, so it was decided early on that anyone even thinking of taking this faculty development course had to take the existing self-paced tutorial first."

The participant responses highlight the immediate challenge faced in implementing the faculty development program, primarily due to the unknown factors surrounding its development. Participants expressed concerns about the tight timeline, the need to train a large number of faculty, and the scope of the curriculum. For instance, ID7 described the pressure to condense a typical ten-week training into just a few weeks while supporting ongoing faculty needs. Document analysis revealed a lack of initial guidelines from leadership, leaving participants uncertain about timelines and expectations. Despite frustrations, ID5 acknowledged the unprecedented circumstances and emphasized the opportunity to demonstrate value by anticipating needs. A key issue arising from the lack of direction was identifying the target audience, which varied widely in terms of experience with the learning management system (LMS). Participants noted the diverse backgrounds of faculty, ranging from novices to self-proclaimed experts, spanning different age groups and teaching experience levels. Notably, larger departments like Education, Sciences, and Engineering presented unique challenges, particularly in their historical resistance to online teaching methods, as highlighted by ID4.

5. Discussion

Defining the purpose and intent of the faculty development program steered the pedagogy and drove development decisions. Participants utilized the "backward design" framework by Wiggins and McTighe to work from the end goal, determining desired outcomes and planning course content based on faculty needs. This approach, widely accepted for over twenty years, specified mastery evidence and guided content and instruction planning.

Participants recognized faculty time constraints as a barrier to program implementation, exacerbated by COVID-19 factors. Understanding these limitations, the team developed an estimated timeline and workload distribution to manage development tasks efficiently. Clear communication and transparency about delays and impacts were vital for success.

6. Implications

This case study indicates the importance of identifying a timeline and determining what can and cannot be accomplished within these parameters. The study participants revealed the impact of time constraints and limitations on their ability to design, develop, and facilitate a faculty development program. The ID's time had to be fruitful and progressive consistently. Beyond the time constraints of the IDs, acknowledging and being mindful of the workload balance and calculation of how much time faculty will be asked to invest in the course. Deciding on the engagement of faculty participants may impact the sense of focus and rhythm of participant progress. It is crucial to consistently ensure a healthy and manageable expectation for faculty participation throughout the program.

Collaboration between IDs was highly effective throughout this case study, which addressed problems afflicting the design and development of a faculty development program. The ongoing partnerships proved successful as the team of IDs worked collectively to address the needs of the university. By sharing a common goal, IDs may leverage their unique expertise and experience to cultivate a masterful approach to providing solutions and successfully developing faculty development programs. Additionally, working in these collaborative conditions may enhance a team's innovation, efficiency in the design and development process, and ability to deliver ongoing and transparent communication.

By creating a culture of collaboration, similar to that of team learning, IDs improve their work outcomes and learn from their experiences. In addition, the collaborative culture cultivates a place for openly inviting feedback and opinions, transferring knowledge amongst the team, and accumulating a better understanding of individual approaches to working. Furthermore, IDs that collaborate have a chance to learn from each other, gaining value and new perspectives. Finally, learning from others in this setting allows the workplace culture to promote its emphasis on learning and development.

Higher education institutions have faced crisis shutdowns due to human and natural disasters. All crisis response teams have focused on the physical safety and needs of the institution yet neglected to address how to sustain access to learning during these moments. This pandemic precursor gave no valuable lessons on how enhanced LMS usage and required faculty development programs would have mitigated the impact of a nearly two-week shutdown. However, as this study has established, having elements in place, such as generic LMS faculty training instruction, an ID response team, and a basic plan, could help to efficiently shift to a remote online instructional modality without impacting faculty and students.

7. Conclusion

This case study highlighted critical practices that instructional designers at the University of Central Florida used to design, develop, and implement EOT, a faculty development program developed to respond to the instructional challenges precipitated by the COVID-19 pandemic - namely, moving all instruction online. Based on the themes found after conducting a semi-structured interview with participant IDs, the results indicated that IDs felt a sense of connectedness and collaboration among their colleagues. Because of that, they successfully defined the purpose and intent of their faculty development program despite limited time and insufficient leadership direction. This case study filled previous literature gaps regarding faculty development needs and responses during the COVID-19 pandemic. The lack of knowledge about online remote teaching and the different complications associated with the delivery and communication in online remote instruction have disadvantaged instructors and students alike (Gillis & Krull, 2020). To overcome the barriers reported in this case study, future endeavors must prepare institutions to respond and adapt to emergencies or urgent needs to shift to an online or remote learning modality.

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EXPRESSION OF DIALOGUE AS AN EFFECTIVE INDICATOR OF EDUCATION QUALITY IN LITHUANIAN EDUCATIONAL INSTITUTIONS

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Abstract

Lithuanian educational institutions provide public services (The Law on Education of the Republic of Lithuania, 2003; The National Education Strategies for 2013-2022; The Concept of the Good School, 2015), with the help of which the aim is to turn Lithuanian education into a sustainable basis for an energetic and independent person who responsibly creates his own and the country's future. The effective quality of education can be determined by its compliance with the social and economic conditions of the society, because the quality is closely related to the standard of living, the economic potential of the country. In today's society, when the education paradigm is changing, scientists, educational policy strategists and everyone who cares about the well-being of a young child and the quality of his education have no doubt that the bases of the successful future are laid in preschool childhood. From a social point of view, it is important that the provided educational services would meet the needs of parents and education politicians, as this is an important and significant indicator of the quality of education. In order to reveal the expression of dialogue in a preschool educational institution, a qualitative research was conducted. The data were collected through interviews method, and the research results were processed using the qualitative content analysis. During the empirical study, the tendencies of dialogue expression were evaluated, which help to develop a free and creative personality. The research results show that the dialogue is not a one-time activity, but a systematic and long-term process not only to achieve the desired level of quality, but also to maintain it continuously. According to the respondents, effective quality of education and long-term agreements between all representatives of the community of the educational institution can be achieved only with the help of dialogue.

Keywords: Expression of dialogue, quality of education, educational institution, educational paradigm.

1. Introduction

Countries' preschool education systems are determined by many specific factors such as goals, targets that are raised by the government, historical development and cultural characteristics, traditions and values. Ensuring the quality of children's education is an educational priority in many countries, because quality children's education is perceived as the basis for creating public welfare. Lithuania can be classified as a country where the preschool education system is characterised by an orientation towards integrated, i.e. childcare and education forming a single whole, pre-school education.

The concept of quality is formed through dialogue between interested groups and is based on the values and expectations of a specific society. It is a dynamic, continuous and democratic process. The quality in an educational institution is measured by assessing several aspects: structure (accreditation procedure, requirements for educators, program development, child/teacher relationship); the process (the place of play in the educational program, the relationship between the child and the teacher, the relationship between education and supervision in the program, documentation, evaluation of achievements); child's achievements (added value of education for the child, child's development, his readiness for life, readiness for learning, child's health).

The perception of quality can vary from one educational institution to another, as each one has its own way of looking at its educational processes. When assessing the quality of the process in a preschool, a very important criterion is the interaction between the parents and the preschool, based on a mutual dialogue and its expression. Therefore, when assessing the quality of a preschool, the most important area of assessment should not be to analyse what is the quality of the preschool, but rather to analyse the results the preschool is achieving in terms of the education of the children (Ishime et al., 2010).

2. Literature review

The perception of the quality of education, including pre-primary education, can vary from one educational institution to another, as each institution has its own way of looking at the educational processes that take place within it. According to Banu (2014), quality is a subjective, value-based, relational, dynamic concept. To understand the meaning of this concept and to identify the determinants of the quality of preschool education, it needed to include the social, economic and cultural diversity context.

The quality of preschool education has been studied by many foreign authors, whose work reveals the importance of the quality of preschool education, as well as the attitude of educators and parents towards the quality of education. Researchers point out that there can be many and varied factors that contribute to the quality of preschool education, which is why they categorise the factors of quality of preschool education according to structural, global and the process as a whole component. Quality factors often include components such as staff qualifications, family involvement, adult-child contact based on mutual dialogue, managerial skills and learning environment. Most often, the assessment of the quality of education in a preschool consists of the education and competence of the teachers, even the education and competence of the preschool director, the involvement of the family, as well as the race of the children in the classroom, the family's social situation, the curriculum, etc. (Denny, Hallam, & Homer, 2012).

Parent-preschool interaction is an important criterion in assessing the quality of preschool education. Dialogue is based on the constant interaction, communication, cooperation and coordination between the participants in the educational process. There is no universal model of dialogue expression that would work in any environment, because dialogue is related to the content, process and context of an institution's activities (Bankauskienė et al., 2009).

3. Research methodology

In order to reveal the expression of dialogue in a preschool educational institution, a qualitative research was conducted. The data were collected through interviews method, and the research results were processed using the qualitative content analysis. This method selects the most frequently mentioned meaning units in the text and counts their frequency, which indicates certain features of the phenomenon under study (Tidikis, 2003).

The study of the preschool participants' dialogue expressions was based on communication theory, which states that people communicate through the transmission of messages, where the sender and the receiver encode and decode information, use communication channels and tools, and where one person influences the other person's behaviour or state of mind. Successful communication is determined by the positivity and accessibility of the content of the message, the "matching" of the meaning given to the message by the sender and the receiver, and the choice of effective communication channels and means of feedback (Fiske, 1990, cited by Miltenienė, 2005). Communication between teachers, parents and leaders is an important prerequisite for quality education. Communicative action is understood as a process of dialogue in which preschool participants interact with each other to achieve coordinated actions that have a positive impact on improving the quality of education.

The sample of the study is based on a non-probability sampling method of selecting a group of subjects using criterion sampling, where "sample units are selected from the population in accordance with criteria established by the researcher" (Rupšienė, 2007, p. 31). Participants had to meet the requirement of being a preschool teacher, a leader or a parent of a child attending preschool.

4. Results

In defining the concept of quality, leaders are guided by the notion that the quality of pre-primary education is a shared agreement between the participants in the education process, which guarantees that the services meet pre-established requirements. According to the leaders, it is very important to build a team of creative educators, where staff members trust each other and share their ideas. There is also a need to continuously improve the quality of services by raising the methodological level of teachers. Leaders identify the continuous interaction between the participants involved in education, based on a general dialogue and the principle of equality, as a key factor in the quality of education.

Preschool directors emphasise that the continuous interaction between parents and teachers allows for a close and cordial relationship. There is a tendency that teachers' competences in creating and developing dialogue do not always meet the needs of parents: '<...> sometimes help is not asked for, or is not asked for in the right way', teachers are trying to have a meaningful dialogue with parents and to

create a favourable climate in the institution, but it is not always the case. Parents have untapped skills that could be used in their children's education. Parental support is highly appreciated and volunteering activities can improve the dialogue between preschool teachers and parents, making it less formal and less official: "<...> everyone can contribute in different ways, some with ideas, others with work". There is a need to develop the competences of preschool teachers and directors in promoting parental volunteering in preschools. The analysis reveals the need for new forms of dialogue that enable parents to be involved in their child's education and to feel that they are equal partners in education. The analysis reveals the need for new forms of dialogue that enable parents to be involved in their child's education and to feel that they are equal partners in education.

During the interviews, the preschool directors had the opportunity to give suggestions and observations on how to improve the existing dialogue and its expression in the preschool institution.

Table 1. Category: 'Leaders' suggestions for improving dialogue in preschool education'.

Category name	Subquaternary names	Proving statements	Number
Suggestions from directors to improve cooperation in preschool education	Increasing the use of technology in education	* *Improve electronic communication;* * *The latest technology;* * *It is very important that teachers are proficient in information technology.*	6
	Professional development for teachers	**There is also room for teachers themselves to develop through professional development;* * *To encourage teachers' motivation to improve;* * *We would like to improve, to raise that methodological level.*	3
	Achieving greater interaction between educational participants	* *How much closer the relationship between leaders and the community should be;* * *The dialogue must be inclusive, it is important to encourage all participants to be active and creative*	4
	Search for new dialogue forms	* *Finding newer, more effective ways of communicating and attracting them to us.*	3
	Modernising the environment	* *Modernising groups.*	4

The interviews revealed that parents are aware of the importance of dialogue in their children's education, but are reluctant to take on the role of active participants and lack initiative in dialogue processes. The respondents are of the opinion that dialogue and its expression in preschool institutions must be improved.

The results show that younger teachers face greater difficulties in maintaining a dialogue with parents and colleagues. They often lack the knowledge and skills to develop effective dialogue.

5. Conclusions and recommendations

In defining the concept of quality, leaders are guided by the notion that the quality of education is a shared agreement between the participants in the education process, guaranteeing that the services meet pre-established requirements. Preschool directors point to the constant interaction and dialogue between the participants, based on the principle of equivalence, as a key factor in the quality of education. Therefore, preschool directors need to develop the existing dialogue more consistently and purposefully, forming a united team of teachers, creating a safe atmosphere of trust, supporting and empowering leaders, and exploring new ways and forms to strengthen relationships and effective dialogue.

In order to provide quality services, the preschool education institution should encourage parents to be actively involved in the management of the institution's education by making suggestions and decisions, develop a willingness to help, to volunteer for and actively participate in the organisation of

festivals and outings, and to develop a system of informing and counselling parents as one of the most effective ways to express the dialogue. In addition, it is also very important to promote the professional development of preschool teachers, as well as the enhancement of managerial and communicative competences, ensuring prompt and purposeful dialogue and its expression with colleagues and the families of the children.

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THE CONTRIBUTION OF SELF-EFFICACY, EMOTION MANAGEMENT, AND MENTAL RESILIENCE TO FOSTERING THE EDUCATIONAL CLIMATE AMONG TEACHERS IN SCHOOLS FROM ARAB SOCIETY IN ISRAEL

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Abstract

The work of teachers is exceptionally challenging, as they must navigate complex issues at various levels, including students, parents, and the educational system, all while dealing with current events and emergency situations. Simultaneously, there are high expectations placed on teachers to ensure the optimal education of children. Therefore, teachers require effective tools and skills to excel in their profession. Teachers face multitude of challenges and must provide the best possible response to the diverse needs of students, sometimes under constraints and suboptimal conditions, such as during the COVID-19 pandemic. Occasionally, teachers confront difficulties on their own without adequate support. To address these challenges and establish an optimal educational climate, teachers must leverage available resources. Developing emotional and social skills is essential to better cope with challenges and create an ideal learning environment. Managing emotions and self-sufficiency are components of mental resilience, which play a crucial role in fostering an optimal climate. Participation in educational simulations as part of teacher training can enhance social and emotional skills. However, there is limited research exploring the connection between these variables, particularly within Arab society. This study aims to investigate how self-efficacy, emotional management, and the level of mental resilience among teachers contribute to the educational climate in schools within Arab society in Israel. A quantitative approach was employed in this study, involving 105 teachers. Various questionnaires, including demographic information, self-efficacy, mental resilience, school climate, and emotion management, were used. Key findings revealed statistically significant relationships between self-efficacy, mental resilience, emotional management, and classroom climate. Furthermore, self-efficacy and emotional management, even without mental resilience, were able to predict 55.4% of the variability in classroom climate. In conclusion, an optimal and positive classroom climate is not formed in a vacuum. Instead, it is contingent on two vital factors with high explanatory power: a teacher's self-efficacy and their ability to manage and regulate their emotions, particularly in their interactions with students. Without a high level of personal capacity, coupled with effective emotion management, the realization of an optimal classroom climate, which is the foundation for significant teaching and learning processes, remains uncertain. Educational institutions, as learning organizations, cannot facilitate meaningful teaching and learning without the existence of a highly positive classroom climate. Achieving this ideal climate largely depends on a considerable level of self-efficacy and effective emotion management by teachers.

Keywords: Self-efficacy, emotion management, mental resilience, educational climate.

1. Introduction

The school climate, or "educational climate", is the internal environment perceived by stakeholders such as teachers, managers, parents, and students (Elrod et al., 2022; Yang et al., 2022). However, scholarly literature often focuses on systemic factors, overlooking internal aspects like teachers' self-efficacy, emotion management, and mental resilience.

Interest in school climate spans a century, with various factors influencing it (Grant et al., 2022; Hackman et al., 2022). These factors include physical, administrative, social, and systemic components, impacting the clarity of rules, teacher control, and the order necessary for optimal education (Iverno et al., 2022; Velarde et al., 2022). Socio-economic factors, staff interactions, effectiveness, and parental involvement also play a role (Virtuanen et al., 2022; Yang et al., 2022).

Current research focuses on teachers' mental resilience, emotion management, and self-efficacy (Velesioti et al., 2018; Li, 2019). Awareness of one's feelings is crucial for balanced emotional management (Harpaz, 2011). Additionally, self-efficacy, associated with various areas, including social competence, has diverse measures (Duchatelet et al., 2016; Wang et al., 2013).

The study addresses two assumptions: limited exploration of personal variables influencing school climate, and the second is that even the small literature that has considered the importance of these variables and their potential impact on the school climate has completely ignored the population of Arab teachers in Israel, who have a cultural, religious, and intellectual character that is significantly different from teachers belonging to other cultures, especially Western ones.

Purpose: To investigate how teachers' self-efficacy, emotion management, and mental resilience contribute to the educational climate in Arab society in Israel.

Research Question: What is the connection between teachers' self-efficacy in mediating mental resilience and emotion management, and the educational climate among teachers from Arab society in Israel?

2. Objectives

To examine the contribution of self-efficacy, the ability to manage emotions and the degree of mental resilience of the teacher to the educational climate in the school from Arab society in Israel.

To investigate further, this study aims to identify the specific elements of mental resilience and emotions in teaching that act as mediators in the correlation between self-efficacy and the educational climate experienced by Arab teachers.

3. Study design

The present study is a correlative quantitative study, which is based on the collection of quantitative data from the field using quantitative questionnaires.

4. Method

Materials/evaluation tools: The participants were asked to answer to a Demographic Data Questionnaire, the mental resilience, emotion management, self-efficacy and educational climate Questionnaires.

5. Participants

The study involved 105 Israeli Arab teachers.

6. Procedure

After receiving approval from the school principal and the teachers, Teachers have been linked to participating in online research through the use of the Google Forms platform.

7. Results

The primary findings of the study revealed statistically significant relationships between self-efficacy, mental resilience, emotional management, and classroom climate. Additionally, the study identified that self-efficacy and emotion management, in the absence of mental resilience, accounted for 55.4% of the explained variability in the classroom climate variable.

8. Discussion/Conclusions

In summary, achieving the best and most positive classroom climate is contingent upon two crucial factors: the teacher's self-efficacy and their ability to effectively manage emotions, especially during interactions with students. Without a high level of personal capacity and significant emotion management, realizing an optimal classroom climate, essential for meaningful teaching and learning processes, becomes highly doubtful. A positive classroom climate, facilitated by considerable self-efficacy and emotion management, is fundamental for a school as a learning organization to create an atmosphere conducive to significant teaching and learning experiences.

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EQUITY IN THE CLASSROOM FOR EVERY CHILD

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Abstract

This is a description of one kind of supplement to Equity in the Classroom book/presentation. The four-year old teachers (it can be done with any preschool teacher) can actually implement the first five templates in the Appendix of the book. This qualitative research project can demonstrate how teachers can make changes to include diverse learners and impact their curriculum by incorporating the core values that have been cited in the book.

Keywords: Equity, core values, diverse learners.

1. Introduction

Teachers in the early childhood four year-old classrooms will incorporate into their curriculum the seven core values that are discussed in the book, *Equity in the Classroom for Every Child.* This is a cross-sectional, exploratory study that will be conducted with ten teachers at different schools/early childhood centers of four year-old children.

2. Objectives

To close the achievement gap for children of color.
To ensure equity for children in the classroom.

3. Design

The teachers will implement the first five (5) templates in the Appendix of the book. After the implementation of each template, the teacher will answer the following questions, write a reflection on the template, and discuss which of the seven core values were impacted.

Table 1.

Template	Question	Reflection	Identify one (1) or more of the core values that has been impacted by the template
Template 1-The Blueprint for Education	*How do you feel the collaboration with parent/caregiver, family, and community; respecting and appreciating diverse learners; and empowering students has impacted the teaching and learning experiences in your classroom?*	*As you reflect, how has the implementation of template 1 affected the classroom climate, individual students' learning and/or group learning?*	*How does Template 1 demonstrate any of the seven core values?*
Template 2 & 3- All About Me	*How do you feel the All About Me template has impacted the teaching and learning experiences in your classroom?*	*As you reflect, how has the implementation of template 2 & 3 affect the classroom climate, individual students' learning and/or group learning?*	*How does Template 2 & 3 demonstrate any of the seven core values?*

Template 4- Child's Picture Book	How does the Child's Picture Book template have an impact on teaching and learning experiences in your classroom?	As you reflect, how has the implementation of template 4 affect the classroom climate, individual students' learning and/or group learning?	How does Template 4 demonstrate any of the seven core values?
Template 5- Meet the Teacher	How does Meet the Teacher template have an impact on teaching and learning experiences in your classroom?	As you reflect, how has the implementation of template 5 affect the classroom climate, individual students' learning and/or group learning?	How does Template 5 demonstrate any of the seven core values?

The three overall questions for the teachers to answer:

(1) Has incorporating the templates empowered the diverse learners in your classroom?

(2) Do you plan to integrate the seven core values into your curriculum?

(3) After implementation of the five templates, what new indicators (such as student participation, student is more engaging, student communicates more effectively) have the students demonstrated?

4. Discussion

The researcher will analyze the different responses related to the five templates of the ten teachers and the three overall questions.

5. Conclusion

The overall outcome should exhibit understanding, appreciation, and respect for diverse learners. The supplement, like the book, is a guide for preschool teachers to ensure equity for each child in the classroom by integrating the seven core values into the classroom curriculum.

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EXPLORING PEDAGOGICAL PRACTICES: INTEGRATING ICT TOOLS IN GRADE 10 LIFE SCIENCES EDUCATION

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Abstract

This paper investigates the diverse pedagogical practices employed by Grade 10 Life Sciences teachers in integrating Information and Communication Technology (ICT) tools into their teaching methodologies. With the increasing integration of technology in education, understanding how teachers utilize ICT tools in the context of Life Sciences education becomes imperative. Drawing upon qualitative research methods, including interviews, observations, and document analysis, this study explores the strategies, challenges, and outcomes associated with the incorporation of ICT tools in teaching and learning processes. The findings shed light on the multifaceted approaches adopted by teachers, ranging from interactive multimedia presentations to virtual simulations and collaborative online platforms. Furthermore, the study illuminates the barriers faced by educators, such as technological constraints and pedagogical adaptation, while also highlighting the transformative potentials of ICT integration in enhancing student engagement, understanding, and critical thinking skills within the Life Sciences curriculum. Ultimately, this research contributes to the ongoing discourse on effective pedagogical practices in technology-enhanced learning environments, offering insights for educators, policymakers, and curriculum developers seeking to optimize ICT integration in science education at the secondary level.

Keywords: Pedagogical practices, ICT tools, technology integration, teaching and learning.

1. Introduction

In contemporary education, the integration of Information and Communication Technology (ICT) tools has become increasingly prevalent, revolutionizing traditional teaching, and learning practices across various disciplines. Within the realm of science education, particularly in Life Sciences, the utilization of ICT tools presents a promising avenue for enhancing student engagement, fostering deeper understanding, and promoting critical thinking skills (Kulshreshtha et al., 2023). Grade 10 marks a pivotal stage in secondary education where students delve deeper into the intricacies of Life Sciences, exploring fundamental concepts such as genetics, ecology, and human biology. In this context, the pedagogical practices adopted by Grade 10 Life Sciences teachers when integrating ICT tools into their instructional methodologies play a crucial role in shaping the learning experiences and outcomes of students.

This paper aims to investigate the diverse pedagogical approaches employed by Grade 10 Life Sciences teachers in harnessing ICT tools to facilitate teaching and learning processes. By examining the strategies, challenges, and outcomes associated with ICT integration, this study seeks to offer insights into the effectiveness and implications of incorporating technology in Life Sciences education at the secondary level. Understanding how teachers navigate the dynamic landscape of ICT integration can provide valuable guidance for educators, policymakers, and curriculum developers striving to optimize pedagogical practices and enhance student learning experiences (König et al., 2022).

Through qualitative research methods, including interviews, observations, and document analysis, this study explores the rich tapestry of pedagogical practices adopted by Grade 10 Life Sciences teachers. From interactive multimedia presentations to virtual simulations and collaborative online platforms, teachers employ an array of ICT tools to engage students, contextualize abstract concepts, and promote inquiry-based learning. However, amidst the potential benefits of ICT integration, educators also encounter various challenges, ranging from technological constraints to pedagogical adaptation and equity issues.

By delving into the experiences and perspectives of Grade 10 Life Sciences teachers, this research endeavors to contribute to the ongoing discourse on effective pedagogy in technology-enhanced learning environments. By elucidating the complexities of ICT integration in Life Sciences education, this study aims to inform best practices, inform curriculum development, and inspire innovative approaches to teaching and learning in the digital age.

2. Purpose of the study

The purpose of this paper is to investigate and explore the pedagogical practices adopted by Grade 10 Life Sciences teachers when integrating Information and Communication Technology (ICT) tools into their teaching and learning processes. By examining the strategies, challenges, and outcomes associated with the use of ICT tools, this research aims to shed light on the diverse approaches employed by educators in enhancing student engagement, understanding, and critical thinking skills within the context of Life Sciences education. Through qualitative research methods, including interviews, observations, and document analysis, this study seeks to provide valuable insights for educators, policymakers, and curriculum developers striving to optimize pedagogical practices and promote effective technology integration in secondary science education. Ultimately, the paper aims to contribute to the ongoing discourse on innovative teaching methodologies and technology-enhanced learning environments, offering guidance for improving instructional practices and fostering meaningful learning experiences for Grade 10 Life Sciences students.

3. Research design and methodology

3.1. Research design

This study employed a qualitative research design to explore the pedagogical practices adopted by Grade 10 Life Sciences teachers when integrating ICT tools in their teaching and learning processes. Qualitative research methods are particularly suitable for investigating complex phenomena, such as teaching practices and technology integration, by capturing the rich experiences, perspectives, and contextual nuances of participants.

3.2. Sampling

The study employed purposive sampling to select Grade 10 Life Sciences teachers who have experience using ICT tools in their teaching. The selection criteria included factors such as years of teaching experience, ICT proficiency, and willingness to participate in the study.

3.3. Data collection techniques

Semi-Structured Interviews: In-depth interviews were conducted with Grade 10 Life Sciences teachers to explore their experiences, strategies, and challenges related to the integration of ICT tools in teaching Life Sciences. The interviews allowed for probing questions and eliciting detailed narratives from participants.

Classroom Observations: Observations were conducted in selected Grade 10 Life Sciences classrooms to document how teachers utilize ICT tools during instructional sessions. Observation protocols were developed to capture teacher-student interactions, instructional strategies, and technology usage.

Document Analysis: Relevant documents, such as lesson plans, teaching materials, and student artifacts, were analyzed to supplement interview and observation data. This analysis provided insights into the planning and implementation of ICT-integrated lessons.

3.4. Data analysis

Thematic Analysis: The data collected from interviews, observations, and document analysis was subjected to thematic analysis to identify recurring patterns, themes, and categories related to pedagogical practices and ICT integration.

Cross-Case Analysis: Comparative analysis was conducted to explore similarities and differences in pedagogical practices among Grade 10 Life Sciences teachers, considering factors such as teaching styles, technology preferences, and contextual influences.

Trustworthiness: Strategies such as member checking, peer debriefing, and triangulation of data sources were employed to enhance the credibility, dependability, and transferability of the study findings.

By employing a rigorous qualitative research design and methodology, this study aims to provide a comprehensive understanding of the pedagogical practices adopted by Grade 10 Life Sciences teachers when utilizing ICT tools in teaching and learning contexts.

4. Findings

The results of the study revealed several key findings regarding the integration of ICT tools in Grade 10 Life Sciences classrooms:

Diverse Use of ICT Tools: Grade 10 Life Sciences teachers employed a diverse range of ICT tools to enhance teaching and learning experiences. These included interactive multimedia presentations, virtual simulations, educational software applications, online collaboration platforms, and digital resources such as videos and animations.

Enhanced Student Engagement: The integration of ICT tools significantly enhanced student engagement in Life Sciences lessons. Interactive multimedia presentations and virtual simulations captivated students' interest, fostering active participation and deeper exploration of scientific concepts.

Facilitation of Inquiry-Based Learning: ICT tools facilitated inquiry-based learning approaches in Grade 10 Life Sciences classrooms. Teachers utilized online research resources and digital databases to encourage students to explore scientific topics independently, formulate hypotheses, and conduct investigations.

Promotion of Visual Learning: Visual learning was promoted using ICT tools such as videos, animations, and interactive diagrams. These visual aids helped students visualize abstract concepts, such as cellular processes and ecological phenomena, leading to improved understanding and retention of information.

Challenges in Technology Integration: Grade 10 Life Sciences teachers faced several challenges in integrating ICT tools into their teaching practices. These challenges included limited access to technology resources, technical issues with software and hardware, time constraints in lesson planning, and the need for professional development in ICT skills and pedagogy.

Adaptation of Pedagogical Strategies: Teachers adapted their pedagogical strategies to effectively incorporate ICT tools into their teaching practices. They utilized a combination of direct instruction, guided exploration, and collaborative activities to scaffold students' learning experiences and maximize the benefits of ICT integration.

Student-Centred Learning Environments: The integration of ICT tools promotes student-centred learning environments in Grade 10 Life Sciences classrooms. Students have increased autonomy and agency in their learning process, as they engaged with digital resources, collaborate with peers, and actively participated in inquiry-based activities.

Overall, the results of the study highlight the positive impact of ICT integration on pedagogical practices and student learning experiences in Grade 10 Life Sciences education. Despite the challenges faced by teachers, the effective use of ICT tools enhances student engagement, facilitates inquiry-based learning, and promotes deeper understanding of Life Sciences concepts. These findings underscore the importance of ongoing support and professional development for teachers to leverage the full potential of ICT tools in science education.

5. Discussion

The findings underscore the importance of incorporating diverse ICT tools into teaching practices to enhance student engagement and promote deeper understanding of Life Sciences concepts. Teachers leveraged visual learning resources, interactive simulations, and online collaboration platforms to create dynamic and student-centred learning environments (Guillén-Yparrea et al., 2023). The adaptation of pedagogical strategies, such as inquiry-based learning approaches, facilitated active student participation and fosters critical thinking skills (van Uum et al., 2016). Despite the benefits of ICT integration, teachers faced challenges such as limited access to technology resources, technical issues, and time constraints in lesson planning (Bećirović, 2023). The study's findings may be influenced by factors such as the participants' technological proficiency, school infrastructure, and institutional support for ICT integration.

The study highlights the need for ongoing professional development programs to support teachers in developing ICT skills and pedagogical strategies for effective technology integration. Training workshops, mentoring programs, and collaborative learning communities can provide teachers with opportunities to enhance their proficiency in using ICT tools and adapt their teaching practices accordingly. Future research could explore the long-term impact of ICT integration on student learning outcomes, academic performance, and career aspirations in Life Sciences fields. Comparative studies

across different grade levels, subject areas, and educational contexts can provide insights into the differential effects of ICT integration on teaching practices and student engagement. Investigating innovative approaches to address the challenges of ICT integration, such as mobile learning initiatives, blended learning models, and open educational resources, can further enrich the discourse on technology-enhanced pedagogy in Life Sciences education. The discussion of the study's results highlights the transformative potential of ICT tools in Grade 10 Life Sciences education while also acknowledging the challenges and opportunities associated with their integration. By addressing the implications, limitations, and future directions outlined in the discussion, educators, policymakers, and researchers can work collaboratively to optimize pedagogical practices and promote effective technology integration in science education.

6. Conclusion

This study has provided valuable insights into the pedagogical practices adopted by Grade 10 Life Sciences teachers when integrating ICT tools in teaching and learning contexts. Through qualitative research methods, including interviews, observations, and document analysis, the study has illuminated the diverse approaches, challenges, and outcomes associated with ICT integration in Life Sciences education. The findings of the study underscore the positive impact of ICT tools on enhancing student engagement, promoting inquiry-based learning, and facilitating deeper understanding of Life Sciences concepts. Teachers leverage a variety of ICT resources, including interactive multimedia presentations, virtual simulations, and online collaboration platforms, to create dynamic and student-centred learning environments. By adapting pedagogical strategies to incorporate ICT tools, teachers foster active student participation, critical thinking skills, and collaborative learning experiences.

However, the study also highlights the challenges faced by teachers in integrating ICT tools, such as limited access to technology resources, technical issues, and time constraints. Addressing these challenges requires ongoing support and professional development opportunities for teachers to enhance their ICT skills and pedagogical proficiency. Moving forward, it is essential to continue exploring innovative approaches to optimize ICT integration in Grade 10 Life Sciences education. This includes further research into the long-term impact of ICT integration on student learning outcomes, as well as the development of tailored professional development programs to support teachers in leveraging ICT tools effectively. Ultimately, by harnessing the transformative potential of ICT tools and addressing the associated challenges, educators, policymakers, and curriculum developers can work collaboratively to enhance pedagogical practices and promote meaningful learning experiences for Grade 10 Life Sciences students in the digital age.

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THE ROLE OF THE GEOGRAPHY PRESERVICE TEACHERS' SERVICE-LEARNING IN THE DEVELOPMENT OF MAP LITERACY

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Abstract

This article draws insights from the experiences of Geography preservice teachers gained from the mandatory mapwork service-learning for Geography learners in grades 10, 11, and 12. Map work is considered an essential element of Geography, yet acquiring map skills remains problematic for many South African Geography learners. There is a consistency in the outcry of the learner's lack of map literacy, regardless of the robust strategies emphasized for the effective teaching of map skills and the emergence of technologies. Considering that the issue of map literacy has been persistent in South Africa, it is imperative to explore every possible alternative that would contribute towards equipping learners with map skills and other competencies required for mapwork. Therefore, the article explores the challenges, strategies, and resources used by Geography preservice teachers to tutor map work in grades 10,11 and 12 during service-learning. Accordingly, the article argues that mandatory mapwork service-learning could contribute to reducing some of the challenges around mapwork. Empirical data was collected through an in-depth analysis of twenty teachers' structured reflections that were administered at the end of the preservice teachers' service-learning. The analysis of these reflections followed a content and qualitative analysis approach. The findings indicate that the preservice students had a positive and developmental experience during the service-learning. Different teaching strategies and resources were repurposed for tutoring. Although met with some learners' challenges, the processes employed in implementing the strategies helped develop learners with basic map skills, which the data indicated was a major challenge before the mandatory mapwork service-learning.

Keywords: Geography preservice teachers, mapwork, tutoring, service-learning.

1. Introduction and background

Service-learning is a fundamental component in higher educational institutions for many reasons. Internationally, the emergence of service-learning has been understood as a modern way of teaching and learning (Salam, Awang Iskandar, Ibrahim, & Farooq, 2019). In other parts of the world, the importance of service-learning has also been evident in basic education levels (Chambers & Lavery, 2012). Locally, Petker and Peterson (2014) have reported that service-learning is relatively new in South Africa. It was introduced in the 1990s in higher education as a result of the higher education policies designed by the Department of Education (Le Grange, 2007). In recent years, the scholarship on service-learning for preservice teachers has become prevalent. According to Resch and Schrittesser (2023), service-learning is a teaching approach that allows students to gain a nuanced understanding of the content covered in class and gain civic engagement skills through connecting theory to practice in communities. Similarly, Heider, Valenti, Long, Garbou, Rex, and Harper (2018) posit that service-learning is grounded on the connection between the student's academic learning, civic engagement, and personal growth. In this way, service-learning is not perceived as a mere civic engagement opportunity. However, it contributes to the student's learning by providing a platform in which the students can transfer their knowledge and skills and also enhance the student's growth. Service-learning programs are promoted in higher education institutions to enhance learning and equip students with a sense of civic engagement (Pérez-Ordás, Nuviala, Grao-Cruces, & Fernández-Martínez, 2021). In this way, Petker and Peterson (2014) argue that service-learning instills the understanding that the ethic of care in education is not foregrounded within the school curriculum or classrooms but transcends community structures.

While there are a plethora of studies endorsing different ways in which effective service-learning could be undertaken (See Cone & Harris, 1996; Kiely, 2005; Petker & Peterson, 2014; Swords & Kiely, 2010; Fourie, 2003; Pérez-Ordás, Nuviala, Grao-Cruces, & Fernández-Martínez, 2021), Mogk and King (1995) maintain a good service-learning initiative must have a clear articulation of needs of the community, training of students, meaningful action, and reflection upon the action. Similarly, Dorsey (2001) argues that when service-learning programs for Geography are carefully designed, they have the potential to generate valuable first-hand experience and contribute to therapy and research. The application of service-learning in teaching and learning Geography in different educational stages of training is of utmost importance (Oqaiby, Mohammed, & Hafez, 2022). Accordingly, in Geography, service-learning is used in different innovative ways to help students transfer Geographical content knowledge and skills to communities. In a study exploring the impact of service-learning for Geography students from a critical view, Cahuas and Levkoe (2017) report that service-learning creates opportunities for social change in the classroom and community, which makes it a promising pedagogical strategy for Geographers aiming to create alternate teaching approaches in their classrooms. On the other hand, Mahon, Conway, Farrell, and McDonagh (2020) investigate the contribution of service-learning to Geography students' professional identity. In other cases, service-learning has been used to expose students to fieldwork, an inextricable Geography component (Grabbatin & Fickey, 2012).

Despite the prevalent scholarship on the role of service-learning in Geography education, there is a dearth of studies on the role of service-learning in map literacy in South Africa. Map literacy is considered an essential element of Geography, yet acquiring map skills remains problematic in many South African Geography classrooms. There is a consistency in the outcry of the learner's lack of geospatial competence, regardless of the robust strategies emphasized for the effective teaching of map skills and the emergence of technologies. It is imperative to explore every possible alternative that would contribute towards equipping learners with geospatial competence and other competencies and skills acquired from mapwork.

Against the backdrop of the above, the article draws insights from the experiences of Geography preservice teachers gained from the mandatory mapwork service-learning, which focused on grades 10, 11, and 12. The article argues that mandatory service-learning designed specifically for mapwork could greatly minimize the challenges around mapwork. The service-learning program is a mandatory component for the 3rd year preservice teachers. Preservice teachers are expected to engage in any form of community service-learning for a duration of 45 hours. In the Geography methodology and practicum module, the service-learning was modified and tailored specifically for mapwork, following the high failure rate in mapwork in South Africa. The aim of the mapwork mandatory service-learning is to ensure the contributions of Geography preservice teachers in their communities through their mapwork expertise.

2. Research methodology

The study employs a qualitative research methodology, defined by Merriam and Tisdell (2016) as a methodology that seeks to reveal the meanings from the experiences of people involved in it. In this way, the qualitative research helped the Geography preservice teachers articulate their service-learning experiences within their context.

3. Data collection and analysis

Data was collected through the preservice teacher's reflections. A purposive sampling technique was used to select sixteen reflections on the mandatory map work service-learning submitted by the Geography preservice teachers who are in their third year of study. The reflections were analyzed through qualitative analysis, which allows a deep analysis of the text (Castleberry, Payakachat, Ashby, Nolen, Carle, Neill, & Franks, 2016). Atlas, ti 24 was used to code and categorize the themes that emerged from the reflections and to also generate the word cloud with the codes and themes.

4. Findings and discussion

The findings show that the mapwork service-learning provided the Geography preservice teachers with insightful experience. The three themes; are learners' challenges with map work, mapwork strategies and resources, and lessons learned by the Geography preservice teachers.

4.1. Learner's challenges with mapwork
The data indicates that the learners who were tutored by the Geography preservice teachers had a number of challenges with mapwork. Although the challenges differ between grades 10, 11, and 12, it is interesting to note that the data shows that most learners lacked the basic mapwork skills such as reading a map, identifying map symbols and features, recalling formulas for calculating an area for a dam or a

distance from one feature to another, and identifying the different types of maps. Some of the specific reflections were the following:

> "They (learners) have trouble understanding or picturing spatial concepts, and they have trouble interpreting maps."
> "Students in grade 11 found it difficult to comprehend map symbols and legends, read complicated maps, and use spatial analysis tools."

On the other side, some challenges were not related to the mapwork content, but they emanated from the attitudes and behavior of the learners. A few reflections indicated that:

> "The learner's attitude towards mapwork is very negative as they do not understand the basics of mapwork and do not enjoy it for that reason."
> "These students consider map work to be boring or unrelated to their everyday lives."

On the contrary, a few reflections showed that the learners did not encounter challenges and that they had a positive outlook on mapwork. Essentially, they wrote that:

> "Some students (learners) tackled map work with curiosity and zeal. They see it as a chance to learn more about and explore their surroundings. These students take pleasure in examining data, working with maps, and evaluating Geographic data."

Challenges related to mapwork are well captured in the literature. However, the challenges shown by the data provide different insights in that one may assume that mapwork is challenging because it is abstract in grades 10,11 and 12. However, the nature of the challenges in this study reveals that the problem may be in the lower grades where learners are taught the basic mapwork skills. Admittedly, learners are not the same so that the performance may vary; however, when learners are taught and trained with the basic mapwork skills, then navigating through the challenges, which at this point may be presented by the abstract part of mapwork, may be manageable. Additionally, when dealing with the mapwork section, it is important not only to deal with the content and skills but also to endeavor to inspire learners through the section of mapwork that is taught so that their attitudes and behaviors may change.

4.2. Mapwork strategies and resources

There are many strategies and resources that are used to teach and tutor mapwork skills (*see Figure 1 for the strategies*). The data shows that the preservice teachers repurposed different teaching strategies as tutoring strategies. The data also indicates that although the preservice teachers used different strategies in different grades and classes, many were collaborative. However, the preservice teachers who also integrated direct instruction indicated that these strategies were more effective when used prior to the implementation of the collaborative strategies. The common explanations were that using direct instruction before placing learners in collaborative settings enabled them to contribute something within the group, in the form of insights or asking questions from their peers for clarification purposes. Moreover, the data shows that providing real-life examples and administering practical activities was effective in equipping learners with map work skills.

Figure 1. Teaching strategies tailored by the preservice teachers for the mapwork service-learning.

Although the data shows that the strategies were always used with the conventional mapwork resources such as maps, hands-on apparatuses, pictures, and so on, the preservice teachers alluded to the importance of integrating technological applications in mapwork. Accordingly, some preservice teachers commended the effectiveness of the Google Earth application in helping learners calculate the distance from one feature to another and the area of a dam on a map. This is an important discovery from the data because the preservice teachers were introduced to the Google Earth application for the Geography teaching module the same year, they were sent to the mandatory mapwork service-learning. Therefore, the use of Google Earth in real-life Geography classrooms shows that the preservice teachers have an improved understanding of the content, and it is the application, as Mutambara (2023) argues, is one of the benefits of service-learning. Nevertheless, despite many of the strategies and resources being presented as being effective for mapwork, the data shows that the essence lies within the manner in which these strategies and resources are used.

4.3. Lessons from tutoring mapwork during the service-learning

Data shows that the preservice teachers had a positive experience with the mandatory mapwork service-learning. Essentially, these teachers felt that the service-learning greatly impacted their communication skills, teaching approach, and abilities, perceptions about the use of technology in mapwork, adaptation of strategies and resources, and how the learners acquire mapwork skills. These insights point to the personal and professional growth development explained by Mutambara (2023). The data also indicated that the preservice teachers considered service-learning as a platform from which they could learn from their practice, learn from the answers given by the learners, and the practicality of what they have been taught in the Geography teaching and practicum methodology module. This validates Mutambara's (2023) claims that service-learning is a good platform from which the preservice teacher's professional growth could be enriched through exposure to real-life environments.

However, the exposure provided through the mandatory mapwork service-learning differs from the programs such as work-integrated learning in the sense that the former is specifically designed for mapwork literacy following the learner's poor performance on it. At the same time, the latter exposes the preservice teachers to a broader range of dynamics in the teaching profession and in the teaching of Geography. In this way, the work-integrated learning may or may not expose the preservice teachers to mapwork as these teachers engage in work-integrated learning in a particular season using an annual teaching plan, which determines what should be taught on a weekly basis.

5. Conclusion and recommendations

Service-learning is important for the preservice teachers. However, designing service-learning that is intended for the development of the Geography preservice teachers and the community at once makes service-learning intentional. As such, the study has indicated that mandatory mapwork service-learning contributes to enhancing the learners' mapwork skills, and in return, the preservice teachers develop professionally. Moreover, practical assessments, contextualization of examples, and Google Earth play an invaluable role in equipping learners with mapwork skills. Therefore, mandatory mapwork service-learning for Geography preservice teachers may be the approach that is needed by South Africa and other countries whose learners are struggling with mapwork. Although strategies and resources may be extrapolated to other countries, contextual factors, the preservice teacher's teaching approach, the different types of learners, the availability of resources, and other factors might have to be considered.

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EXPLORING THE EXISTENCE OF MATHEMATICS-SCIENCES ANXIOUS-ENDEMIC EQUILIBRIUM AMONG PRE-SERVICE PHYSICAL SCIENCES TEACHERS: A PATHWAY TO BUILDING RESILIENCE AMONG STEM STUDENTS

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Abstract

This study is part of a larger project that delves into the intricate dynamics surrounding the existence of Mathematics-Sciences Anxious-Endemic Equilibrium (MSAEE) among pre-service physical sciences teachers and its potential impact on fostering resilience among students pursuing STEM disciplines in South African universities. The South African international performance in mathematics and sciences has been of concern over the years. South Africa's maths and science learners have come to the international spotlight since it started participating in the Trends in International Mathematics and Science Study (TIMSS) for grades 4 and 8 learners in 1999 and 2003 and with grade 4 and 9 learners from 2011 to 2019. Notably, South African learners' performance at TIMSS for both mathematics and science has been very poor. Evidence from research indicates that a significant number of learners/students experience fear and exhibit subpar academic achievement in mathematics and science. While the origins of maths/science anxiety are still being debated, reducing math anxiety has been shown to enhance attainment and improvement in mathematical and science proficiency. Hence, there is a need to address these anxieties to improve learner performance in STEM subjects. The study utilised a mixed-methods approach, incorporating both quantitative surveys and qualitative interviews, to investigate the prevalence and features of MSAEE in pre-service physical sciences teacher education programmes. Statistical and thematic analyses were employed to identify patterns and relationships within the data. The findings indicated that the majority of respondents acknowledged experiencing some degree of maths/sciences anxiety. Another noteworthy characteristic was the phobia of mathematics/science examinations and the inclination to recoil when the moment arrived to attend a maths/science lecture, however, over time, participants developed an interest in these courses and shared their self-efficacies in the subjects as they build resilience in maths and science. Findings from the research contribute to the understanding of the complex interplay between mathematics and science anxiety, and the preparation of pre-service teachers to provide insights for educators, policymakers, and researchers interested in enhancing the quality of STEM education.

Keywords: Anxiety, mathematics, pre-service teacher, resilience, science.

1. Introduction

In the realm of education, particularly within the STEM (Science, Technology, Engineering, and Mathematics) fields, the mental well-being of pre-service teachers (PSTs) is of paramount importance. Among the myriad challenges they face, anxiety surrounding mathematics and sciences stands out as a significant concern (Hussein & Csíkos, 2023; Megreya et al., 2021). This anxiety not only impacts the PSTs themselves but also has implications for the future generations of STEM students they will educate. Thus, it is imperative to delve into the dynamics of this anxiety and explore potential pathways to address it effectively. In recent years, there has been a growing recognition of the intricate relationship between anxiety and academic performance (Demedts et al, 2022), particularly within mathematics and sciences education. This nexus is specifically pronounced among PSTs, who not only navigate their anxieties but also bear the responsibility of nurturing resilience among their future students in STEM disciplines. Understanding this dynamic is essential for crafting effective interventions that foster a balanced equilibrium conducive to learning and personal growth.

Despite the acknowledgement of the prevalence of mathematics and sciences anxiety among PSTs, there exists a noticeable gap in the literature concerning the specific intersectionality of this anxiety

within the context of physical sciences education. Previous research has predominantly focused on generalized STEM anxiety or has primarily centred on either mathematics or science anxiety individually (Hussein & Csíkos, 2023; Rozgonjuk et al., 2020). Thus, there is a dearth of comprehensive studies that specifically address the unique nature, extent, and underlying factors contributing to this equilibrium in mathematics and science anxiety. Furthermore, while existing literature has identified various factors contributing to STEM anxiety, there is a lack of in-depth exploration into the interconnectedness and equilibrium dynamics between mathematics and science anxiety among PSTs. Understanding these intricate relationships is crucial for developing targeted interventions that can effectively disrupt the anxious-endemic equilibrium and foster resilience among both PSTs and their future students.

Against this background, this study aims to bridge these gaps in the literature by exploring the existence of mathematics-sciences anxious-endemic equilibrium among PSTs. By doing so, it seeks to pave the way for the development of resilience-building strategies that can ultimately enhance the quality of STEM education and promote the mental well-being of all stakeholders involved.

This research seeks to address the following key questions:
1. Is there a prevalence of Mathematics-Sciences Anxious-Endemic Equilibrium among PSTs?
2. How does MSAEE influence the teaching practices and efficacy of PSTs?
3. What are the strategies and interventions implemented to alleviate MSAEE and promote resilience among PSTs and their future students?

2. Literature

Anxiety, particularly mathematics anxiety, significantly hinders confidence, mathematical capability, and participation in STEM fields (Wang et al., 2020). Mathematical models have shown that there are distinct equilibrium points associated with anxiety behaviour and performance in mathematics, one of which is free from math anxiety and the other is endemic to it (Nathan & Jackob, 2020). Research indicates that PSTs with high levels of mathematics anxiety may struggle with teaching mathematics effectively (Boyd et al., 2014), and may project this anxiety onto their future students (Mizala et al., 2015). However, the anxiety experienced by PSTs is not limited to mathematics; it extends to other subjects like physics and chemistry, influencing their overall teaching practices (Putra et al., 2021). On the other hand, the literature has shown that there is a negative correlation between mathematics anxiety and mathematics teacher efficacy (Swars et al., 2006). Additionally, factors such as content knowledge, attitude towards mathematics, and self-efficacy play a role in influencing mathematics anxiety and teaching practices (Aksu & Kul, 2019). It is therefore essential to address PSTs' anxiety to enhance their teaching practices.

The concept of academic resilience is particularly relevant in the context of STEM education, where students often face high levels of attrition and challenges (Morganson et al., 2015). Building resilience among students, especially those from disadvantaged backgrounds, is essential for promoting academic success and persistence in STEM majors (Kuldas et al., 2014) and supporting students' achievement in mathematics and other STEM subjects (Ghazzawi et al., 2021). In a study by Para and Johnstone-Wilder, (2023), they argued for the inclusion of such tools as the Growth Zone Model in classroom practice to help build students' resilience. Interventions such as improving PSTs' mathematical beliefs can help reduce mathematics anxiety and enhance their teaching efficacy (Yuniarti et al., 2019).

3. Methodology

This longitudinal study was framed within Action Research methodology to address PST anxieties in mathematics and science and promote positive change as they build their resilience in these subjects. The method entails an iterative process of strategizing, implementing, monitoring, and reflecting allowing PSSTs to collaboratively work towards resilience (Narayanamurthy et al., 2017). A whole class intervention was implemented in a third-year class of 29 PSTs who were majoring in Physical Sciences and Mathematics. The main instruments were the questionnaires, interviews and PSTs reflective dairies. The questionnaire was adopted from the Betz scale (1978) MAR-S scale to measure both PSTs' anxiety in mathematics and sciences.

4. Results

4.1. Demographic profile of pre-service teachers

The sample consists of a majority of male PSTs, with nineteen males and ten females. All participants were in their third year at the university, suggesting they have progressed through their

academic program and are approaching the completion of their teacher education. While specific ages may vary, their age ranges from 20 years to 23 years. These participants have already completed their second field placements in educational settings, gaining practical experience working with students under the supervision of an experienced teacher.

4.2. Prevalence of mathematics-sciences anxious-endemic equilibrium

Tables 1 and 2 show an analysis of PSTs' anxiety levels in mathematics, physics and chemistry.

Table 1. Descriptive analysis.

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
Physics	Female	10	28,80	2,616	,827	26,93	30,67	24	33
	male	19	29,63	2,733	,627	28,31	30,95	24	34
	Total	29	29,34	2,676	,497	28,33	30,36	24	34
Maths	Female	10	29,30	3,164	1,001	27,04	31,56	25	35
	male	19	30,47	2,674	,614	29,18	31,76	25	35
	Total	29	30,07	2,853	,530	28,98	31,15	25	35
Chemistry	Female	10	30,80	1,932	,611	29,42	32,18	28	34
	male	19	29,74	2,806	,644	28,38	31,09	25	35
	Total	29	30,10	2,554	,474	29,13	31,08	25	35

Table 2. ANOVA.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Physics	Between Groups	4,531	1	4,531	,624	,436
	Within Groups	196,021	27	7,260		
	Total	200,552	28			
Maths	Between Groups	9,025	1	9,025	1,114	,301
	Within Groups	218,837	27	8,105		
	Total	227,862	28			
Chemistry	Between Groups	7,405	1	7,405	1,141	,295
	Within Groups	175,284	27	6,492		
	Total	182,690	28			

The Table 1 and 2 provide means, standard deviations, and F values for between-group differences in the total MAR-S. A one-way analysis of variance (ANOVA) was conducted, and the findings are presented in Table 2. In all the cases, the p values are higher than 0.05 which means no significant difference in the variables was observed. Hence, the conclusion is that there is no difference in PSTs' anxiety levels in mathematics, physics and chemistry. This means that PSTs experience anxiety in maths, physics and chemistry.

4.3. MSAEE influence on the teaching practices and efficacy of PSTs

Understanding the impact of math and science anxiety on teaching practices and efficacy is crucial, particularly for PSTs during their teaching practice. This theme seeks to delve into the intricate relationship between math and science anxiety and teaching practices, exploring how these factors intersect and influence one another, as was observed in the classroom and noted during the interviews. One participant responded:

> "Well, as a PST, I've realized that my own anxieties about math and science can sometimes trickle down into my teaching practices. When I feel anxious about a particular concept or topic, I notice that I may rush through explanations or avoid certain activities altogether. This has impacted my confidence and efficacy because learners pick up on my hesitancy and become unsure or disengage themselves. Therefore, I've been actively working on addressing my anxieties through the interventions that have been introduced to my class by my lecturer. I am also seeking support from my mentors to ensure I can confidently teach these two subjects." (PSTA).

This sentiment was also observed during the researcher's teaching practice observations. The author observed that most of the PSTs rush through explanations of the key concepts in maths and physical science often due to their anxiety about these concepts, probably because they have low content knowledge and lack confidence to teach those subjects. Another PST reiterated that:

"I have found that my own math and science anxieties have influenced the way I plan and deliver lessons. When I am anxious about a particular mathematical concept, I spend excessive time preparing for that lesson, sometimes at the expense of other important topics. This can lead to a lack of balance in my teaching and affect my efficacy as a teacher because I might not cover all the necessary material adequately and stick to more traditional teaching methods rather than incorporating hands-on or inquiry-based learning activities." (PSTD).

4.4. Strategies to alleviate MSAEE and promote resilience

This theme delves into the exploration of various strategies aimed at alleviating math and science anxiety while concurrently promoting resilience among PSTs during lectures. When asked about strategies to reduce anxiety levels among the participants, they gave varied responses including growth mindset, reflection, supportive environment and tailoring instructional approaches. Participants narrated:

"My lecturers emphasized the importance of adopting a growth mindset. They encouraged us to view challenges as opportunities for growth and learning, rather than obstacles to our success. As they promote a positive attitude towards learning and development, they cultivated resilience and confidence in our abilities to effectively learn math and science concepts during lectures." (PSTB).

"My lecturers prioritize creating a supportive learning environment to foster open communication, encouraging questions, and providing additional resources to address any gaps in understanding. By acknowledging our anxieties and providing a safe space for learning, they helped to build our confidence in math and science and efficacy during teaching practice." (PSTC).

"We have been exposed to varied instructional strategies tailored with emotional tools like the use of the Growth Zone Model, relaxation response and the Hand Model of the Brain. These strategies have been implemented during lectures as we break down complex topics into smaller, more manageable parts to help us navigate through challenging content." The relaxation response model makes me relax as I tackle challenging problem-solving. This has allowed me to persevere in solving problems in math and science" (PSTA).

5. Discussion

This study delves into the intricate balance of anxiety experienced by PSTs in mathematics and sciences. Results across a wide range of previous studies have indicated that mathematics and science anxiety occur frequently among students of all grades and even at higher institutions of learning and that it is more likely to occur in females than in males. This study found that PSTs experience anxiety in both mathematics, physics and chemistry (math mean = 30.07, SD = 2.853, F=1.114; physics mean =29.34, SD =2,676, F=.624; chemistry mean =30.10, SD =2.554, F=1.141) and that their anxiety levels are comparable among the population sampled for the study. This finding corroborates with Putra et al., (2021) study which found that the anxiety experienced by PSTs is not limited to mathematics; it extends to other subjects like physics and chemistry, influencing their overall teaching practices.

In addition, this study found that PSTs' anxiety influenced their teaching practices and efficacy, especially during teaching practice sessions, undermining their effectiveness as teachers. The literature reviewed has shown that there is a negative correlation between mathematics anxiety and mathematics teacher efficacy (Swars et al., 2006). Additionally, factors such as content knowledge, attitude towards mathematics, and self-efficacy play a role in influencing mathematics anxiety and teaching practices among PSTs (Aksu & Kul, 2019). Moreover, several studies have argued that PSTs with high mathematics anxiety may project this anxiety onto their students, leading to lower academic expectations (Mizala et al., 2015). It is therefore essential to address pre-service teachers' anxiety to enhance their teaching practices.

Furthermore, in this study PSTs were exposed to varied instructional strategies tailored to emotional tools like the use of the Growth Zone Model, relaxation response and the Hand Model of the Brain. These strategies have been implemented during lectures as complex topics were broken down into smaller, more manageable parts to help PSTs navigate through challenging content. According to Para and Johnstone-Wilder (2023), these tools should be embedded in teacher practice to help address anxiety in the context of mathematics.

6. Conclusions and recommendations

This study explored the existence of Mathematics and Science anxious equilibrium among PSTs in Physical Sciences. The study highlights the significant but frequently disregarded issue of anxiety among PSTs teachers and its potential implications for STEM education. The study reveals a state of existence of anxious equilibrium among the PSTs towards mathematics and science, which has a

substantial impact on how they teach these subjects and, subsequently, their practices. By acknowledging and dealing with this balance, policymakers and teachers may create strategies to cultivate resilience among STEM students, promoting a nurturing learning atmosphere that encourages academic achievement and sustained involvement in science and mathematics disciplines. This study highlights the significance of advocating for the well-being of teachers and addressing anxiety-related difficulties in STEM education to foster a flourishing and inclusive learning environment for all students.

Acknowledgements

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CAREER MANAGEMENT SKILLS FOR VULNERABLE YOUTH.
A CAREER GUIDANCE AND VOCATIONAL TRAINING POINT OF VIEW

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Abstract

Access to quality guidance services, among other objectives, should enable individuals to acquire the skills to manage their careers and direct their life and career paths. These competencies are necessary to cope with decision-making processes, especially in times of change and transition. By focusing on young people who are vulnerable due to adverse, social, family and economic conditions, the analysis can be approached from the perspective of equity and social justice. Promoting the acquisition and development of these skills by these young people has been one of the main concerns of European governmental authorities and entities, which has led to the implementation of different educational measures. These include access to specific vocational training programs aimed at preventing dropouts and achieving social and professional inclusion. This research is part of a wider project, funded by the "Severo Ochoa" Grant Program for Training in Research and Teaching of the Government of Principado de Asturias (Spain), grant number PA-22-BP21-202, which aims to know what research has been done on career guidance in vocational training programs for at-risk youth. Documentary analysis and literature review were used as a method, analyzing twenty-two scientific documents and guidance actions integrated in thirty-six European vocational training programs. The results of the analysis of the scientific papers, in terms of the process of acquiring career management skills, indicate that these young people perceive themselves as having high levels of socio-professional skills acquisition. However, there are differences in perceptions regarding the acquisition of several soft skills and discrepancies between the perceptions of the young people and those of the educational, social and professional agents who work with them in these programs. As conclusions, we highlight the need to adopt a systemic approach that promotes experiences and opportunities for guidance and learning in real contexts, bringing together views between educational and professional environments in order to foster participation, critical awareness and positive expectations regarding the competences acquired by learners. Furthermore, the documentary analysis carried out recognizes the need to propose lines of research focused on the analysis of guidance and competence development processes from a lifelong learning approach, in order to contribute to dropout prevention.

Keywords: Career management skills, vocational training, at-risk youth, documentary analysis.

1. Introduction and objectives

Access to quality guidance services is one of the main challenges to achieve by education systems (Psifidou & Ranieri, 2020), to respond to social demand for people to acquire the necessary skills to manage their careers and steer their life and career paths. These kinds of competences, referred to in the scientific literature as *career management skills*, are necessary to cope with decision-making processes, especially in times of change and transitions (Blokker et al., 2019).

Several studies have analyzed the guidance processes of young people in vulnerable situations for different reasons (social, family and economic issues), bearing in mind that these processes must be approached from a clear perspective of equity and social justice (Villardón-Gallego, 2020; Weber, 2023). In this sense, these concerns for promoting the inclusion of particularly vulnerable groups have led to the implementation of various measures and programs in the field of Vocational Education and Training (VET) aimed at reducing educational dropout rates (Cedefop, 2023). For this reason, it is necessary to deepen our knowledge of what kind of career guidance actions are carried out in these programs, which agents are involved in, and what kind of repercussions they have for the improvement of the processes of acquisition and development of socio-professional competences of these youth.

The research presented here is part of a wider research project, which has as general objective: understand the situation of career guidance in the context of VET programs for young people who are at risk of dropping out of the education system. Specifically, the objectives of the present paper are the following:

1. Identify the career guidance actions implemented in Europe's vocational training programs.
2. To find out which career management skills are developed through such actions in Europe's vocational training programs.
3. To examine the implications of these aspects in relation to the educational, social and vocational inclusion of at-risk youth.

2. Methods

This paper presents the results of the bibliometric analysis carried out in the initial phase of the research. A documentary analysis was carried out, following the qualitative approach of the research methodology (McMillan & Schumacher, 2005), through a review of the scientific literature and the analysis of vocational training programs in Europe.

In total, thirty-six VET programs in the European context were reviewed, using the database developed by Cedefop & ReferNet (2019), *Vocational education and training in Europe*. In addition, 22 scientific papers, included in the two of the most relevant databases in the field of study (*WOS Core Collection* and *Scopus*), were analyzed.

Data analysis followed the methodology set out in the PRISMA 2020 statement (Page et al., 2022), in three phases: identification, screening and inclusion, according to eligibility criteria. Once the study sample was selected, we proceeded to the narrative and content analysis by defining a system of categories, that included the main characteristics of the programs and the studies. All of this, in line with the objectives established in the research.

3. Results

3.1. The state of career guidance in VET programs for at-risk youth

The analysis of Europe's vocational training programs (Figure 1) has made it possible to establish similarities and differences in terms of: (1) the purpose and profiles targeted; (2) the system of vocational qualifications they accredit; and (3) the guidance actions developed.

Figure 1. Number of vocational training programs analyzed by country.

Note: Countries where only on VET program has been analyzed are shown in colour green, while countries where two VET programs have been analyzed are shown in colour orange.

(1) Regarding the purpose of the most programs (24/36), they are aimed at promoting the educational, social and labor inclusion of different profiles of students: those who are at risk of dropping out of the educational system or who have experienced situations of school failure in previous educational levels (14/24), students with special educational needs or learning difficulties (7/24) and students who are socially and economically disadvantaged (3/24).

Specifically, in Austria, the Pre-VET programs (*Berufsbildende Mittlere Schulen, BMS*) are aimed exclusively at migrant pupils with no knowledge of the target language, while the other programs (11/36) do no set specific access requirements.

(2) To assess the level of qualification, we have used as references, the International Standard Classification of Education ISCED 2011 (UNESCO, 2012) and the European Qualifications Framework (QEF) for lifelong learning (Council Recommendation of 22 May 2017), which means that most of the programs analyzed (35/36) are part of secondary education, linked to ISCED level and EQF 2 and 3. All except in Ireland, where this kind of programs are part of post-secondary education, which can recognize ISCED level 4.

These qualifications are recognized in the labor market as the necessary qualification to perform simple and basic tasks. Moreover, in 20 of the 36 programs, these qualifications allow students to remain in the education system by providing direct access to the next level of the vocational education and training system.

(3) Finally, with regard to the guidance actions developed in these programs, they can be classified into four main types of actions:

- Counselling through centers and services with professional counsellors, who provide information on educational and professional insertion pathways (17/36).
- Integrated career guidance systems, which should place special emphasis on the emotional support of students attending such programs (8/36).
- Curriculum-integrated activities and specific vocational guidance subjects taught by specialized teaching staff (5/36).
- Coordinated actions from employment agencies and services for vocational guidance (4/36).
  Only 3 programs out of the 36 analyzed do not provide information on this topic.

3.2. Career management skills developed in VET programs for at-risk youth

The literature review yielded a total of 22 scientific articles, which explore different features of vocational training programs aimed at young people at risk of dropping out of the education system. As a result of this analysis, this paper highlights those scientific articles that are directly related to the process of acquisition and development of career management skills (4/22, see Table 1), in order to identify the most significant implications for research and application in the educational field.

The studies reviewed are focused on analyzing the processes of acquisition of career management skills by young people who live in and experience situations of vulnerability and who are also enrolled in vocational education and training. These studies analyze the self-perceptions of these young people, as well as the perceptions of other educational, social and occupational actors regarding the degree of acquisition and importance given to different competences (Table 1).

As main results, they all agree that these young people have a high degree of perception of the acquisition of these competences. However, according to Frey et al. (2014), in comparison with the perceptions of other young people who are not at risk, the perceptions are relatively lower, especially in the acquisition of social (cooperation, communication, conflict resolution, leadership and responsibility, among others) and methodological (autonomy, techniques and work habits and setting professional goals). Likewise, in contrast with the perceptions of teachers, counsellors and employers' agents, the studies by García-Ruiz et al. (2013), Olmos (2014) and Olmos-Rueda & Mas-Torelló (2017) indicate a large discrepancy between these agents and between these and the students' perceptions, being the first ones much lower.

Table 1. Scientific studies that address the process of acquiring Career Management Skills (CMS) and that have been included in the review.

Authors (publish year)	Research country	Methodology	CMS analyzed
Frey et al. (2014)	Germany	Quantitative	Social Competence (cooperation, conflicts resolution and communication) Methodological Competence (reflexivity, flexibility and analytical ability) Personal Competence (self-awareness, empathy and curiosity)
García-Ruiz et al. (2013)	Spain	Mixed	Interpersonal competence (sincerity, independence, affectivity, kindness, obedience, honesty, coexistence, collaboration and tolerance) Intrapersonal competence (self-improvement, initiative, emotion, self-esteem, learning, knowledge, thinking, knowing, pleasure, vitality and responsibility) Image and care (elegance, aesthetics, good image, adornment, health and personal cleanliness).
Olmos (2014)	Spain	Mixed	Communicative competence Mathematical competence Digital competence Social, civic and labor competences Autonomy and initiative competences Health competence (emotional, physical, social and psychological) Learning to learn competence Interaction with the environment competence
Olmos-Rueda & Mas-Torelló (2017)	Spain	Qualitative	Basic employability competences (instrumental, social and citizenship, autonomy and personal initiative, learning to learn, emotional health and intrapersonal intelligence and responsibility)

4. Discussion and conclusions

The results obtained allow for a better understanding of the processes of guidance and development of career management skills of students enrolled in initial or basic grade of vocational training programs.

Taking into account the specific objectives set out, firstly, it has become clear that the main guidance actions within this type of programs are related to the direct and indirect counselling provided by various educational, social and professional agents. In this respect, it is essential, in accordance with the research proposed by Romero-Rodríguez et al. (2022), to promote collaborative processes and spaces that allow understanding that career guidance must be a shared task and responsibility and, therefore, to achieve the integration of educational and career guidance in the educational plans that take place in these kind of VET programs.

Secondly, in response to the second of the proposed objectives, the analysis of relevant research in this field has highlighted the importance of transversal competences in promoting greater student involvement in their learning process. In line with Villardón-Gallego et al. (2020), the main competences to be taken into account will be related to self-awareness, the development of self-confidence, teamwork and responsibility, as well as emotional, interpersonal and problem-solving skills. However, it will be necessary to analyze the adjustment of realistic and positive expectations regarding the levels of competences acquired, given the discrepancies between teachers' and student's perceptions.

Finally, the third objective was related to the link between these aspects and the processes of inclusion and re-engagement of students in the education system. In this sense, we can conclude that the development of coordinated career processes, as well as the development of lifelong learning and career management skills are key aspects to prevent the risk of dropping out of the VET system (Boza et al., 2015; Cerda-Navarro et al., 2017).

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PRE-SERVICE TEACHERS' UNDERSTANDINGS OF HOW SOCIAL VALUES CAN BE INTEGRATED IN LIFE SCIENCES TEACHING AND LEARNING

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Abstract

The National Curriculum Statement (NCS) Grades R-12, comprising the Curriculum Assessment and Policy Statement (CAPS), is currently used for teaching, and learning in South African schools. Since the dawn of democracy, school curricula documents in South Africa have been built on 10 fundamental social values that inspired the country's post-apartheid Constitution Act 108 of 1996. These social values comprise democracy, social justice and equity, equality, non-racism, and non-sexism, Ubuntu (human dignity), open society, accountability, rule of law, respect, and reconciliation. The Manifesto on Values, Education and Democracy is another education policy statement which accentuates these values. Consequently, the NCS is underscored by a curriculum philosophy that urges teachers to equip learners with values during classroom teaching of all approved subjects, Life Sciences included. Such a stance is consistent with global efforts at promoting values education. Therefore, the study reported herein investigated pre-service teachers' understandings of the teaching strategies suitable for integration of some values into classroom teaching of Life Sciences. In a qualitative study underpinned by perception-value as the theoretical framework, 70 Life Sciences pre-service teachers were selected to participate in the study. The participants were in their final (fourth) year of studying for a Bachelor of Education Degree and were enrolled for a Life Sciences methodology module at a university in South Africa. These teachers had taught in diverse school contexts as part of work integrated learning, hence were knowledgeable about the nature of South African classroom contexts. In collecting data, each participant was tasked to: 1. select a topic/concept from the Life Sciences CAPS document; 2. identify values they can inculcate in learners; and 3. critically discuss how the identified values may be integrated into Life Sciences classroom teaching of the chosen topic/concepts. Each participant's submission formed the data and was subjected to content and thematic analysis. From the analysis of data, the following strategies were identified as suitable for inculcating values in the learners whilst teaching various Life Sciences topics: discussion; role playing/mock sessions; collaborative group work; engaging in debates; using analogies; making reference to learners' lived experiences; and using examples familiar to learners' lives. The discussed teaching strategies were indicative of how the South African philosophy of Ubuntu is critical in developing values in learners. The findings of the study have implications on not only pre- and in-service teacher professional development but also inform how the societal issues may be mitigated through the teaching of values.

Keywords: Life Sciences, pre-service teachers, teaching strategies, values, Ubuntu.

1. Introduction

The National Curriculum Statement (NCS), Grades R-12, a comprehensive policy document embodying the Curriculum and Assessment Policy Statement (CAPS) for each approved subject, currently guides teaching and learning in South African schools (Department of Basic Education [DBE], 2011a). Rooted in post-apartheid ideals, the NCS is underscored by a principle which emphasizes the need for teachers to instil social values in learners during classroom teaching across all subjects. Hence, this principle aligns with the ethos of values education described by Oeschger et al. (2022) as value formation conveyed through educational goals usually set by curricular documents. Shaped by a series of reforms and the principles of the South African Constitution, the NCS reflects abstract notions of value, which vary in interpretation (Askeland, 2020; DBE, 2011a; Frese, 2015). Schwartz (2012) delineates six key features of values, highlighting their emotive nature, motivational role, and overarching significance. Values, whether perceived as nouns or verbs, denote worth and importance, resonating with the essence of significance (Magendanz, 2003). Embedded within the post-apartheid South African Constitution are fundamental social values, including democracy, social justice, Ubuntu (human dignity), and reconciliation (DoE, 2001; Botha et al., 2016). Ubuntu, in particular, encapsulates these core values, embodying interconnectedness and interrelatedness (Dube, 2023). However, implementing values-driven education poses challenges, requiring teachers to be discerning and innovative in achieving such outcomes (García-González et al.,

2020). Of particular concern is how pre-service teachers engage with curricular principles, such as integrating social values into teaching practices. Understanding the perspectives of pre-service teachers becomes pivotal for teacher educators, informing pedagogical approaches (García-González et al., 2020). Consequently, against the backdrop of illuminating pathways for values-based teaching and learning (values education), this study sought to explore pre-service teachers' understandings of integrating social values within Life Sciences education (teaching and learning).

2. Literature review

The abstract nature of value(s) as a social construct renders it elusive, lacking physical presence and existing only as a conceptualization dependent on perspective (Frese, 2015; Seewann & Verwiebe, 2020). Social value(s) manifests as intangible nouns such as honesty, love, and respect, influencing human behavior across various contexts (Eyal et al., 2009). Rhodes and Roux (2004) identify factors shaping social values, including moral, aesthetic, political, legal, and religious dimensions. These factors give rise to key values reflected in societal activities, encompassing ideologies, ethics, humanitarian principles, and cultural norms (Rhodes & Roux, 2004) which align with the fundamental social values enshrined in the post-apartheid South African Constitution. Hence, within educational contexts, social values permeate South Africa's curricular documents, where they were integrated across learning areas. The initiative titled 'Values, Education, and Democracy: Report of the Working Group on Values in Education' aimed to identify key values for integration into the South African curriculum (Ferreira & Schulze, 2014; Rhodes & Roux, 2004). This effort culminated in the development of the "Manifesto on Values, Education, and Democracy" (DoE, 2001), aligning with the ten fundamental Constitutional values previously mentioned. The current NCS Grades R–12 serves as the cornerstone of educational policy in South Africa, shaping teaching and learning practices across various subjects. Plausibly, the NCS is deeply rooted in South Africa's historical context of apartheid and reflects ideological and socio-political inspirations (Gervedink et al., 2013; Hildebrand, 2007).

Furthermore, post-apartheid educational reforms in South Africa emphasized a values-driven curriculum, evidenced by the implementation of the "Guidelines for Inclusive Teaching and Learning" (DBE, 2010) and the "Guidelines for Responding to Learner Diversity in the Classroom" (DBE, 2011b). These initiatives were specifically geared towards fostering social justice, equity, and development within the framework of a democratic South Africa (Chisholm, 2012). As previously elucidated, a fundamental tenet of the NCS Grades R–12 is the mandate for educators to imbue learners with the social values enshrined in the South African Constitution through the teaching of CAPS-approved subjects. Building upon this principle, Jeannette and Julialet (2003) assert that in South Africa, issues such as violence, indiscipline, and high crime rates stem from a deficiency in values conducive to a healthy society and a well-disciplined school environment. Such challenges are not unique to South Africa but are part of a global phenomenon (Simuforosa & Rosemary, 2014) often resulting in teachers bearing the brunt of blame. In light of these circumstances, this study proposes leveraging classroom teaching of life sciences concepts as a means to impart social values. However, as future teachers, exploring pre-service teachers' understanding of how this can be done creates an avenue for cultivating a positive value system among learners. By integrating values education into the curriculum, educators can play a pivotal role in nurturing socially responsible individuals and fostering a conducive learning environment aligned with the principles of the NCS.

3. Research design

We employed a qualitative approach to explore pre-service teachers' understanding of how social values can be integrated in life sciences education in relation to the NCS's philosophy of 'equipping learners with values'. Drawing from interpretivist and constructivist paradigms, we adopted a qualitative case study methodology to facilitate the exploration. To explore how pre-service teachers may implement the curriculum philosophy in real time classroom LS teaching and learning we used the CAPS for Life Sciences as the context within which their understanding was examined. Participants in the study comprised 70 final-year students enrolled in a Bachelor of Education program, specifically focusing on teaching Life Sciences in high schools. Moreover, the participants had taught in diverse school contexts as part of work integrated learning, hence were knowledgeable about the nature of South African classroom contexts. All participants provided consent for participation. The authors employed Bowen's (2009) approach to document analysis to collect and analyze data from the CAPS for Life Sciences. We focused on understanding the curriculum principle of 'equipping learners with values' and how it translates into classroom teaching. The approach involved iterative steps of skimming, reading, and interpretation, leading

to the identification of relevant textual data to understand the curriculum principle. The participants were then taught about the process.

Subsequently, participants were tasked with analyzing an extract from the Manifesto on Values Education and Democracy (MVED) and selecting a Life Sciences topic from the CAPS for Life Sciences. They were instructed to identify constitutional values incorporated in their selected topics and discuss teaching strategies by which the identified values can integrated in classroom teaching of the topics. Data collected from their responses formed the basis of our study. Data analysis encompassed content and thematic analyses (Bowen, 2009), involving coding and category construction based on the characteristics of the data. Thematic analysis facilitated the identification of patterns and themes within participants' responses, guiding the interpretation of findings. Overall, this methodological approach allowed us to explore the participants' understanding regarding the incorporation of values into Life Sciences instruction and to uncover insights into suitable teaching strategies for value integration.

4. Results

From the analysis of data, the participants suggested teaching strategies which may be achieved either during real-time teaching in the class or outside the classroom in direct or indirect relation to the topics taught. The following strategies were identified as suitable for inculcating values in the learners whilst teaching various Life Sciences topics: drawings/illustrations; discussion; visitations, role playing/mock sessions; collaborative group work; engaging in debates; using analogies; making reference to learners' lived experiences. Some of the strategies are represented in the three themes enunciated below. The values to be integrated, specific topics and teaching strategies (Bold and italicized) are as reflected in the excerpts derived from the participants (using pseudonyms). Ultimately, how the suggested teaching strategies were indicative of how the South African philosophy of Ubuntu is critical in developing values in learners. Three themes are presented. All names given are pseudonyms.

4.1. Theme 1: Teaching strategies to inculcate values in direct relation with topic

Excerpt 1 that follows explicates an example of how this theme was expressed in one of the pre-service teachers Johnson's response.

Johnson: …*The first value being **equality** can be integrated when teaching the **structure of the human ear**. Here the teacher can **draw** the structure of outer, middle and inner parts of the human ear. After that he or she can describe how sound waves travel from the outer ear until they reach the inner ear, and explain why a person cannot hear if one of the parts does not work. For example, when the cochlea found in the inner ear is damaged, the recipient will not hear anything. This will make learners to realize that all parts of the ear are equally important to make a person to hear sound. The teacher can then relate this to the society and tell learners that all people in the society are equally important to make the society work. For example, clinics need nurses, cleaners, doctors and patients so that they can function efficiently. Without one of these, they will not function accordingly.*

Johnson suggested the use of ***drawings or illustrations*** as a strategy to teach the value of ***equality*** incorporated in the teaching of the topic of ***structure of the human ear***. Using the illustrations/drawings, Johnson noted the importance and role played by the different parts of the ear for sound waves to be detected. In essence, all the parts of the human ear are of equal importance for sound waves to be transmitted and detected appropriately. Correspondingly, the value of Ubuntu (interdependence) is exhibited among the different parts of the outer, middle and inner ear.

4.2. Theme 2: Teaching strategies to inculcate values not in direct relation with the topic

Excerpt 2 that follows enumerates an example of how this theme was enunciated in one of the pre-service teachers, Debora's response.

Debora: …*I will ask the learners to **discuss** ways to **use water** to prevent water from running out and w**hile one learner is speaking, I will urge the others to actively listen** by posing follow-up questions or asking them to summarize what their peer said. By doing so, I will provide a platform for learners to contribute their ideas, making them a part of the lesson, which will encourage meaningful learning of the topic and help them comprehend, appreciate, and respect the different viewpoints of their peers.*

Debora's understanding of the strategy of ***discussions*** to teach the topic on the '***use of water***' for inculcating the values of ***respect and responsibility*** was not in direct relation with the concepts taught. However, the strategy involves how the teacher mediates or facilitates the discussions in a way to ensure mutual respect among the learners. Hence, Debora indicated that she will ensure that w*hile one learner*

speaks, she would urge the other learners to actively listen. Therefore, learners learn to respect one another while the teacher *provides a platform for learners to contribute their ideas, thereby making them to be part of the lesson.* Each learner is allowed to take **responsibility** of their explanation(s) during the discussion to enhance an interactive and learner-centred classroom. Ultimately, the value of Ubuntu is espoused in the teaching strategy as each learner's comprehension of the topic taught is inspired by other learners' contributions (interdependence) during the discussions.

4.3. Theme 3: Teaching strategies involving outside-class activities (Visitation)

Excerpt 3 that follows enumerates an example of how this theme was expressed in one of the pre-service teachers, Lucky's response.

Lucky***:*** *…As we discuss the* **water availability** *subtopic in class, I would encourage the learners by asking them if they have experienced any issues when it comes to water availability in their areas and what they think could be the cause for such an issue. In this manner, they will communicate and participate in investigating the causes of this issue if they do not already know it. The learners can* **go to the municipal offices [visitation]** *to enquire in order to get valid responses. Considering that as teachers we have a responsibility of having to be role models and lead by example, I would also go to the relevant offices to help learners find the information we need. This will teach learners how important* **participation [responsibility/accountability]** *is in the context of nation building.*

Unlike in Themes 1 and 2, Lucky suggested a teaching strategy that will take the learners outside of the classroom environment. This teaching strategy is in relation to a Grade 11 main topic on "***Human impact on the environment: Current crises for human survival: Problems to be solved within the next generation" (DBE, 2011a, p. 51) with a specific focus on water availability and its quality***. Hence, the strategy involves a ***visit to the municipal office*** in charge of water supply to find out about issues related to water availability or shortages. This strategy becomes germane especially in relation to the way South Africa has been experiencing erratic power supply, coupled with a shortage of water supply in recent times. According to Lucky, this strategy will be useful to teach learners about the ***values of responsibility/accountability*** because there should be someone in the municipal office who had a responsibility but failed to do do his/her work appropriately, hence failing to take accountability for it. Therefore, the value of Ubuntu is expresed in the teaching strategy as it elaborates how the citizens' access to quality water is depedent on the proper functioning of all personnel of the municipal office. Similarly, the strategy implies how citizens must be responsible for the appropriate uses of water and care for water-related public equipment.

5. Discussions and conclusions

Notwithstanding that the NCS, inspired by a post-apartheid Constitution of South Africa, is established on social values, cases of injustice, racial discrimination and human rights abuses are still prevalent, especially among youths, 20 years into democracy in the country (Roux & Janse van Rensburg, 2017). Considering this situation, "the explicit development and teaching of applicable and appropriate values have become an urgent need" (Roux & Dasoo, 2020, p. 1). However, the NCS is underscored by a principle which urges teachers to equip learners with social values, exemplified by ten fundamental constitutional values, during classroom teaching of all approved subjects. A balanced curriculum theory and teacher pedagogical practices is essential within schooling contexts in South Africa for appropriate implementation of the curricular principle. Therefore, how pre-service teachers understood the curricular principle with respect to how social values can be integrated in Life Sciences teaching and learning formed the fulcrum of discourse in this study. From the analysis of data, the following strategies were identified as suitable for inculcating values in the learners whilst teaching various Life Sciences topics: discussion; role playing/mock sessions; collaborative group work; engaging in debates; using analogies; making reference to learners' lived experiences; and using examples familiar to learners' lives. The discussed teaching strategies were indicative of how the South African philosophy of Ubuntu is critical in developing values in learners. The findings of the study have implications on not only pre- and in-service teacher professional development but also inform how the societal issues may be mitigated through the teaching of values.

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PARENT'S ACTIVE ROLE AND SPECIFIC INVOLVEMENT IN CHILD EDUCATION: A SOUTH AFRICAN TEACHER'S PERSPECTIVE

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Abstract

This study sought to investigate parents' particular and active involvement in their children's education from the viewpoint of a South African teacher. Three different schools' high school teachers participated in the study. The study examined parental engagement in a child's education using a quantitative research methodology and an interpretive paradigm. Teachers who were not included in this study participated in a pilot study. The 62 teachers who were purposively selected as the study sample. A qualitative case study technique has been employed in the research design to provide a thorough investigation of the issue in the context of South Africa. Frequency tables and graphs were used to present the manually examined data. Semi-structured interviews were used as data collection instruments, and a wide range of teachers from different topic areas and grade levels participated in the interviews. Purposively choosing the participants allowed for a complete representation of viewpoints and experiences. Tables and graphs were used to analyze the data. The data's recurrent themes and patterns were found using thematic analysis. The study's findings revealed that educators generally agree that parents' active involvement in their children's education is beneficial. Educators consistently emphasize that parental involvement in their child's education—both online and offline—as well as assistance with homework and assessments, play a major role in fostering academic achievement, social and emotional growth, and a positive outlook on learning. The findings show that educators generally agree that parents' active involvement in their children's education may be beneficial. Educators consistently emphasize that parental involvement in their child's education—both online and offline—as well as assistance with homework and assessments, play an important part in fostering academic achievement, social and emotional growth, and a positive outlook on learning. The study attempts to benefit learners, teachers, parents, school administrators, and policymakers in education by providing insights into creating a cooperative atmosphere that could support and promote active parental involvement. The study suggests that stakeholders and teachers, who have valuable viewpoints, ought to develop strategies and programs that support productive home-school collaborations, thus improving children's education. By offering a teacher-centric viewpoint on the novel and open concept of active parental involvement in education, the research adds to the body of knowledge already in existence and clarifies the precise degrees of involvement that educators believe are most advantageous for the child's overall development.

Keywords: Active role, child education, engagement, specific involvement.

1. Introduction

Parental involvement is vital for academic success in South Africa (Smith & Ndlovu, 2020). This study delves into parents' roles in education, as perceived by South African teachers. Employed parents often prioritize education, enrolling children in urban schools (Smith & Ndlovu, 2020). Some families near schools convert homes into boarding houses due to limited facilities, covering expenses like fees and transportation (Jones, 2018). Patel and Dlamini (2022) note the evolving nature of parental involvement, influenced by societal factors. Educators offer insights into parental engagement's impact on student outcomes. This study explores diverse parental support forms, aiming to enhance parent-teacher partnerships and education holistically in South Africa.

2. Literature review

To fully understand parents' active role and specific involvement in child education from a South African teacher's perspective, this part reviewed theoretical and empirical literature.

2.1. Theoretical literature review

The theoretical literature on South African parental involvement in child education highlights its impact on academic outcomes and considers socio-cultural contexts (Jones, 2018; Patel & Dlamini, 2022). Theoretical frameworks like social capital theory stress community networks (Smith & Ndlovu, 2020), while ecological systems theory examines family, school, and community roles (Smith & Ndlovu, 2020). Parental efficacy affects involvement, crucial for student success (Jones, 2018; Patel & Dlamini, 2022), guiding educational practices and policies.

3. Research methodology

This section discusses methodological issues such as the research approach, design, population and sampling, data, and analysis methods.

3.1. Methodological design

The study of parental involvement in South African child education employs qualitative methods which was a case study research design. Quantitative survey involvement prevalence across socio-economic backgrounds, measuring dimensions like communication. Document analysis supplements data, informing educational strategies (Jones, 2018; Patel & Dlamini, 2022; Smith & Ndlovu, 2020).

3.2. Population and sampling

A purposive sample was utilized, encompassing three high schools and sixty educators, to guarantee a rich exploration of perspectives (Creswell & Creswell, 2017). A purposive sample of 62 teachers was used as the participants of this study. This approach made it easier to deliberately choose participants based on their knowledge and experiences in the South African education system, guaranteeing a range of viewpoints from important stakeholders like educators. A deliberate selection of sixty educators was made from three high schools.

3.3. Theoretical literature

Theoretical literature on South African parental involvement in child education is diverse (Jones, 2018), highlighting its impact on academic outcomes (Patel & Dlamini, 2022). Frameworks stress socio-cultural contexts, community networks (Smith & Ndlovu, 2020), and reciprocal parent-teacher relationships (Patel & Dlamini, 2022). Scholars integrate theories, informing educational practices (Jones, 2018; Patel & Dlamini, 2022; Smith & Ndlovu, 2020).

3.4. Empirical literature

Parental involvement in South African child education offers crucial insights into engagement dynamics (Jones, 2018). Jones highlights parental contributions to academic achievement through surveys and interviews, emphasizing homework assistance and communication with teachers. Patel & Dlamini (2022) explore evolving parental engagement, identifying socio-cultural barriers and proposing collaboration strategies. Smith & Ndlovu (2020) address challenges and facilitators, stressing tailored approaches for diverse families. Synthesizing findings, this literature emphasizes parental roles and informs educators, policymakers, and parents in fostering supportive learning environments (Jones, 2018; Patel & Dlamini, 2022; Smith & Ndlovu, 2020).

3.5. Data collection and data analysis

To investigate parental involvement in South African child education, qualitative methods like semi-structured interviews with teachers captured detailed perceptions and experiences (Jones, 2018). Additionally, focus group discussions facilitated interaction and rich insights (Patel & Dlamini, 2022). These surveys were measured dimensions like communication and participation (Jones, 2018).

3.6. Data collection procedure

Data collection for exploring parental involvement in South African child education was structured and ethical. After securing approval, diverse teachers voluntarily participate (Govender & Nkosi, 2020). Qualitative methods, including interviews and focus groups, were conducted with consent, ensuring minimal disruption (Nzimande & Dube, 2018). Quantitative surveys gathered data anonymously (Ramasamy & Vilakazi, 2022). Coding schemes and triangulation enhanced reliability and validity. The procedure aims for comprehensive insights into teachers' perspectives on parental involvement (Govender & Nkosi, 2020; Nzimande & Dube, 2018; Ramasamy & Vilakazi, 2022).

3.7. Data treatment and analysis

To make sense of the information gathered on parental engagement in children's education from the viewpoint of South African teachers, a methodical approach to data treatment and analysis was used. Graphs were drawn and presented the findings.

4. Findings and discussions

Findings unveil insights into South African teachers' perspectives on parental involvement in child education (Ramasamy & Vilakazi, 2022). Themes like socioeconomic factors and cultural beliefs emerged (Ramasamy & Vilakazi, 2022).

4.1. Positive parental support in the education of a child

Figure 1. Parental support of children as much as any parent would do.
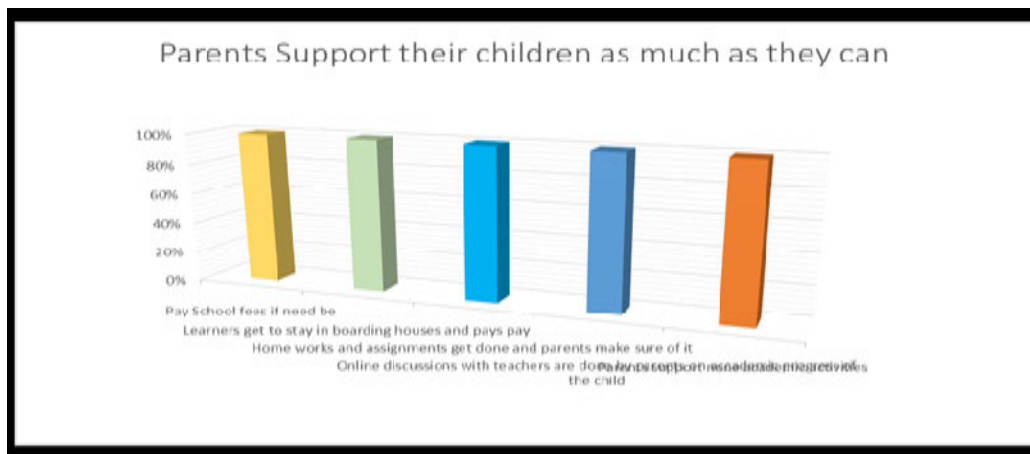
According to participants, Figure 1 depicts 100 % of parental support for their children's education. Every participant (100%) stated that their parents helped their children with homework, assignments, or projects; paid for boarding houses so that their children would stay closer to school; paid for extra classes outside of school; attended parent-teacher conferences; and had online discussions about their children's academic progress. The findings are supported by Jones (2018) who stated that parental involvement in South African child education offers crucial insights into engagement dynamics (Jones, 2018). Jones highlights parental contributions to academic achievement through surveys and interviews, emphasizing homework assistance and communication with teachers. Patel & Dlamini (2022) explore evolving parental engagement, identifying socio-cultural barriers and proposing collaboration strategies.

4.2. Children taking advantage of their parents and getting into misbehavior

Figure 2. Children staying in boarding house taking advantage of their parents' kindness.
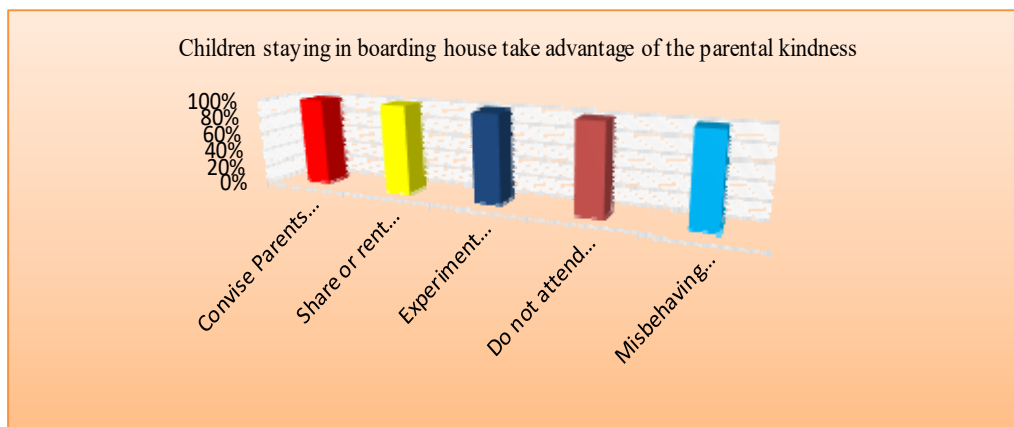
Figure 2 reveals that 97% of parents reported that their children persuaded them to live in a boarding home, rent with friends, or remain near to school. As a result, parents are unaware of their children's misbehavior; they also skip school, experiment with alcohol, and sometimes throw weekend parties. When the school calls parents about a child's misbehavior, the child doesn't tell the real parent and instead pays a stranger to act as a stand-in for the parents. The findings are supported by Jones who say that, some families near schools convert homes into boarding houses due to limited facilities, covering expenses like fees and transportation (Jones, 2018).

5. Conclusion

In conclusion, this study has provided valuable insights into parental involvement in child education from the perspective of South African teachers. The findings underscore the critical role parents play in shaping their children's educational journey and the significance of fostering strong parent-teacher partnerships. Through both qualitative and quantitative analysis, the study has elucidated various factors influencing parental engagement, including socioeconomic status, cultural beliefs, and institutional barriers.

6. Recommendations

To enhance parental involvement in South African education, several recommendations arise from the findings:

- **Strengthen Communication Channels:** Establish effective channels for updates on students' progress and school activities.
- **Promote Inclusive Engagement:** Adopt approaches considering diverse socioeconomic and cultural backgrounds.
- **Provide Parental Support Programs:** Offer programs to equip parents for active engagement.
- Foster Collaborative Partnerships: Encourage partnerships among parents, teachers, and communities.
- **Address Institutional Barriers:** Tackle issues like language, transportation, and financial constraints.
- **Conduct Further Research:** Explore longitudinal studies to sustain engagement and measure outcomes. Implementing these recommendations can create an inclusive, supportive system fostering student success in South African schools.

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GUIDING FIRST-YEAR STUDENT TEACHERS IN THE APPLICATION OF THE SKILL OF SET INDUCTION IN MICRO-TEACHING

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Abstract

In teacher education and training, the skills of teaching and learning are significant parts of microteaching. Every student teacher must be enabled to teach effectively to ensure they can master the practice of teaching. When student teachers go for teaching practice as part of their work-integrated learning (WIL), they must present lessons that will make learners eventually achieve in their academic endeavors. Teaching and learning involve several activities that student teachers must be knowledgeable of and master proficiently. In microteaching, these activities are called skills. There are several skills such as set induction skills, questioning skills, writing on chalkboard skills, and so on. that must be understood by the student teachers to present effective lessons. In most cases, student teachers who are doing their Bachelor of Education degree attend teaching practice during the second semester of their first year of study. During this period, they are expected to have mastered the skill of set induction. This skill is essential because it is the first skill of microteaching and plays an important role in ensuring that student teachers are ready for the basic principle of teaching. This research paper will provide an explanation of the skill of set induction, its purpose, its components, and strategies that student teachers can employ to successfully apply set induction in a classroom situation.

Keywords: Microteaching, teacher education, set induction, Work Integrated Learning (WIL), teaching practice.

1. Introduction

The first year at the university is characterized by many factors that may be positive or negative. Simpson and Frost (1993) demonstrate that the first year at the university is apparently a fresh start for the students. Mainly, it is the first time away from home where they will be liberated to make their own personal choices. Tappu (2015) and Terenzin et al., in Millet (2005) add that these students experience challenges that are conventionally associated with the transition from high school to university such as finance, homesickness, socializing with peers, and lack of skills. Compounding this challenging situation, the first-year students face, particularly the B.Ed. students in teaching, is the attendance of teaching practice where the student teachers must go to the real classroom and present lessons. These student teachers seemingly have no confidence, are fearful of what they might experience at the school, and do not have the skills that will make them effective in presenting the lessons. This paper intends to provide some guidelines and strategies the student teachers may apply to gain confidence and use the available teaching skills, principally the skill of set induction, to present lessons effectively.

2. Methodology

The paper is a narrative review of the literature exploring the strategies that Central University of Technology first-year student teachers may use to apply the skill of set induction successfully. This study will make use of the relevant literature primarily from academic collections, journals, google scholar, and the internet. The paper will reveal its findings in the results section and thereafter provide recommendations. The paper will further invite engagement for future studies.

3. Literature review

3.1. Explanation of microteaching

Researchers explain microteaching in a variety of ways. The earliest researcher, Klingstedt (1974) describes microteaching as a controlled experiment of genuine teaching which is scaled down about learners and time. Wangchuk (2019) explains that microteaching is a productive teacher empowerment method that improves the skill that student teachers must acquire. Remesh (2013) views micro teaching as a teacher training method that is used to learn teaching skills. Microteaching is a skill-based mechanism that is utilized in teacher education to narrow the gap that exists between theory and practice in teaching (Taole, 2015). The significant part of microteaching is that it is traditionally placing its emphasis on assisting student teachers to master a variety of teaching skills (Amobi, 2005). The microteaching circle can be represented as follows, with every skill following this circular process:

Figure 1. Microteaching cycle.

As highlighted in this study, the skill of set induction will be explored to assist the CUT first-year students who will be taking part in the teaching practice in the second semester of the year 2022. In congruence with the authors above, Kalaimathi and Julius (2015) confirm that microteaching is an instrument for teacher training that trains teaching behaviour and skills in a minute group setting assisted by video recordings. On the one hand, Mollo (2021) concludes that microteaching has assumed a productive role as a teacher empowerment strategy that is utilized by many universities to prepare their student teachers with the necessary teaching skills. On the other hand, Msimanga (2021) resolves those micro-lessons that are presented during microteaching can develop student teachers' skills when there is a progression in students' groupings.

3.2. Set induction as the microteaching skill

It is fundamentally important for student teachers to understand the basic skills that teachers must be acquainted with to become better teachers. Teachers must develop the skills that will inspire and prepare learners for learning. Thus, the skill of set induction is precisely applicable at this stage. Primarily, Schuck (1970); Naranyanan, Shankar, and Ananthy (2019) view a set as a preceptive process triggered by a stimulus or a stimulus perceived in an environmental situation. Schunk (1970) illustrates that a set determines how an individual is inclined to respond to what is prevailing in a particular situation. Set induction can be defined as a pre-instructional method that often starts at the beginning of the class period, nonetheless, set induction may still happen during the lesson (Kalaimathi & Julius, 2015). Hargie (2011) contends that the set induction as a teaching skill is often used at the commencement of the lesson for gaining attention, apprehending past knowledge, presenting an introduction of the content to follow, and determining the expectations of the learners. Set induction refers to a process of making use of the thought-striking account, exciting point, or an audio-visual stimulus at the start of the lesson to gather the attention of the learners and to provide an overview about the lesson or the topic (Narayanan et al., 2019; idsemergencymanagement.com, 2020). Changingminds.com (2020) concludes that the set induction is about the preparation in a formal lesson presentation. When learners are set, they are ready to learn. As a result, set induction is about making certain that learners are ready to learn and thus placing them into a correct frame of mind.

3.2.1. Purpose of the set establishment. There is a rich body of evidence highlighting the rationale behind the utilization of the set induction such as Kalaimathi and Julius (2015); Perrott (1982) and Schuck (1970) among others. For instance, Kalaimathi and Julius (2015) insist that set induction is utilized to develop continuity from lesson to lesson and from unit to unit and encourages learners to garner interest and encourage participation in the body of the lesson. Schuck (1970) argues that the purpose of the set induction is to develop a frame of reference to facilitate the creation of communicative connectivity between the experiential field of knowledge that is possessed by the learners and the desired behavioural goals of the learning session. Following the same line of thought as the researchers in the preceding paragraph, Perrott (1982) cites that focusing attention on what is to be learned by securing the attention of the learners, moving from ancient to new materials and linking the two, providing sense to a new concept or principle and providing a structure for the lesson and setting expectations of what will happen are factors that serve as representatives of the purpose of set induction: While Changingminds.com. (2020) assets that the set induction ensures that learners are actively and fully engaged in the learning process. This author highlights that this process can be effectively done by explaining potential advantages to the learners, providing crystal clear instructions to the learners and describing what is going to occur.

3.2.2. Components of the set induction skill. Kalaimathi and Julius (2015) introduce four components of the set induction skill which are vitally important to student teachers. These components are listed and discussed below:

Attracting learners' attention: It is imperative that while starting a lesson, learners' prior knowledge is evaluated in order to attract their attention. When teaching from the known to the unknown perspective, will evidently bring effective outcomes in attracting the attention of the learners (Kalaimathi & Julius, 2015). Attracting the learners' attention is preparing them for the state of readiness, that is readiness to learn (idsemergencymanagement.com, 2020).

Initiating motivation: Motivation is essential in the teaching and learning process. Motivation can be induced by giving pre-instructional illustrations and by ensuring that learners get interested in the lesson. These can include factors such as tale-telling, analogy, or any striking activity (Kalaimathi & Julius, 2015; idsemergencymanagement.com, 2020).

Structuring: Kalaimathi and Julius (2015) and Idsemergencymanagement.com (2020) the student teacher must propose a working design of the lesson by delineating timing, planning appropriate methodology, and announcing his or her plan to the learners to bring forth the complete picture of the lesson.

3.3. Strategies to successfully employ the implementation of set induction skill in a normal classroom setting

There is rich body of evidence about strategies that can be employed by the student teachers to successfully apply the set induction skill in the classroom. Schuck (1982) cites that student teachers that are taught by the teacher who is capacitated in the use of set induction skill has a far greater level of success than those teachers who are not capacitated on set induction skill. In accord with the previous author, Aurbertine (1968) maintains that teachers are presumed to be efficient in their teaching work when they employ set induction technique into the pedagogical strategies. In the section below the strategies that can be employed by the first-year CUT students who will be taking part in the teaching practice during the second semester are suggested.

3.3.1. Resourceful teaching strategies. The student teachers may use the funny and exciting ways when applying the skill of set induction to present their lessons resourcefully in the classroom setting. These are tabulated below (idsemergencymanagement.com, 2020):

Table 1. Teaching strategies.

Brainstorming	A group activity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas.
Use of technology	Google classroom, video games that can be used to teach on the internet.
Getting out of the classroom	Going out of the classroom and teach about an object found outside the classroom.
Using puzzles and games	Games that try to test a person's knowledge or puzzles whereby a solver is expected to put pieces together.
Using mind maps	Diagram in which information is represented visually, usually a central idea placed in the middle and associated ideas arranged around.
Roleplay	Acting out or performing part of a person.
Building a story board	Visual outline of a film, preproduction process, or a series of images.

3.3.2. Exciting modes of commencing a lesson. A student teacher can use the following modes such as commencing with a video, because most individuals are fond of a good video, especially school learners, commencing with an object thus making your learners speculate about the topic by showing them an object that is related to the content, commencing by asking a question, commencing with a movement or commencing with a mistake to start with his or her lesson. To remember these modes of commencing with the lesson, Changingminds.com (2020) developed this acronym STEP which is denoted as follow:

3.3.3. Conducting creative activities in class. The students can create the activities such as cut and glue, sticker fun, raised Salt Painting, drawing with Oil Pastel, the Back-and-Forth drawing games, playdough modelling game, marble painting and water balloon painting.

4. Conclusion

The skill of set induction is primarily the introductory skill in the teaching and learning process that creates an enabling atmosphere for effective educative endeavour. The paper acknowledges that CUT first-year student teachers will gain confidence and present lessons proficiently when they apply the skill of set induction successfully. The paper further provides strategies that can be used when applying the skill of set induction during their teaching practice period.

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STABILISING THE LINK BETWEEN SECONDARY AND HIGHER EDUCATION THROUGH LIFELONG LEARNING PROGRAMMES

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Abstract

At the heart of this report is the question of the relationship between secondary and higher education in the post-secondary situation. The focus of the analysis is the Bulgarian education system, as here the Covid-pandemic deepened a number of negative phenomena related to serious educational deficits. The introduction of distance learning into the secondary education system, although a necessary measure to contain the pandemic, could not compensate for the traditional forms of Education - direct teacher-student communication. The latest results of international tests such as PISA highlight new low levels in the preparation of Bulgarian students, both among those from the primary stage of education and those who are on the verge of completing their secondary education. It is yet to be analyzed how these defects of Secondary Education will be reflected in the Higher Education System. And more importantly, can they be overcome? Currently, students in the Higher Education are such a group of students who lack a number of skills and habits - communicative and professional. It has also been observed that their theoretical knowledge has not transformed into a sustainable foundation of their competence. So that the natural link between secondary and higher education is broken, higher education must quickly compensate for these deficits of general preparation. It turns out that the fastest this task can be solved by adapting lifelong learning programmes. First of all, to expand the forms of practical training by additional organization of qualification courses, by introducing productive attempts to acquire professional skills and competences – internships, brigades, practical expeditions and so on. Secondly, updating the three stage model of Higher Education: Bachelor – Master- Doctor, with the addition of practical activities, and this in the direction of increasing the duration of the Bachelor to five years - inclusion of additional courses to overcome the deficits from school education. Thirdly, expanding the opportunities for organizing short-term courses together with employers. The complex of short-and medium-term actions through the inclusion of the lifelong learning system within higher education will compensate for some of the deficits and contribute to the formation of the necessary professional skills for the future realization.

Keywords: Lifelong Learning, Secondary Education, Higher Education, professional skills, competences.

1. Introduction

This report focuses on the link between secondary and higher education in the postcovid situation. The Covid pandemic imposed a number of restrictions, including on the education system. The rapid introduction of distance learning in poorer countries like Bulgaria, with decades of economic, social and demographic problems, with severe regional disparities, showed that the education system - also in European terms - needs such a type of planning that guarantees the stability of the system even in emergency situations (Vasileva, 2019).

However, analysis of the education system in Bulgaria over the last three years shows educational deficits of students in the transition from secondary to higher education. And deficits in the fundamental preparation of the individual to orient and solve issues of the present and the future. Deficits affecting personal and social skills and competences. Humanitarian training of the personality, the acquisition of values through the study of history and literature emerged as a problem (Velev, 2021). The fact that books are hardly read is an acute problem, especially in poorer countries. In the search for solutions to these issues, it is worth looking at lifelong learning, borrowing approaches and methods to stimulate self-interest and personal willingness to compensate for what is not learned and mastered (Vasileva, Nusheva, Yankova, & Pavlova, 2018).

2. Observations on the state of secondary education

The state of secondary education in Bulgaria in the post-Covid reality is a reflection of a number of factors: economic, social, demographic. Statistics show that Bulgarians are the fastest melting nation in Europe. In just fifteen years - 2009 to 2022 - the birth rate has fallen by nearly 30% and the death rate has increased. For 2024, the trend remains extremely negative. (Bulgarian Government, 2021)

There are more and more experts who see education (both secondary and tertiary) as a possible way out of the deepening crisis factors. On the other hand, the changing technological environment requires a rapid adaptation of the education system: *employers demands on the workforce in terms of skills to work with new production, information and communication technologies, as well as knowledge of foreign languages are continuously increasing* (Yankova, Nusheva, & Dimitrova, 2017).

Next, education has been affected by the Kovid-pandemic, the result of which is very negative for the Bulgarian education system. Recent research has shown the instability of knowledge and highlighted a number of problems in social experience and communicative opportunities among students. Above all, the pandemic had a negative impact on students' skills and competencies in reading and mathematics. It is possible, in our opinion, that in the future we will discuss, and very seriously, the problem of the dehumanisation of the individual. And this is not just about the accelerated penetration of artificial intelligence, but about the increasingly relevant topic of reading and comprehension deficits as nodal humanizing factors.

Last but not least, the Kovid-pandemic has deepened inequalities in education. To a large extent, the lack of a clear economic programme to guarantee free access to the Internet through incentive measures has had a knock-on effect on social differentials, both within individual social groups and along regional lines - some are developed, others are in extreme poverty.

The introduction of distance learning in the Bulgarian education (Vasileva, Yankova, & Ivanova, 2021) system as an essential measure to tackle the Covid pandemic has not contributed to the sustainable development of education. The issue is not distance education, but the political unpreparedness and failure to adapt working distance education programmes to Bulgarian conditions. The lack of methodology on how to work with students of different ages and levels of education has proved to be one of the preconditions for today's educational deficits.

In Bulgaria there is a large group of bilinguals who, in the conditions of distance education, have not been able to meet the minimum national educational requirements related to reading skills, text comprehension, social skills useful in the knowledge society, etc.

A series of technical problems also had an impact: the majority of learners (pupils and students), as well as their teachers, were not provided with electronic devices suitable for distance learning. Also, in some of the Bulgarian settlements the lack of free access to the Internet did not allow for full learning. (Chantova, 2008) Additionally, the electronic resources of libraries - both national and European - were not fully free for use by all European students and trainees.

The educational system turned out to be unprepared for the post-covid situation as well - the deficits were not analyzed and identified in a timely manner, and accordingly, measures for their compensation were not foreseen. Although the first signal of problems in the general preparation of secondary school students came in the external assessment in 2021 - a relatively high number of poor grades, especially in bilingual areas. (24 Hours Newspaper, 2021). At the end of 2023, the negative results were confirmed by the international PISA study: not only have Bulgarian schoolgirls sharply worsened their indicators in comparison with the previous study, but they have performed poorly in reading and comprehension, as well as in the area of mathematical competence, traditionally strong for Bulgaria. (Ministry of Education and Science in Bulgaria,2023).

3. Through the experience of Lifelong Learning programmes

As it is well known, Lifelong Learning is based on the understanding of the permanent need for new and adequate solutions to issues born from globalization, technological development, aging population. These solutions must ensure the full development of the human factor, preparing it for quality realization in rapidly changing and emerging professions . One of the most important differences of lifelong learning programmes is that they are the result of personal initiative, they are voluntary. The individual himself is aware of the need for complementary qualifications, for acquiring new or upgrading acquired competences. The documents obtained - certificates, etc., are often more relevant for one or another position than the educational qualifications. But, and this is also specific, without the relevant educational background and formed habits, upgrading with new competences and skills is almost impossible.

In Bulgaria, the Lifelong Learning Programme has been fully implemented since its inception in 2006-2007. In the period 2012-2013, the projects "BG-Implementation of the European Union Programme for Adult Learning"; "Partnership for Continuing Education and Training of Teachers"; NELLII - Network of Initiatives and Information for Lifelong Learning; days and celebrations related to lifelong learning have been organized at national level. (Lifelfong Learning Programme in Bulgaria). A Lifelong Learning Strategy was developed and adopted in 2014. (Eurydice, 2023).

Work on the document "Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021-2030)" follows, which attempts to implant lifelong learning as an integral part of the education process. (Strategic Framework, 2021)

Structurally, lifelong learning takes place in legitimate institutions. These include Vocational Training Centres, which by law can also exist in higher education institutions. At this stage, a more comprehensive analysis of the operation of the individual programmes at the time of the Covid pandemic is lacking. But in the post-covid reality, interest in the courses and the sarified practices is gradually being restored. (Tomova, 2021)

4. New challenges for higher education in the post-Covid reality

Currently, the generation trained and graduated in the conditions of the Covid pandemic is entering the higher education system in Bulgaria. It is yet, as highlighted above, to comprehensively avalise the deficits with which they come from secondary education. But, as researchers and educators in higher education what can be generally pointed to their training?

On the positive side, distance learning has improved their e-communication skills and their ability to quickly navigate the Internet environment. With the caveat, however, that they have not formed the habit of distinguishing between truth and falsity. In this aspect, they can become an easy target for manipulation. On the other hand, significant gaps are found both in general educational fluency, which prevents future specialized training, and in relation to competencies and skills, especially analytical and communication skills.

In relation to the acquisition of primary vocational skills - these were also a problem for the education system before the pandemic, but at the moment they are not developed even at a theoretical level. For example, the specialty of tourism trains students who lack basic educational knowledge, but also elementary professional competences. This makes it necessary - through the Vocational Training Centre as well as through non-formal education - to compensate both theoretical and professional training. It is also necessary to develop practical training - for example, to provide students with competences in professions that do not require higher education, but without which they cannot fully develop in the field of higher education. The example of tourism can be illustrated by the introduction of qualification courses for maid, piccolo, cook, etc.

Or another example. As a result of insufficient preparation in certain fields of study, for example, history or literature, students engage in courses, work in creative teams, projects and other forms of research and education to enable them - at a later stage - to obtain the necessary theoretical-practical preparation at the graduate level.

Today, therefore, higher education faces a new challenge - to find adequate approaches, to introduce programmes and courses to compensate for the deficits in the general educational preparation of students from the previous stage of secondary education, resulting from the unforeseen circumstances surrounding the Covid-pandemic. The most natural solution is by adapting approaches and programs from lifelong education to help address significant gaps from the very beginning of students' education. It is to be expected, however, that such use of programmes from another system will affect the structural, organisational and thematic characteristics of higher education.

First of all, it is necessary to expand the forms of practical training - by additionally organizing qualification courses, by introducing productive attempts to acquire professional skills and competences - internships, brigades, practical expeditions, etc. Secondly, to update the three-tier model of higher education: Bachelor - Master - PhD, extending the Bachelor's degree from four to five years. Reducing training, as is being pushed in some quarters, will exacerbate negative phenomena. Thirdly, extending the possibilities of organising shorter-term courses in conjunction with employers' organisations to make up for shortcomings in students' professional training.

5. Conclusion

As is clear, the post-covid situation outlines a number of challenges for the education system. This calls for a comprehensive analysis and a set of measures in the short and medium term to compensate for the deficits of individual educational development. As students trained in the Covid context are yet to enter

higher education, it is imperative that a large part of these measures be directed towards higher education, which should focus on introducing lifelong learning programmes that have proven to be effective, expanding forms of practical training and the formation of habits and competences, and introducing more immediate forms of communication and training for students.

Acknowledgments

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FACING THE FUTURE: VET SKILLS FOR TODAY AND TOMORROW

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Abstract

The new information and communication technologies, COVID-19, the dynamic changes are leading to changing world of work brings and the key importance of VET. Nowadays a key factor for success is the ability to develop the skills needed in the labor market that employers are looking for. Therefore, those changes are following by the important structural changes in the educational system and the need to re-engineer certain parts of VET systems in some countries to make them more resilient. It is argued that high-quality Vocational Education and Training (VET) plays a key role in ensuring that the population has the relevant and necessary skills of today to help them meet socio-economic challenges and thrive both personally and professionally with a plan. The place of inclusive education is particularly important - both for today's youth, for whom vocational education and training ensures a smooth entry into the labor market after completing compulsory education, and for adults who need to upgrade their qualifications and retrain to adapt to the changing world of work. The methodology applied in the study includes searching and analyzing factual information. This paper aims to highlight the fundamental role of vocational education and training in the preparation of personnel for the future, presenting a detailed picture of the current situation and prospects for VET, the labor market and individual professions, which will present a view of the future. This paper was developed within the framework of a scientific research project "A model for evaluating the effectiveness and quality of inclusive education, training and lifelong learning" with contract № КП-06-Н80/1, funded by National science fund of Bulgaria.

1. Introduction

People's skills have always been a key factor in human development civilization, but in the nowadays dynamic, globalized and strongly individualized 21st century, as if they were the main engine of development and success, and high value. It is human skill that is an opportunity for success in the solution of every task and in the initiation of every undertaking. It depends on the ability, from the maturation and from the exercise of the individuals.

In modern Society of Knowledge precise communication tools open new levels of coverage and profitability for the business entities involved in LLL. On the other hand LLL learners may consistently develop better their skills, receive self satisfaction and certified approval while using communication tools. (Yankova et al., 2017)

In an age characterized by rapid technological transformation and a range of changes, including demographic crisis and changing workplace dynamics and demands, the importance of vocational education and training (VET) has never been more perceptible. As our society adapts to the emerging challenges and opportunities of the 21st century, the skills required of workers continue to transform. This report explores the critical importance of VET in preparing the workforce for today's and tomorrow's work environment, focusing on the skills needed for sustainable growth in an ever-changing environment.

2. The importance of VET for achieving innovation, inclusive and sustainable growth

Change is an inevitable part of life. The value of skills is also changes, as well as the environment in which they are formed, developed and implemented. The transformation of requirements to modern valuable skills determined by several global trends: an increase in life expectancy; entry of smart machines and systems into life of people, societies and economies; exponential data growth; use of new communication tools and channels; transformation of jobs and professions, and the emergence of such a phenomenon as "global a workplace' full of diversity, cultural and subcultural differences;

emergence of new organizational structures defined by changes in manner at work, and he – influenced by innovative technologies and social networks. (Vasileva, 2020)

Accessibility, rapid updating and effective management of educational resources are the absolute basis for modern quality education and continuing education, as well as the application of innovative methods of pedagogical interaction and the acquisition of new generation digital skills.(Vasileva et al., 2020)

Today, we are observing a significant change in industries and existing professions, which inevitably leads to a change in the requirements of the labor market and, accordingly, to the requirements for employees. Vocational education and training (VET), especially if it is of high quality, plays a fundamental role in ensuring that people have the necessary skills to meet socio-economic challenges and achieve impressive results both in personal, as well as in professional life. VET is important both for today's youth, for whom it seeks to ensure a smooth transition from compulsory education to the labor market, and for adults who have a vital need for upskilling and retraining to adapt to the changing working world. (Vasileva et al., 2019)

According to the European commission's definition for 'vocational education and training' is 'education and training which aims to equip young people and adults with knowledge, skills and competences required in particular occupations or more broadly on the labour market' This type of training can be provided, in both formal and non-formal settings, at all levels of the European Qualifications Framework (EQF). VET is the education and training sector that is closest and most closely related to the labor market. VET is considered an extremely important and effective form because it provides skills that prepare workers for specific careers and occupations, while providing valuable transferable skills and responding effectively to economic needs. (European commission, 2022)

The European Union (EU) is leading the way in promoting and investing in VET. The Council Recommendation on VET for Sustainable Competitiveness, Social Equity and Sustainability, published in 2020, sets out the EU's overarching vision for the future of VET. Our aim is to make VET a high-quality, attractive opportunity for all learners.

While the Commission leads the way with a wide range of policy initiatives, support instruments and funding mechanisms at EU level, Member States have the power to make the necessary reforms a reality.

In today's fast-paced world, industries and professions are undergoing significant transformation, which necessitates a corresponding change in the demands of the labor market and, gradually, in the skill set required by employees. In this context, vocational education and training (VET), when delivered to a high standard, takes a central role in equipping individuals with the necessary skills to meet socio-economic challenges and develop both personally and professionally.

VET serves as a cornerstone for today's youth, facilitating a seamless transition from education to employment. Furthermore, it addresses the imminent need for upskilling and retraining among adults, enabling them to adapt effectively to the dynamic nature of the modern workplace.

The European Union (EU) is leading the way in engaging and investing in VET initiatives. The Council Recommendation is on VET for sustainable competitiveness, social justice and sustainability, set in 2020, setting out the EU's overarching vision for the future of vocational education. The EU's mission is to position VET as a beacon for high-quality, attractive education accessible to all learners.

Although the European Commission implements a diverse set of initiatives supporting these instruments and funding mechanisms at EU level, it is essential to recognize that they are now exerting significant influence in translating visions into tangible reforms on the ground. Cooperation between EU countries, national governments, educational institutions and stakeholders is paramount to realizing the transformative potential of VET.

By embracing collaboration and embracing innovation, additional potential is being harnessed for vocational education and training to empower people, improve employability and promote sustainable socio-economic development around the world. Shaping a future where VET serves as a cornerstone for inclusive growth, social cohesion and lifelong learning for all takes a long-term view of VET and its relevance to society today.

3. Current landscape of VET skills

Today, VET encompasses a wide range of skills, ranging from technical expertise to so-called "soft skills" such as communication, problem solving, crisis and conflict management, etc. The demand and supply of highly skilled employees in fields such as healthcare, information technology, green energy and advanced manufacturing is constantly increasing. This leads to a necessary change of VET in terms of curricula, educational content and delivery formats. They need to be adapted to provide learners with the appropriate knowledge, skills and competences that are in line with the needs of the labor market.

4. Technical proficiency

Basic technical skills play a key role in various areas of public life. In the digital age, where every profession intersects with information technology, skills in coding, data analysis, digital literacy and artificial intelligence are crucial. These professional knowledge and skills are concentrated not only in the information technology sector, but also in all other spheres of business and science.

VET programs need to be updated and to reflect the latest technological trends to ensure that learners acquire the modern skills that are needed in the labor market.

5. Adaptability and lifelong learning

In an age of rapidly evolving technology, adaptability and lifelong learning is essential. Vocational education and training graduates must not only be aware of the changing demands of the labor market, but also be prepared to adapt to them. Acquiring skills that are relevant and applicable then becomes an ongoing process that lasts throughout life.

Organizations in the field of VET need to apply more innovative and modern approaches, because of innovation and entrepreneurship, providing an incentive for constant learning and development, which in turn attracts today's generation, which is tied to a large extent to ICT.

Today, flexibility and resilience are critical to successfully navigating the uncertainties brought about by the period of change and the challenges of the work activities of given professions on a global scale. The ability of today's employees to cope with stress, adapt to changing circumstances and withstand unexpected challenges.

Flexibility is another important aspect of VET training. The ability to adapt to rapidly changing conditions, accept different roles and adapt to different situations is extremely important for competitiveness in the labor market.

When talking about vocational education and training, it is clear that adaptability, resilience and flexibility are essential. Only by investing in programs that incorporate the qualities listed above can it be ensured that learners will be ready to face the challenges of the future and achieve success in their careers and personal lives.

6. Critical thinking and problem-solving

In an age of rapid change and uncertainty, the ability to think critically and solve problems creatively stands out as a hallmark of successful professionals. Curricula in the field of VET must focus on the development of these key skills, which are crucial for successfully meeting the challenges of today's digital and informational world.

Analytical reasoning and decision-making are fundamental to understanding the complex problems that arise in any field of activity. VET programs should provide training that stimulates the development of these skills by providing real-world scenarios and tasks that require analysis, evaluation and informed decision-making.

Additionally, innovative problem-solving techniques are essential for developing creative and effective solutions. VET curricula should encourage learners to use a variety of problem-solving methods and strategies, which will prepare them to deal with complex real-life situations.

Encouraging learners to face real-world challenges gives them valuable experience and confidence to solve problems. This practical approach to the learning process prepares learners for the diverse demands of the modern labor market and provides them with the necessary skills and resources to adapt and successfully cope with the challenges that await them in their professional careers (European commission, 2022).

7. Communication and collaboration

Effective communication and collaboration are the engine for the successful functioning of any profession, regardless of the sector. Communication skills play a crucial role in any work environment. Verbal and written communication, as well as the skill of active listening, are essential to build clear and effective communication both within the organization and with external partners and users. VET programs should develop these skills alongside vocational skills, enabling learners to practice communication in different contexts and with different audiences.

Collaboration is another key aspect that should be emphasized in VET programs. Teamwork is an integral part of everyday work, so developing teamwork skills and the ability to collaborate with different people is vital. By creating an educational environment that encourages collaboration and

interaction, VET programs can prepare their learners to be successful in a variety of team projects and tasks.

Effective communication and collaboration are essential aspects of success in any profession. Developing these skills in learners prepares them for the dynamic and modern work environment into which they must fit.

8. Ethical and social responsibility

Today, with the advent of technology, our society faces new ethical challenges that graduates of vocational education and training must be prepared to meet. These are the ethical dilemmas that arise as a result of the use of technology, while affecting contemporary values and beliefs. It is therefore important that VET integrates ethical reasoning and social awareness into its curricula and learning content.

VET programs should create an educational environment where learners consider the ethical aspects of technological innovations and their possible implications for society. By providing critical analytical tools and stimulating debate on ethical issues, VET can help learners better understand the ethical challenges they face and develop skills to overcome these challenges.

It is important that VET encourages learners to think broadly and consider the impact of their actions on individuals, communities and the environment. By instilling a sense of ethical responsibility, VET prepares society to take an active role in setting ethical standards in society and to contribute positively to the betterment of society.

So, by completing VET programs, learners not only acquire technical skills, but also prepare themselves to deal with the ethical challenges they face in today's world. By embedding ethical principles and social responsibility into the curriculum, VET plays a key role in shaping citizens who are capable of making a positive difference in the world around them (European commission, 2022).

9. Future trends and emerging skills

Looking to the future, several trends stand out that will transform the overall skills picture in vocational education and training (VET). Increasingly noisy and entering many spheres of public life - artificial intelligence (AI), automation and robotics are factors that cannot help but leave their mark on the professions that we are familiar with at the moment and the new perspectives before them, caused of these innovative and technological solutions. These changes will transform not only job roles, but also the required knowledge, skills and competencies of future workers.

Therefore, it is vital that VET programs are constantly updated and adjusted to meet these challenges and opportunities of the new age. Not only the enhancement of technical skills, but also the development of skills that are sustainable over time should be envisaged. Other important factors are Emotional Intelligence, creativity and the ability to solve complex problems, key to the success of future workers in the world of AI and automation.

It is important to emphasize that despite technological changes, humans bring unique qualities that can complement and enhance activities that machines cannot perform. The development of these human skills, which are difficult to control by automation, becomes a key factor for successful adaptation to future technological requirements (European commission, 2022).

10. Conclusions

Facing the challenges of the new information society and the prospects of tomorrow, the role of professional education and training is key in providing individuals with the skills necessary for success and successful realization in personal life and in the work environment. The combination of foundational competences and emerging skills requires VET institutions to cope with dynamic changes and enable learners to navigate the labor market with confidence and resilience. Through collaboration, innovation and a commitment to lifelong learning, VET can serve as a cornerstone for building a skilled, adaptable and future-ready workforce.

In conclusion, the future requires a workforce equipped with a diverse set of skills and a mindset ready for continuous adaptation. By seeing innovation as normal and vital in the transformation and adaptation of vocational education and training institutions, fostering collaboration and prioritizing the development of both traditional and emerging skills, VET can play a crucial role in shaping the workforce of tomorrow.

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IMPACT OF PHYSICAL ACTIVITY ON THE HEALTH STATUS AND QUALITY OF LIFE OF CHILDREN AND SCHOOL ADOLESCENTS

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Abstract

Healthy behavior during the day is very important for the improvement of the quality of life of children and adolescents. However, not all behaviors are equally important in the perception of well-being among adolescents of different sexes (boys and girls). The incidence of physical activity on the quality of life for children and school-aged adolescents stands out as the main behavior. Furthermore, it is necessary to promote these healthy habits from the educational context from an early age. Regular assessment of the impact of healthy behaviors that include diet, physical activity, and sleep time with various psychosocial benefits should be done. It is also necessary to study different sedentary activities separately (use of mobile phones, video games, computers) and assess whether they all have a negative impact on the psychosocial well-being of children and adolescents. A growing number of studies have highlighted the health benefits of greater physical activity, less screen time, and optimal sleep duration in school-age children and adolescents. **Objective:** This paper aims to examine the individual and combined association between physical activity, screen time and sleep time on the quality of life in boys and girls. **Method:** A total number of 220 students from primary and secondary schools on the territory of the municipality of Probishtip participated in the research. The results obtained for physical activity, time spent in front of the screen, and duration of sleep on the quality of life were analyzed. **Results:** Descriptive, correlational, and regression analyzes were conducted to determine the significance of the health-related behaviors of all participants. The results revealed a significant positive association between physical activity and sleep time on quality of life. Finally, regression models showed that physical activity outcomes improve quality of life, especially in children. It was also concluded that movement is particularly important for a healthy and qualitative life, and the impact of physical activity on the quality of life is emphasized as the main factor for the health condition, and for the improvement of the quality of life of the school adolescent population.

Keywords: Physical activity, health status, quality of life, children, school adolescents.

1. Introduction

One of the important domains of quality of life is health. Health can also be viewed as a subjective representation of function and well-being, as stated earlier in the WHO definition, which shifted from a purely biological model to a bio-psycho-social model in which the well-being and quality of life of individuals were assessed. The WHO definition (1948) (WHOQOL Group, 1995) holds an important expansion of the view of health, which is not only understood by somatic indicators, but comprises how a person feels, psychologically and physically, and how she or he manages with other persons and copes with everyday life. Health related quality of life is described as a multidimensional construct covering physical, emotional, mental, social, and behavioural components of well-being and function as perceived by patients and/or other individuals. The WHO quality of life group extends this definition and includes the cultural perspective: quality of life is defined as an individual's perception of their position in life in the context of the cultural and values systems in which they live, and in relation to their goals, expectations, standards and concerns. Meanwhile, researchers in the fields of psychology, medicine and public health have developed useful techniques that have helped to conceptualise and measure these multiple domains and how they relate to each. To date, the importance of measuring health-related quality of life in individuals or groups of patients is well accepted. This is true for adults and increasingly for children and adolescents, although the utility of generic health-related quality of life measurement in population health of children and adolescents has only recently begun to be explored. Health-related quality of life questions about perceived health and function are thought to be an important component of health surveillance and should be routinely included as an indicator. Health-related quality of life measures can aid in identifying subgroups of children and adolescents who are at-risk for health problems, and can assist in determining the burden of a particular disease or disability. Results of such an evaluation can be used to influence public policy decisions, promoting policies and legislation related to children's and adolescents' health, and aiding in the allocation of healthcare resources. Monitoring the

health status of the population allows public health professionals to improve the health of populations, by tracking health trends, identifying discrepancies in health, and planning health promotion activities and interventions.

2. Materials and Methods

2.1. Participants

The research was conducted in primary and one secondary school in the territory of the municipality of Probishtip, Republic of North Macedonia. The students ranged in age from 10 to 16 years old (14.25) including children (n = 115) and adolescents (n = 95), participated in the study. Individuals ranged in age from 10 to 16 years old (14.25 ± 1.32 years), including 102 boys (13.14 ± 1.24 years) and 118 girls (13.75 ± 1.24 years). The selection of the students was carried out through an intentional student for convenience according to the distance of the schools to the research staff in charge of data collection, the willingness to collaborate on the part of the teaching staff, and the time required for the researchers to travel. Likewise, all subjects consented to their participation in the study.

2.2. Measuring physical activity and screen time

Physical activity and screen time was measured using the Youth Activity Profile Questionnaire. This report instrument, designed to measure physical activity and screen time in youths (was validated in Macedonian children and adolescents).

The instrument comprises 15 items related to the practice of physical activity in different domains (inside and outside of school and sedentary time) every day of the week. Each answer is scored on a 5-point Likert Scale ranging from 1 to 5. The questionnaire divided into three sections: activity at school, activity out of school, and screen time.

Physical activity was measured as the average of activity at school (as activity during physical education class, lunch, and recess) and out of school (activity before school, activity right after school, activity during the evening, and activity on each weekend day). Screen time was calculated by inverting values from positive to negative according to the nature of the variable and calculating the average value of all responses related to screen media (watching television, playing video games, using the computer, and using a cell phone).

Sleep duration was measured using the sleep question naire. This instrument is a valid and reliable measure to assess sleep duration among adolescents. The questionnaire has four questions about usual week-day and weekend bedtimes and wake-up times. Daily sleep time was calculated by weighting weekdays and weekend days using a ratio of 5:2, i.e., daily sleep duration on weekdays 5 + daily sleep duration on weekend days 2:7.

2.3. Health-related quality of life

Participants were assessed using the Serbian version of the Kidscreen-10 questionnaire [The Kidscreen Group, 2004]. The Kidscreen-10 is a valid and reliable measure to assess health-related quality of life in youths. The Kidscreen-10 index was developed from the Kidscreen-10 and operationalizes general health-related quality of life in a single scale (Ravens-Sieberer et al., 2010).

With only 10 items, the Kidscreen-10 index is the shortest version of the Kidscreen-1 Kidscreen-10 questionnaires and measures general health-related quality of life. It then provides a useful global measure of health-related quality of life. The scale comprises 10 items assessing the subjective perception of health and well-being. Each statement is scored on a 5-point Likert scale ranging from 1 (never/not at all) to 5 (always/extremely). The reliability analysis showed acceptable reliability for the present sample (α = 0.71).

Health-related quality of life refers to an individual's perception and subjective evaluation of their health and well-being within their unique cultural environment. Generic questionnaires for children and adolescents can be useful in identifying subgroups of children and adolescents who are at risk for health problems, and can assist in determining the burden of a particular disease or disability (Ravens-Sieberer et al., 2010). Assessing the health-related quality of life of children and adolescents could also help to detect hidden morbidity and health care needs which are not identified using traditional medical indicators (Eiser et al., 1999; Seid et al., 2004). Although it is important to obtain responses via self-reports whenever possible, this may not be practicable in very young children or children with developmental delay or mental retardation (Gopinath et al., 2012). In that case, health-related quality of life may only be ascertained via proxy (parent) reports.

3. Results

Table 1 shows the results of the statistical processing of the data through a bivariate correlation between the examined variables (Physical activity, Screen Time, sleep duration (h/day), quality-of-life (1−5). The descriptive analysis showed a significantly higher percentage in boys compared to girls (all, p < 0.01), except for time spent sleeping (p > 0.05).

Table 1. Descriptive statistics and bivariate correlations of the variables studied.

Variables of Study	Total n = 210		Boys n = 102		Girls n = 118			Correlation	
Point A	M	DT	M	DT	M	DT	P	1 2	3 4
1. Physical activity (1−5)	2.30	0.56	2.25	0.52	2.19	0.67	**0.00**	- 0.05	0.03 0.14
2. Screen Time	2.24	0.45	2.19	0.48	2.35	0.75	**0.00**	- - -	0.16 0.11
3. Sleep duration (h/day)	7.65	0.91	7.95	0.91	8.12	1.23	**0.25**	- - -	0.13
4. Quality-of-life (1−5)	3.10	0.56	2.98	0.52	2.95 0.55		**0.00**	— —	— —

bold = significance; p * < 0.05; p ** < 0.01.

When analyzing the correlation, a significant association between physical activity and quality of life was obtained (p < 0.01). However, time spent sleeping was significantly negatively related to screen time (mobile phone and computer use).

Table 2 shows the association between individual and combined performance of a specific physical activity and their impact on quality of life in boys and girls. It shows the results of the statistical processing through a three-step regression analysis. In the first step, the results of a single linear regression analysis between physical activity, screen time, and sleep duration are presented. In the second step, a multiple regression analysis was performed of the results obtained from physical activity and screen time, physical activity and sleep duration, and screen Time activity and sleep duration. In the third step, a multiple regression analysis was also performed between physical activity, screen time, and sleep duration. The results obtained show that the beta value varies every time a new activity was introduced into each step. More specifically, the first step presents the regression analyses of each of the variables that make up movement and behavior in predicting the quality of life, showing a unique significance in PA behavior (p < 0.01). In the second step, several different and possible combinations were made and it was monitored how the beta values varied when only two physical activities were analyzed. Finally, in step three, the variation in beta values was evaluated by the combination of the three activities, resulting in a significant value (p < 0.05) that can explain the impact on the quality of life.

Table 2. Correlation between physical activity, screen time, and sleep durationand quality of life in the samples by sex.

Models Unajdjusted	**Bois**				**Girls**			
	R²	β	p	CI95%	R²	β	p	CI²%
Step1								
PA	0.087	0.293	**0.004**	{0.091,0.257}	-0.005	-0.038	0.541	{-0.113,0.065}
SC	0.010	-0.108	0.149	{-0.138,0.019}	0.003	-0.038	0.524	{-0.116,0.058}
SD	0.002	0.048	0.425	{-0.050,0.117}	0.015	0.128	0.085	{-0.011,0.158}
Step2								
PA+SC		0,285	**0,006**	{0,090,0,253}	**0,000**	-0,038	0,575	{-0,112,0,058}
	0.121	-0.109	0.126	{-0.138,0.017}	0.110	-0.042	0.534	{-0.119,0.058}
PA+SD	0.091	0.298	**0.000**	{0.084,0.259}		-0.048	0.532	{-0.019,0.059}
		0.065	0.112	{-0.155,0.010}	0.020	0.138	0.074	{-0.146,0.041}
SC+SD		-0.294	**0.000**	{0.087,0.245}		0.008	0.434	{-0.127,-0.055}
	0.016	-128	0.078	{-0.149,0.009}	0.025	-0.088	0.264	{-0.146,0.044}
		0.008	0.186	{0.028,0.148}		0.157	**0.045**	{0.000,0.174}
Step3								
PA+SC+SD		0.302	**0.000**	{0.090,0.260}		-0.056	0.398	{-0.128,-0.057}
	0.013	-128	0.082	{-0.152,0.010}	0.028	-0.088	0.257	{-0.152,0.040}
		0.098	0.188	{-0.028,0.145}		0.163	**0.050**	{0.00,0.178}

Adjusted								
Step1								
PA	0.049	0.284	**0.000**	{0.069,0.238}	0.054	-0.065	0.384	{-0.127,0.049}
SC	0.048	-0.097	0.162	{-0.135,0.022}	0.058	-0.101	0.196	{-0.159,0.031}
SD	0.040	0.051	0.174	{-0.054,0.128}	0.051	0.042	0.612	{-0.072,0.120}
	0.138	0.288	**0.000**	{0.079,0.236}	0.068	-0.070	0.327	{-0.136,0.048}
Step2		-0.114	0.120	{-0.145,0.015}		-0.108	0.179	{-0.158,0.030}
	0.124	0.274	**0.000**	{0.000,0.002}	0.057	-0.058	0.436	{-0.128,0.058}
		0.070	0.299	{-0.042,0.128}		0.041	0.498	{-0.071,0.022}
	0.138	0.284	**0.000**	{0.062,0.220}		-0.065	0.325	{-0.135,0.046}
Step3		-0.126	0.068	{-0.177,0.009}	0.066	-0.124	0.112	{-0.177,0.016}
		0.095	0.194	{-0.026,0.164}		0.063	0.364	{-0.058,0.139}

PA (phusical actuvity), SC (screen time), SD (Sleep duration), bold (significance)

4. Discussion

The research that was conducted aimed to determine the individual and combined association between movement behavior (physical activity, time spent in front of screens - mobile phone and computer, and time spent sleeping) and quality of life in boys and girls. The obtained results showed that higher physical activity has a positive effect on the quality of life, especially among boys. And the research results of Gopinath et al. (2012) and Wanner et al. (2014) showed that changes in physical activity levels were associated with positive changes in quality of life. These results could explain the positive benefits of physical activity on physical and psychosocial health, thereby influencing the quality of life of adolescents. Also, the results showed that sleep time was positively and significantly related to quality of life. In this sense, some studies have shown a negative association between sleep quality with poorer quality of life and quality of life in children (Mireku et al., 2019). The results also showed that only individual physical activity behavior and combined sleep and screen time predicted quality of life.

Research by Zurita-Ortega et al. (2018) showed that when the level of physical activity increases, there is an overall increase in quality of life. In this regard, poor sleep timing can have consequences on mood and the immune system (Foerster & Röösli, 2017), in addition to causing problems related to weight gain, which can be caused by increased use of television, video games and mobile phones (Stiglic & Viner, 2019). Also, in the unadjusted model for the entire sample, where the three behaviors (physical activity, screen time, and sleep time) were taken together, our results showed that the sum of them all predicted quality of life; these results are similar to those found by Marques et al. (2019) where healthy behaviors such as physical activity, healthy diet and sleep time were inextricably linked to quality of life. Considering the unadjusted regression model for children, our results showed that only physical activity behavior had a significant role on quality of life. However, for girls in unadjusted regression models, our findings highlighted that only sleep time combined with physical activity and screen time was important for quality of life.

In contrast to our results, the research of Guimarães et al. (2020) and Hesketh et al. (2017) showed higher adherence to movement behavior. Guimarães states that girls show greater ease in complying with sleep recommendations compared to their peers. A possible explanation for this fact is that not all healthy behaviors are equally important for the quality of life in different sexes. It may happen that children with fewer hours of sleep are also those who spend more time in front of the screen due to the influence of new technologies (smartphones, video games, computers) that can cause sleep difficulties, fatigue and headache (Mireku et al., 2019). However, parenting style and home conditions may also affect their quality of life (Dong et al., 2020). Our results showed significance for physical activity and screen time in combination of the three behaviors in the total sample and for physical activity among men. In this sense, our results are consistent with those found in previous studies (Ravens-Sieberer et al., 2007) where the magnitude and intensity of physical activity are associated with a better quality of life. On the other hand, individual or combined healthy behaviors did not show significance for predicting quality of life in this adolescent population.

5. Conclusions

From the research results, it can be concluded that a healthy lifestyle is very important for a better quality of life for adolescents. However, not all behaviors are equally important in the perception of the well-being across genders. Hence, the general conclusion is that the incidence of physical activity significantly affects the quality of life and is emphasized as the main behavior in predicting the quality of life for children and school-aged adolescents. Furthermore, the need to promote these healthy habits in an educational context from an early age is emphasized. Future studies that aim to assess the impact of

healthy behaviors should include behavioral eating habits, in addition to physical activity, sleep time, and sedentary time in order to link them to various psychosocial benefits. It would also be good to study different sedentary behaviors separately (use of mobile phones, video games, computers) to assess whether they all have a negative impact on the psychosocial well-being of children and adolescents. All this contributes to a new perspective on promoting healthy behaviors and improving the well-being of children and adolescents. In this sense, future intervention activities should focus on promoting healthy habits during the day, developing activities that promote the development of adequate sleep habits, avoiding sedentary rest and complying with the recommendations for moderate to vigorous physical activity in children and adolescents, through the use of active teaching methods in primary and secondary schools. In this sense, health should be promoted from a global perspective in the educational context, using active methodologies and development of projects that encourage greater involvement of students and their families, which will favor the cooperation with teachers, students and families in the development of activities that promote healthy habits, such as the correct use of new technologies, appropriate sitting habits and compliance with the recommendations for moderate to vigorous physical activity among children and adolescents

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THE STUDY OF ENGLISH LISTENING PROBLEMS OF THAI EFL UNIVERSITY STUDENTS

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Abstract

English listening difficulty is one of the barriers to English communication which causes misunderstanding and misinterpretation between the speakers and the listeners. It is beneficial for teaching and learning English communication to study students' problems and their need for improvement. This study aimed to explore difficulties in English listening of Thai EFL university students. Samples were 30 second-year undergraduate students, majoring in English for Business Management at a public university in Thailand. The questionnaire was employed to explore students' English listening problems, the causes of listening problems, and students' need for English listening skill improvement. The results revealed that Thai EFL university students reported a medium level of English listening problems in four types regarding the problems related to the messages, the contexts, the speakers, and the listeners. In terms of the individual items, they rated a high level of listening problems with the speed of the speaker, the pronunciation of the speaker, and the ability of the listener to understand at the first time of listening. For the causes of English listening problems, students rated four causes at a high level of agreement including lack of listening skill practice, lack of exposure to different kinds of listening materials, lack of knowledge in vocabulary, and lack of knowledge in grammar. With regard to students' need for English listening skill improvement, the findings showed a high level of improvement need. The highest level of agreement was the need to improve English vocabulary and knowledge by reading English from books or online materials. Further results drawn from students' suggestions and comments indicated their need for English listening skill improvement in six main areas: practicing speaking English in class, practicing speaking English with native speakers, practicing listening English in class, learning new vocabulary and technical terms, learning pronunciation with different accents, and learning listening comprehension strategies. It can be concluded that Thai EFL university students mostly had English listening difficulties especially problems related to speaking speed and pronunciation of speakers. Moreover, most students reported that they need to improve their English listening skills. Based on the findings, it is suggested that EFL teachers should consider students' problems and implement more activities in class which can help students improve their skills in English listening.

Keywords: English listening problems, English listening skill improvement, EFL English listening.

1. Introduction

1.1. Background

Listening is very crucial for communication, especially for EFL students. Grant (1987) stated that there are two reasons why listening is important. First, it is important for communication as communication can not be completely processed with listening. The communication will be more successful if the listener understands the message. Second, it is important for learning as it enables students to understand the lesson. Skilled listeners can understand the lesson and language more easily. However, listening comprehension requires many skills. As, it is an active process, the learners need to construct the meaning by inferring clues from the text and from the prior knowledge (O'Malley et al, 1989). In addition, Anderson (1995, p. 37) mentioned that in listening, the listener needs to recognize segmenting phonemes from the continuous speech stream.

Thus, many students encountered listening difficulties. Underwood (1989) stated seven major listening problems: the inability to control the speed of the speaker, the inability repeat the listening, limited vocabulary, cannot notice the signals, having problem in interpretation, failure to concentrate,

building learning behaviors. Moreover, previous studies revealed English listening problems of employees (Phoonkum, 2021) and EFL high school students (Thangpradit, 2020; Tran & Duong, 2020).

1.2. Objectives

The purposes of this study were to explore English listening problems of Thai EFL university students. In addition, this research aimed to study the causes of listening problems and the need of the students for English listening skill improvement.

2. Methods

2.1. Research design and participants

This research study employed a quantitative research method design. The questionnaires were utilized to collect data from participants. The participants of this study were selected by a purposive sampling method. The participants in this study were the students who enrolled the English for Business Communication course. This course was selected because English listening skill is important for business communication. There were 30 second-year undergraduate students, majoring in English for Business Management at a public university in Thailand.

2.2. Data collection

A five-points Likert scale questionnaire was adapted from Phoonkum (2021) and Tamtani et al (2019), to explore students' English listening difficulties. The questionnaire comprised three main parts: 1) Self-assessment of English listening problems, 2) Causes of English listening problems, and 3) The need of listening skill improvement. There was an open-ended question at the end of the questionnaire to collect the students' additional suggestions for listening skill improvement. The questionnaire was translated into Thai to applicable with the students' native language.

The English for Business Communication course consisted of 15 weeks. The students were administered the questionnaire in week 1 to study their English listening problems before starting the course. The students were assigned to answer the questionnaire in the classroom for 30 minutes.

2.3. Data analysis

The data obtained from the questionnaire were analyzed using statistical methods. Descriptive statistics were employed to describe the mean scores and standard deviations. Then, the means were interpreted into three levels based on Oxford and Burry-Stock (1995)'s concept: high (mean of 3.5 or higher), medium (mean of 2.5-3.4), and low (2.4 or lower). Furthermore, the data drawn from the open-ended questions were analyzed and categorized through the content analysis.

3. Results

3.1. English listening problems of Thai EFL university students

Table 1 shows the results obtained from part 1 of the questionnaire regarding the students' English listening problems.

Table 1. Self-assessment of English listening problems.

Problems	Mean	S.D.	Level
A. English Listening Problems Related to the Message			
1. I find it difficult to understand technical terms or unfamiliar words.	3.38	0.75	Medium
2. I find it difficult to understand slang words, idioms, phrasal verbs.	3.22	0.83	Medium
3. I find it difficult to understand complex grammatical structures.	3.31	0.82	Medium
4. I find it difficult to understand long connected speech.	3.00	1.05	Medium
5. I find it difficult to understand unorganized messages.	3.31	1.00	Medium
Overall	**3.24**	**0.90**	**Medium**
B. English Listening Problems Related to the Context			
6. I find it difficult to understand conversations when I lack background knowledge.	3.41	1.13	Medium
7. I find it difficult to understand unfamiliar topics.	3.22	1.04	Medium
8. I find it difficult to understand conversations when I don't understand the cultural context.	3.00	0.84	Medium

Overall	**3.21**	**1.01**	**Medium**
C. English Listening Problems Related to Speakers			
9. I find it difficult to understand when speakers speak stammering with occasional pauses.	3.03	0.93	Medium
10. I find it difficult to understand when speakers speak too fast.	3.88	0.98	High
11. I find it difficult to understand when speakers speak unclear pronunciation of words.	3.78	0.94	High
12. I have problems with intonation and stress.	2.81	1.03	Medium
13. I have problems with different accents of different speakers.	3.19	1.15	Medium
14. I have problems with speakers' non-verbal language.	2.03	1.00	Low
15. I have problems with pronunciation of final sounds.	2.50	0.95	Medium
16. I have problems with communication/conversation characteristics determined by culture.	2.91	0.93	Medium
Overall	**3.02**	**1.13**	**Medium**
D. English Listening Problems Related to Listeners			
17. I find it difficult to understand the message when I listen to it just one.	3.56	1.01	High
18. I sometime lose my concentration while listening.	3.19	0.97	Medium
19. I can't grasp the key words or main ideas of the message.	3.44	0.80	Medium
20. I feel uncomfortable when communicating with foreigners.	3.28	1.17	Medium
Overall	**3.37**	**1.00**	**Medium**
Overall of English Listening Problems	***3.21***	***1.01***	***Medium***

As seen from table 1, Thai EFL university students rated their English listening problems at a medium level for the overall mean score of students' problems (M=3.21, S.D.=1.01), and for the four types of problems (the messages: M=3.24, S.D.=0.90; the contexts: M=3.21, S.D.=1.01; the speakers: M=3.02, S.D.=1.13; the listeners: M=3.37, S.D.=1.00). With regard to the individual items, the mean scores were ranged from the low to the high level of problems. The highest mean score fell into Item 10: I find it difficult to understand when speakers speak too fast. (M=3.88, S.D.=0.98), and the lowest mean score went into Item 14: I have problems with speakers' non-verbal language. (M=2.03, S.D.=1.00).

3.2. Causes of English listening problems

Table 2 presents the results obtained from part 2 of the questionnaire regarding the causes of English listening problems.

Table 2. Causes of English Listening Problems.

Causes	**Mean**	**S.D.**	**Level**
21. Lack of listening skill practice.	3.50	1.05	High
22. Lack of exposure to different kinds of listening materials.	3.50	1.22	High
23. Lack of knowledge in vocabulary.	3.81	0.93	High
24. Lack of knowledge in grammar.	3.50	1.14	High
25. Lack of understanding of correct pronunciations.	3.47	1.02	Medium
26. Lack of cross-cultural knowledge.	3.31	0.93	Medium
27. Problems related to physical conditions (e.g. Noisy setting).	3.25	0.95	Medium
28. Feeling uncomfortable, excited, and nervous.	3.06	1.11	Medium
29. Feeling embarrassed.	2.88	1.16	Medium
Overall	**3.36**	**1.08**	**Medium**

As shown in Table 2, the overall mean score of listening problem causes was reported at a medium level of agreement (M=3.36, S.D.=1.08). In terms of individual items, the students reported their agreements with all 9 items ranged from a low to a high level. The highest mean score was Item 23: Lack of knowledge in vocabulary. (M=3.81, S.D.=0.93), and the lowest mean score was Item 29: Feeling embarrassed. (M=2.88, S.D.=1.16).

3.3. The need of the students for English listening skills improvement

Table 3 illustrates the results obtained from part 3 of the questionnaire regarding the need of the students for English listening skills improvement.

Table 3. The need of Listening Skills Improvement.

Listening Skills Improvement	Mean	S.D.	Level
30. I need to learn about pronunciation.	4.00	1.05	High
31. I need to understand English accents.	3.94	0.95	High
32. I need to practice my listening skills by talking with my English teachers.	4.28	0.85	High
33. I need to practice my listening skills by talking with foreigners or native speakers.	4.50	0.88	High
34. I need to increase my grammar knowledge.	4.31	0.82	High
35. I need to increase my English vocabulary and knowledge by reading English from books or online materials.	4.56	0.67	High
36. I need to improve my English listening proficiency by attending English training courses.	3.94	1.08	High
37. I need to improve my knowledge and skills related to cross-cultural communication.	4.16	0.85	High
Overall	**4.21**	**0.92**	**High**

As presented in Table 3, the overall mean score of the students' need for English listening skills improvement was rated at a high level (M=4.21, S.D.=0.92). For individual items, all of 8 items were reported at a high level of the students' improvement need. It can be seen that the highest mean score went into Item 35: I need to increase my English vocabulary and knowledge by reading English from books or online materials. (M=4.56, S.D.=0.67), the lowest mean score was Item 31: I need to understand English accents (M=3.94, S.D.=0.95) and Item 36: I need to improve my English listening proficiency by attending English training courses. (M=3.94, S.D.=1.08).

Furthermore, the results obtained from the open-ended questions revealed that they need English listening skill improvement. The students' need can be categorized into six main aspects: 1) to practice speaking English in class, 2) to practice speaking English with native speakers, 3) to practice listening English in class, 4) learn new vocabulary and technical terms, 5) to learn pronunciation with different accents, and 6) to learn listening comprehension strategies.

4. Discussion

4.1. English listening problems of Thai EFL university students
The overall results of this research study showed that the students encountered various problems in English listening. They faced difficulties at the same medium level in all four types of problems including problems related to messages, contexts, speakers, and listeners. In terms of the individual items, the students agreed that they had listening problems at the medium level with almost 20 problems. It is noticeable that they reported a high level of listening problems with the speed of the speaker, the pronunciation of the speaker, and the ability of the listener to understand at the first time of listening. This means the students strongly agreed that these three problems were the most-frequently faced problems.

4.2. Causes of English listening problems
Overall, the students agreed that all nine causes had the impact on their English listening at the medium level. Four causes were reported at a high level: lack of listening skill practice, lack of exposure to different kinds of listening materials, lack of knowledge in vocabulary, and lack of knowledge in grammar. This means the students strongly agreed that these four causes had the greatest factors affecting their English listening.

4.3. The need of students for English listening skills improvement
The results from the questionnaire showed a high level of the students' need for English listening improvement regarding the overall and all eight skills. The top-three needs were: the need to practice their listening skills by talking with foreigners or native speakers, the need to increase their grammar knowledge, and the need to increase their English vocabulary and knowledge by reading English from books or online materials. It can be seen that the top-three needs of English listening improvement were in line with the four-highest level causes of problems. This means they need to improve their listening in all eight skills, especially the top-three needs.

5. Conclusions

This study explored English listening problems of Thai EFL university students, causes of problems, and the need of English listening skill improvement. It can be concluded that Thai EFL university students faced various problems under the categories of messages, contexts, speakers, and listeners. They mostly encountered English listening difficulties with speaking speed of speakers, the pronunciation of speakers, and the listeners' ability to understand at the first time of listening. Moreover, the students reported a high level of their need to improve their English listening skills, especially the need to practice listening, the need to increase grammar knowledge, and the need to enhance vocabulary and knowledge. Based on the results of this study, it is suggested that EFL teachers should consider students' problems and implement more activities in class which can help students improve their skills in English listening. In addition, the needs of the student should be considered as the important points to create the activities in classroom.

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LEARNING THROUGH PEER ASSESSMENT: STUDENT PERCEPTIONS BEFORE AND AFTER PARTICIPATION

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Abstract

This study aims to find out how students perceive the usefulness of peer assessment for learning in the context of reading circle discussions in higher education before and after participation, and furthermore reflect which factors related to the implementation of the peer assessment promoted or hindered learning. Results compare student expectations and experiences of peer assessment and furthermore show that majority of students both expected and found the peer review process to be useful or very useful. The clear evaluation matrix and iterative nature of peer assessment supported learning. Receiving and giving feedback helped students in analysing and reflecting on their own activities. Overall, the peer assessment seemed to support the analytical and critical approach among students and enhance their self-knowledge. At the same time, the results highlight areas for development in the peer assessment practices that could further promote learning by raising the level of given peer feedback. These development areas are rater training, course incentives for high-quality feedback, and the emphasis on the learning benefits of giving feedback.

Keywords: Peer assessment, learning, reading circle discussion, survey, higher education.

1. Introduction

Peer assessment can be defined as an action where "students judge and make decisions about the work of their peers against particular criteria" (Adachi et al., 2018, p. 295). Studies have shown the effectiveness of peer assessment in promoting learning (Double et al., 2020; Li et al., 2020). However, there are challenges in peer assessment (Adachi et al., 2018) and many factors impact on whether, how well and under what conditions peer assessment promotes students learning. In this study, peer assessment was implemented and studied in the context of student-led reading circle discussions. Compared with previous studies on peer review, the context in which the *performance in discussion* is evaluated by peers is rather unique. In previous literature, tasks that are typically rated when assessing the effectiveness of peer review are written assignments (Li et al., 2020). The concept of reading circle discussion resembles the concept of talking circles (Chacon et al., 2023) by being a weekly student-led small-group discussion in consistent groups but differs from it, e.g., by being a rather long discussion monitored and evaluated by the teachers. It is important to study how peer assessment is experienced in this specific context. This study aims to find out *how students perceive the usefulness of peer assessment for learning in the context of reading circle discussions before and after participation*, and furthermore reflect which factors related to the implementation of peer assessment promoted or hindered learning.

2. Learning through peer assessment

Previous studies on students' perceptions of peer assessment show that students generally see peer assessment positively (Mulder et al., 2014; Nicol et al., 2014; Planas Lladó et al., 2014). Peer assessment has potential to improve learning in various ways, for example, by developing learners' critical thinking abilities and evaluative judgment and helping them to become more independent thinkers and practitioners (Tai & Adachi, 2019). Two recent meta-analyses of peer assessment impacts imply that peer assessment has positive effects on academic performance and learning (Double et al., 2020; Li et al., 2020). The most critical factor influencing positive peer assessment effect on learning was rater training (Li et al., 2020). Anonymous peer assessment could also provide certain advantages in terms of learning, such as delivering more critical feedback (Panadero & Alqassab, 2019). Thus, it is evident that the peer assessment context and practices impact on the learning outcomes.

3. Research context and method

The study was conducted in the context of higher education, in a Finnish university with master level students. In this study, peer assessment was studied in the context of reading circle discussions, where the task being evaluated is the student's performance in the discussion, and students need to prepare for the discussions by familiarizing theoretical material beforehand. The reading circle discussions were designed as a format, where six discussion sessions of 90 minutes were hold during the course. The discussions were conducted in small groups of six students, where one of the students acts as a chair and one as a peer reviewer assessing the work of the others. The performance of each discussant is assessed by the peer reviewer by using the peer assessment rubric/matrix and a form, giving both comments and grades on scale 1–5, so the purpose was both formative and summative, and feedback non-anonymous. The peer assessment rubric was based on three criteria of which two were focused on the content of discussion and one on discussion skills. Extra criterion was for the work as a chair/facilitator of discussion. Discussions were student-led, where the assigned chair had the leading role, and teachers did not participate in the discussions but monitored them. Final grades of the reading circle discussion performances were formed based on the teachers' overall evaluation, taking into account the peer assessments. Peer assessors' work was evaluated on scale pass/fail.

Data was gathered from seven course implementations (three virtual, four face-to-face) during 2021–2023 by pre- and post-surveys. Table 1 presents this empirical data. Survey respondents represent the course participants quite well: altogether 57 % of course participants (n=82) answered both surveys. The students were Finnish-speaking, except for one course implementation, which was organized in English and where the cultural backgrounds of students were diverse. About 90 % of the respondents had previous experience on peer assessment in their university studies before this course.

Table 1. Empirical data.

	Course implementation (time, course name abbreviation)	On campus / Virtual	Finnish /English	Pre- and post-survey respondents	Participants in the course
1	2021_Fall_Leadership	Virtual	Finnish	11	17
2	2021_Fall_Sustainability	On campus	English	16	18
3	2022_Spring_Leadership	Virtual	Finnish	16	22
4	2022_Spring_Sustainability	Virtual	Finnish	11	29
5	2022_Fall_Leadership	On campus	Finnish	6	12
6	2023_Spring Leadership	On campus	Finnish	6	7
7	2023_Fall_Leadership	On campus	Finnish	16	38
				82	143

Pre- and post-surveys were based on the study by Mulder et al. (2014), who also studied students' perceptions before and after participation in peer review. Thus, both students' expectations and experiences of peer assessment in reading circle discussions were studied. The pre- and post-survey questions are presented in Table 2. The survey data was analysed both quantitatively and qualitatively. Descriptive statistics were used for the closed questions. In addition, one statistical test (Wilcoxon signed-rank test) was used to study the differences between expectations and experiences. Because the variables were measured in an ordinal scale and were not normally distributed, the non-parametric counterpart of the dependent t-test, the Wilcoxon signed-rank test was conducted to determine whether there were differences in the students' perceptions of the expected and experienced learning (question 1 in pre- and post-surveys) and in the students' perceptions of peer reviewer qualification before and after the peer assessment experience (question 3 in pre- and post-surveys). The open-ended questions yielded plenty of answers, 124 about expectations (from questions 4 and 5) and 131 about experiences (from question 5 and 6). This qualitative data was analysed by using inductive thematic analysis, where the data was first coded, then themes were searched, reviewed, and finally defined (Braun & Clarke, 2006).

Table 2. Pre- and post-survey questions (based on Mulder et al. 2014).

Pre-survey on students' expectations of peer assessment	Post-survey on students' experiences of peer assessment
1. As a learning tool, I expect that peer review will be ▪ Very useful ▪ Useful ▪ No opinion	1. As a learning tool, I found the peer review to be: ▪ Very useful ▪ Useful ▪ No opinion ▪ Not very useful

▪ Not very useful
▪ Useless
2. I expect I will learn most from
  ▪ Giving reviews of the work of other students
  ▪ Receiving reviews of my own work
  ▪ Equal value from giving/receiving reviews
  ▪ Not sure
3. I think my peers are well qualified to provide me with feedback on my own work:
  ▪ Strongly agree
  ▪ Agree
  ▪ No opinion
  ▪ Disagree
  ▪ Strongly disagree
4. Describe in your own words what you expect to learn from the peer review.
5. What other expectations, hopes, and/or concerns do you have regarding the peer review?
	▪ Useless
	2. I found that I learned most from:
	  ▪ Giving reviews of the work of other students
	  ▪ Receiving reviews of my own work
	  ▪ Equal value from giving/receiving reviews
	  ▪ Not sure
	3. I think my peers did a good job of providing me with feedback on my own work:
	  ▪ Strongly agree
	  ▪ Agree
	  ▪ No opinion
	  ▪ Disagree
	  ▪ Strongly disagree
	4. I think that I improved my reading circle work as a result of the reviews I received or gave:
	  ▪ Strongly agree
	  ▪ Agree
	  ▪ No opinion
	  ▪ Disagree
	  ▪ Strongly disagree
	5. Describe in your own words how the peer review affected your learning and what did you learn from it.
	6. What other thoughts, comments and / or feedback do you have regarding the peer review?

4. Results and discussion

4.1. Comparison of the expectations and experiences of peer assessment

Majority of students both expected (63 %) and found (59 %) the peer review process to be useful or very useful (Figure 1). Results indicate a significant difference between the expected learning (M=3.6; SD=0.86) and the learning experience (M=3.4; SD=1.00), when using the Wilcoxon signed-rank test. Therefore, the null hypothesis (no difference between the expected and experienced learning benefits of peer assessment) is rejected, and it is concluded that there is a statistically significant difference between the expectations and experiences when assessing peer assessment as a learning tool (Z=-1.961, p=0.050). The results show that students expect peer assessment to be more useful than it actually is based on their experiences. This result corroborates the finding by Mulder et al. (2014), who also observed a positive valuation of peer assessment but a similar decrease in the perceived value of the peer assessment. However, the median was four (i.e. 'useful') for both expectations and experiences, so despite the difference, most students both expected and found the peer review process to be useful or very useful.

Figure 1. Learning in peer assessment (n=82).
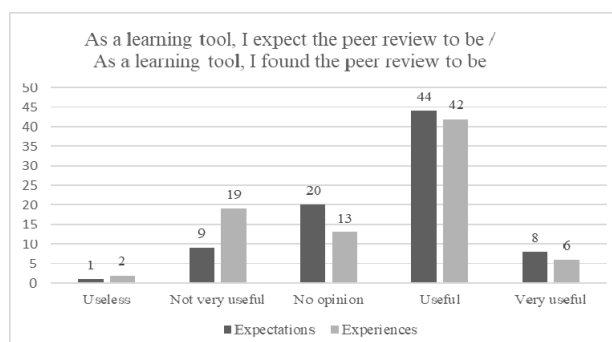
The largest proportion of students (49 %) both expect to learn, and learned, equally from giving and receiving reviews (Figure 2). However, the share of students who expected to learn from receiving reviews diminished after peer assessment (from 34 % to 21 %). The findings resemble the results by Mulder et al. (2014), who also noted that majority expected and gained learning benefits from both receiving and giving reviews. However, Mulder et al. (2014) found out that the proportion of students who think that giving/writing reviews was the most valuable part of the peer-review process increased. In this study, this was not the case as clearly but there was an increase in uncertainty.

Figure 2. Sources of learning in peer assessment (n=82).
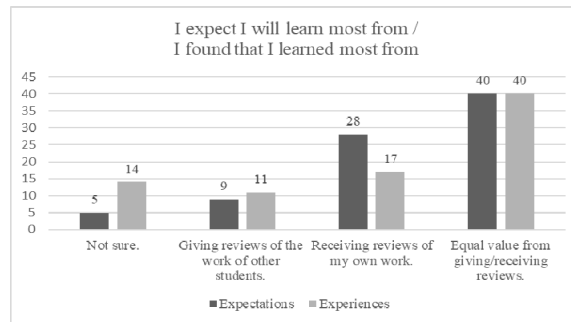
The perceived expertise of peers was considered good both before and after peer assessment (Figure 3). Before peer assessment, 77 % of the students thought that their peers are well qualified to provide feedback, and afterwards, 82 % of the students thought their peers did a good job in providing feedback. The Wilcoxon signed-rank test was also conducted to determine whether there was difference in the students' perceptions of peer reviewer qualification before and after the peer assessment experience (question 3 in pre- and post-surveys). The results do not indicate a significant difference (Z=1.840, p=0.066) between the expected (M=3.87; SD=0.733) and the experienced peer reviewer qualification (M=4.05; SD=0.784).

Figure 3. Perceptions of peer reviewer qualification (n=82).
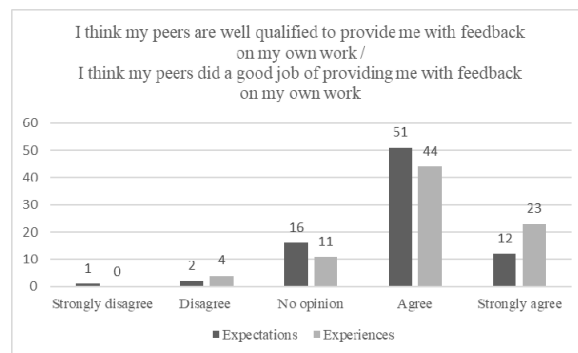
4.2. Learning through peer assessment in reading circle discussions

Experiences of students suggest that peer assessment provided many learning benefits. Some highlighted the benefits from receiving development suggestions and responding to them, whereas others put more emphasis on observing and analysing the activities of others and giving constructive feedback. Both receiving and giving feedback helped in analysing and reflecting on one's own activities. Peer assessment seemed to support the analytical and critical approach among students and enhance their self-knowledge. One key learning effect was indirect: peer assessment enhanced learning in the course by encouraging to prepare well for the reading circle discussion sessions: *"I think the peer assessment was a good thing, because 'encouraged' by it, the group was active and thus the discussions were fruitful.",* summed up one student. In the post-survey, 63 % of students 'agreed' or 'strongly agreed' that their reading circle work improved because of the peer assessment (Figure 4). Mulder's et al. (2014) findings are similar, and both suggest that peer assessment generally results in student work of a higher quality.

Figure 4. Improvement based on the peer assessment (n=82).
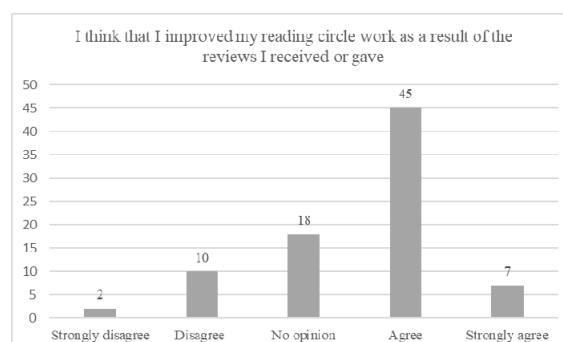
The central concern in many expectations towards peer assessment was that peer evaluations are not invested in and because of that they remain superficial and of no value for the assessee. As one student stated in the expectations: *"Many perceive peer review as a necessary evil and an extra chore rather than an opportunity to give others really valuable perspectives and thoughts."* Experiences showed that this was also the most central perceived problem in peer assessment. Superficial peer feedback and the lack of constructive feedback were for many students the main reasons why peer assessment was not perceived as useful. In light of this, it is interesting that most respondents (82 %) however thought that peers did a good job in providing feedback. It is possible that very critical peer assessment was perceived as challenging in the context of reading circle discussions (real-time and non-anonymous), so the performance of the peer reviewer was valued anyway. Other challenges that came up were subjectivity and social biases of peer review, discomfort and the workload and difficulty.

5. Conclusions

This study showed that the peer assessment implemented in the context of reading circle discussions generally supported students' learning, although the expectations of learning were higher than the actual experiences. The clear evaluation rubric/matrix and iterative nature of peer assessment supported learning. Peer assessment also indirectly enhanced learning in the course by encouraging to prepare well for the reading circle discussion sessions. It also appears that the non-anonymous nature of peer assessment did not cause major discomfort but instead encouraged to perform well in the discussions. At the same time, the results highlighted areas for development in the peer assessment practices that could further promote learning. The need for development was related to raising the level of given peer feedback. First, more training for students on how to give feedback, could be provided. Previous research suggest that peer rating quality could be improved by training (Li et al. 2020). Second, the course design could provide better incentives for proving high-quality feedback that includes also constructive and critical points (e.g., the given peer assessments could have an impact on the grade). Third, the learning benefits of giving feedback could be emphasized more. Students themselves are less likely to recognize that value and how their role as peer assessor can contribute to their learning (Culver 2023). In future research, it would be interesting to investigate whether these practices could improve the perceived usefulness of peer assessment for learning even further.

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INCLUSIVE EDUCATION AND TRAINING DURING A PANDEMIC AND BEYOND - THE NEW NORMAL (IDENTIFYING GOOD PRACTICES)

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Abstract

The emergence of Covid-19 and its spread has faced the whole world with something new and incomprehensible. The pandemic led to a complete reorganization of educational services - in terms of delivery, access and structuring. Part of the measures taken was the introduction of distance learning, an approach that presents a number of challenges for both learners and training providers. In this report, answers will be given to questions such as: What are the challenges of distance learning in an electronic environment and is an effective educational process possible? What are the European policies and practices to support and promote the development of skills that lead to the creation and employment of new jobs? Are there inclusive practices in vocational education? How does the Erasmus+ Program contribute to the inclusion of children and youth with special educational needs? How do training organizations put into practice methods for building inclusive learning environments to create STEM and professional competencies? The methodology used for the present study is an analysis of information resources on the researched topic, a study of good practices and case-studies. This paper was developed within the framework of a scientific research project "A model for evaluating the effectiveness and quality of inclusive education, training and lifelong learning" with contract № КП-06-Н80/1, funded by National science fund of Bulgaria.

Keywords: Inclusive education, pandemic, new normal, good practices, education and training.

1. Introduction

The COVID-19 pandemic has posed unprecedented challenges to education systems around the world. School closures and the need to move to online learning have highlighted the importance of inclusive education and training. This report explores good practices implemented during the pandemic and presents opportunities to improve inclusion in education in the new normal. The term "new normal" refers to the changes in social, economic and behavioral patterns that are established as the standard after a significant event or crisis, such as the COVID-19 pandemic. In the context of education, the "new normal" includes the adaptation and transformation of teaching methods, approaches and infrastructure in response to the challenges imposed by the pandemic and expectations for the future needs of the education system.

To introduce the report, we would like to refer to the words of Reem Al Hout (2017), director of the American Academy in Beirut, a school that includes children with special educational needs. According to her, inclusive education means that all learners are welcome – regardless of gender, ethnicity, socio-economic background or educational need. They learn, contribute and participate in all aspects of educational life. "Inclusive education" is a process of recognizing, accepting and supporting the individuality of each individual and the diversity of their needs, by activating and including resources aimed at removing barriers to learning and teaching and creating opportunities for their development and participation in all aspects of community life.

According to Grima-Farrell, Bain, and MacDonald (2011): "Inclusive education involves the whole school and works to align components of special education with general education in a way that most effectively and efficiently provides quality education to all students." To make inclusive education a standard, society must share and support the key principles of this approach, which include a focus on the needs of learners, the learning environment and a vision for the future of learners after completing the educational stage.

2. Challenges to the education system during a pandemic

The COVID-19 pandemic has caused significant problems and difficulties for education systems around the world. Among the main challenges faced by education are:

- Inequalities in access to education: The pandemic has exposed and reinforced existing inequalities in education systems, limiting access to quality education for students from socioeconomically vulnerable families. The lack of internet access and the necessary technological equipment has made distance learning out of reach for many.
- Technological challenges: The transition to online learning requires significant technological resources and infrastructure, which are not always available. This includes appropriate equipment for students and teachers, as well as stable and fast internet connections.
- Preparing teachers for distance learning: Many teachers were faced with the challenge of teaching online for the first time, which required rapid adaptation to new technologies and teaching methods. The need for training and support in this process is significant.
- Psychosocial impacts on students and teachers: Isolation, changes in the educational process and uncertainty have caused stress, anxiety and other psychosocial problems among both students and teachers. This necessitated the need for psychological support and coping strategies.
- Specific needs of learners from vulnerable groups: Learners with special educational needs, as well as those from marginalized communities, faced additional difficulties in accessing appropriate resources, adapted learning materials and individual support during distance learning.

Addressing these challenges requires integrated approaches, including the improvement of technological infrastructure, professional development of teachers, psychosocial support for students and teachers, as well as specialized strategies to support learners from vulnerable groups.

In the context of the COVID-19 pandemic, distance learning in an electronic environment has emerged as a key element in the educational strategies of many countries. Despite the significant challenges it poses to teachers and students, adequate management and the use of appropriate tools can contribute to its effectiveness. This analysis examines the main problems and suggests potential solutions to overcome them.

Challenges: Technical difficulties: The main obstacle is the lack of a reliable Internet connection and the necessary technical equipment, which limits the possibilities of distance learning; Self-discipline and motivation: Learners may have difficulty maintaining high levels of motivation and self-discipline without traditional learning structure and supervision; Social isolation: Physical distance between participants in the educational process can lead to social isolation; Adaptation to new methodologies: Teachers face the challenge of adapting their teaching methods to the virtual environment; Assessment of achievement: Measuring academic achievement in a distance environment requires the development of new, fair and effective assessment methods.

Despite the challenges, distance learning provides opportunities for flexibility, access to a wide range of resources and a personalized approach to learning. With adequate involvement of all participants in the educational process, distance learning can become an effective and affordable method of education. **Solutions** for this can be sought in several directions: Improving the technical infrastructure: It is essential to make investments in Internet access and the provision of the necessary technical devices for students and teachers; Structuring and planning: It is important to develop clear study plans and schedules to promote engagement and efficiency; Interactive platforms: The use of platforms for interactive communication and collaboration is key to sustaining the learning process; Training for teachers: Providing training and resources for teachers to effectively use digital tools is essential; Innovative assessment methods: There is a need to develop assessment methods adapted to the distance environment, such as projects and portfolios.

Our educational system needs to change to meet the individual needs of all learners, whether they are with or without special educational needs. The modern educational system entering the Bulgarian schools requires a change in the traditional educational environment, change towards dialogue, meaningful communication between the participants, cooperation and general solving of the tasks in the educational process. Through the new educational models, the challenges of inclusion can be met, overcoming inequalities and achieving social justice. Thus everyone will be enabled to gain the basics to develop their abilities, gain knowledge and acquire skills to expand their choice and realization. It is education based on the understanding that all people are different and that each child has the right to access quality education in the general school system (Eftimova, 2018)

3. Education system response to the pandemic

In response to the global health crisis induced by the COVID-19 pandemic, educational systems, including those in Bulgaria, were forced to take adaptive measures and strategies to address the emerging challenges. Educational institutions have quickly adapted to distance and hybrid learning models that combine online and face-to-face sessions. This allowed the continuation of the educational process in the conditions of social isolation and quarantine measures. Various technological innovations have been introduced to support distance learning, including video conferencing platforms, educational software and

applications that facilitate interaction between learners and teachers and support the learning process. Educational institutions have developed and implemented various strategies to ensure the continuity of the learning process by adapting curricula, methodologies and assessment to distance learning conditions. Steps have been taken to support teachers in their adaptation to online teaching, including training in digital skills and distance learning methods. Psychological support programs and wellness initiatives for students and teachers have also been introduced to deal with the psychosocial effects of the pandemic.

The adaptation of educational systems to the conditions of a pandemic demonstrates their ability to quickly orient to innovative approaches and technological solutions. Despite the challenges, quick response and adaptive strategies allowed the educational process to continue, highlighting the importance of flexibility, innovation and support.

Within **vocational education and training (VET)**, the implementation of inclusive practices is essential to ensure equal access and learning opportunities for all learners, including persons with disabilities, marginalized groups and representatives of vulnerable communities. These practices are aimed at creating an educational environment that supports diversity and ensures the development of each individual's potential (Regulation on inclusive education in Bulgaria, 2017). This scientific review presents several key aspects of inclusive practices in VET: The development of individualized curricula allows educators to tailor material and teaching methods to the specific needs and abilities of each learner. This includes adapting teaching resources and teaching techniques to support maximum student participation and success; Accessible learning environments: Creating physical and digital learning spaces that are accessible to students with various physical and sensory disabilities is a key aspect of inclusion. This includes equipping buildings with ramps, lifts, appropriate lighting and sound recordings, as well as the development of learning materials that are available in a variety of formats; Learning support: Providing additional resources and support, such as specialist help (speech therapists, psychologists), mentoring and study skills training, helps learners with special educational needs to participate fully in the educational process; Flexible assessment methods: The use of flexible and adaptive assessment methods ensures that learners can demonstrate their knowledge and skills in ways that take account of their individual abilities and preferences; Teacher professional development: The training and professional development of teachers and trainers in inclusive education is critical to the success of these practices. This includes training in diverse learning strategies, managing diversity in the classroom and adapting the learning process to the needs of all learners; Community collaboration: Engaging families, local communities and employers in the education process can support inclusion by providing additional resources, internships and real-world work opportunities that prepare students for the labor market.

Inclusive practices in vocational education not only contribute to social inclusion and equality, but also improve the quality of education for all learners, better preparing them for the dynamic and diverse global labor market. Educational organizations apply a variety of methods and strategies to create inclusive educational environments, particularly in the fields of science, technology, engineering and mathematics (STEM) and vocational education. The main goal is to ensure equal access and opportunities for all students, including those from marginalized groups or with special educational needs, to develop their skills and competencies. In this context, several key practical approaches are used:

- *Differentiated Instruction*: Educational professionals develop and implement curriculum and strategies that are tailored to students' individual needs, interests, and learning levels. This includes adapting learning materials, tasks and teaching methods to support the achievement of learning objectives by each student.
- *Use of technology*: Technology tools play an important role in creating inclusive learning environments, providing adaptive learning platforms, assistive software and interactive tools that can be customized to the needs of individual students, while promoting independent learning and facilitating access to educational resources.
- *Collaborative learning*: Encouraging collaborative learning projects and activities that encourage teamwork and mutual assistance among students supports the creation of an inclusive environment. This approach promotes the development of social skills, critical thinking and problem-solving skills in a group context.
- *Multidisciplinary approach*: The integration of multidisciplinary approaches in STEM education and vocational disciplines facilitates students to understand the real-world application of science and technology. This can include developing projects based on real problems that encourage creativity and innovation.
- *Feedback and support*: Providing regular and constructive feedback, as well as the availability of supportive resources such as extra study sessions or tutoring, helps to engage and motivate students. These resources are aimed at strengthening students' confidence and skills.
- *Professional development of educators*: Investment in training and professional development of teachers and teaching staff to implement inclusive methods and strategies is critical. This includes

preparing to work with children with special educational needs, managing diversity in the classroom and integrating technology into the learning process.

- *Community involvement and partnerships*: Engagement with local communities, the business sector and other educational institutions can enrich the educational process by providing additional resources, expertise and hands-on learning opportunities.

Through these practices, educational organizations can successfully create inclusive educational environments that promote the development of STEM and professional skills among all students, regardless of their individual challenges or needs.

4. Good practices and successful strategies

The European Union (EU) is undertaking a variety of policy initiatives to support the development of key skills that are important for boosting job creation and increasing employment. These efforts aim at the adaptation of the workforce to the dynamically changing economic and technological conditions, thereby aiming to increase the EU's global competitiveness. Within European policy and practice in the field of skills development, several main areas have been identified:

- Europe 2030 Strategy: This strategy is the EU's long-term plan to stimulate economic growth and employment, including specific targets to increase employment, invest in education and promote social integration.
- Erasmus+ Program: The program supports the education, training, youth and sports sectors in Europe, providing training and exchange opportunities for students, teachers and workers. It facilitates the acquisition of new skills and promotes intercultural understanding.
- European Qualifications Framework (EQF): The EQF facilitates the cross-border recognition of skills and qualifications, helping labor mobility and providing easier access to education and training across countries.
- European Social Fund (ESF): As a key funding instrument, the ESF supports employment and social inclusion policies in the EU by funding training and retraining programs aimed at upskilling the workforce.
- The Digital Single Market Initiative: This initiative aims to boost digital innovation and investment in digital skills, creating new jobs and supporting the growth of the digital economy.
- Skills Strategy: The EU Skills Strategy focuses on the development of critical competences, such as digital literacy, entrepreneurial skills and transversal skills, essential for adapting to new economic conditions.
- Pact for Skills: Part of the European Pillar of Social Rights, the Pact for Skills promotes the strengthening of cooperation between Member States, social partners and the private sector in the field of training and skills development.

European initiatives and policies in the field of skills development and job creation aim to support sustainable and inclusive growth. By investing in education and training, promoting innovation and facilitating labor mobility, the EU aims to shape a dynamic and competitive labor market.

The Erasmus+ program plays an essential role in promoting inclusive education and supporting people with special educational needs (SEN). By providing funding and resources, the program supports initiatives that aim for social inclusion and educational integration, helping to create equal and accessible educational environments. This analysis highlights several key aspects in which Erasmus+ contributes in this area:

- ✓ Mobility funding: Erasmus+ provides targeted mobility funding to students and young people with SEN, facilitating their participation in international educational exchanges and internships. The inclusion of additional support resources, such as teaching assistants and adaptation of learning spaces, ensures the inclusive nature of the program.
- ✓ Strategic partnerships: The program stimulates the creation of strategic partnerships between educational institutions, organizations and NGOs for the development and implementation of innovative approaches to inclusive education. These collaborations often focus on adapting curricula and materials to the needs of students with SEN.
- ✓ Training and collaboration: Erasmus+ support professional development and the exchange of knowledge and practices between teachers and educational specialists in the context of inclusive education. The goal is to increase the competencies for successful integration of students with SEN.
- ✓ Support for youth projects: The program finances initiatives aimed at young people with SEN that promote social inclusion, active citizenship and personal development. This includes projects that offer opportunities to participate in community life and develop key social skills.

    ✓ Inclusive policies and practices: Erasmus+ actively encourage the participation of organizations dealing with persons with SEN in support of the development and implementation of inclusive educational strategies and methodologies.

Through these mechanisms, the Erasmus+ program significantly contributes to the creation of an inclusive educational environment in Europe by ensuring that young people with SEN have access to educational and developmental opportunities supporting their personal and professional development.

The Declaration on Principles, Policy and Practice in the Field of Education for Persons with Special Needs, adopted in Salamanca/Spain in 1994, emphasizes the need for UNESCO to "... encourage the academic community in the plan to strengthen scientific research in this field..... to serve as a center for the exchange of information and for the dissemination of concrete results and experiences..." In accordance with the United Nations Standard Rules for Equality and Equal Opportunities for People with Disabilities, the Salamanca Declaration on Education with Special Needs and other international documents dealing with this issue in the Law on Higher Education in our country - Article 70 (2) (2004) it is stated that students, doctoral students and specialists who are blind, deaf, disabled with permanent disabilities and reduced working capacity of 70 and over 70 percent are entitled to special reliefs regulated in the regulations of the higher education institution.(Law on higher education in Bulgaria, 2004). In the Law on the Integration of People with Disabilities / in force from 01.01. 2005/ in article. 20 is specified - "Higher schools provide: 1. a supportive environment, special adaptations, appropriate teaching materials and additional teaching assistance, supporting the process of learning and assessment of people with disabilities; 2. training of specialists to work with disabled people"(Law on integration of disabled people in Bulgaria, 2006).

5. Conclusion

Good practices in this area include the development and implementation of flexible curricula, the integration of technologies to support distance and hybrid learning, and an emphasis on collaborative and adaptive learning methods. It is also important to emphasize the importance of training teachers and educators to work in the changed environment, which includes providing competencies for the effective use of digital tools and methods for inclusive learning. The pandemic has also highlighted the need for stronger socio-emotional support for learners, as part of inclusive education, to deal with the stress, isolation and other emotional challenges posed by the crisis. Furthermore, the emphasis on collaboration between educational institutions, parents and the community has proven to be key to creating a supportive and flexible educational environment. Inclusive education and training in the context of the "new normal" requires a focused effort to adapt and innovate on the part of all stakeholders. The good practices identified and implemented during this period offer valuable lessons for the development of more sustainable, flexible and inclusive educational models for the future. These approaches not only help address current challenges, but also lay the foundations for an education system that is better equipped to meet the needs of all learners in all circumstances.

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TEACHERS' VIEWS ON INFUSING IK INTO CHEMISTRY TEACHING AT THE JUNIOR SECONDARY OF OMUSATI REGION

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Abstract

This study focused on the views of Natural Sciences teachers on infusing indigenous knowledge in teaching Chemistry concepts at the junior secondary school level. National Curriculum for Basic Education (NCBE) promotes the inclusion of indigenous knowledge into teaching to empower learners to actively participate in making Namibia a knowledgeable-based society. However, IK remains an afterthought in many Omusati region classrooms especially at grades 8 and 9 level. Thus, learners neither associate it with classroom nor Chemistry syllabus. This creates an assumption amongst the learners that their environment has nothing to do with science generally or Chemistry in particular. Moreover, lack of emphasis and clear guidelines on the 'how' of implementation of IK in classroom enforces the neglect of IK infusion by teachers. This paper therefore tapped into teachers views on IK and Chemistry teaching. Five (5) grades 8 and 9 Physical Sciences teachers were purposefully selected from Onesi circuit in the Directorate of Education, Arts and Culture of Omusati region, Namibia. The researcher employed interpretivist qualitative research approach. This qualitative study used CHAT to understand the teachers' views and classroom practices through integrating IK in teaching of Chemistry. Saldana (2013) was used to guide thematic analysis of data. The findings indicated a slight change of views by the Physical Science teachers. Some remained attached to certain practices where they held strong beliefs. The infusion of certain Chemistry concepts depended on the school support. The study recommended that the teaching and learning policies be clear on the 'how' of infusing IK into the classroom, and adequate support through ongoing developmental workshops be provided to the Science teachers. Moreover, the approval of Physical Science textbooks should be dependent on the inclusion of a portion of indigenous knowledge systems with relevant local examples and visuals to encourage and strengthen interest among both teachers and learners.

Keywords: *Physical science teachers, views, indigenous knowledge, chemistry concepts, Continuous Professional Development (CPD).*

1. Introduction and problem

This paper presents on the Natural sciences teachers' views in the infusion of indigenous knowledge (IK) into Chemistry teaching. Indigenous knowledge (IK) is considered an entry point in incorporating knowledge and its relevance into the abstract world of science (Sotero et al., 2020). This statement underscores the importance of linking science with learners' daily experiences, their community members and socio-cultural practices in making learning a meaningful experience. Mandikonza (2019: 2) concurs that "learners bring tacit as well as explicit and conceptual knowledge into learning contexts," however due to lack of recognition and infusion of IK in the classrooms, learners from rural disadvantaged communities tend to find a poor fit between their home experiences and what they learn at school. Moreover, science teachers at junior secondary level still believe that learners enter science classrooms as tabula rasa (De Beer, 2016). Generally, indigenous knowledge is considered less important, particularly in the science classrooms. Mukwambo (2017) found that learners' cultural practices were distanced from their science practices in schools, as such many find science to be out of this world and difficult to learn. Though many African countries still believe strongly in the western worldview that marginalises the indigenous culture and practices, new curriculum reforms such as CAPS for South Africa and NCBE for Namibia advocate for the integration of indigenous knowledge in teaching, particularly science (De Beer, 2016). The integration of indigenous knowledge is a complex multifaceted issue that demands attention and action from educators and researchers (Andrew et. al, 2023). However, Mavuru and Makhunga (2020) found that there has been no concerted effort in assisting

teachers to identify relevant teaching strategies to infuse indigenous knowledge into science concepts. The uncertainties around the 'how' of infusing IK remain a hurdle for many teachers. This study found it necessary to tap into teachers' space and solicit their views on infusing IK into Chemistry teaching and learning. The following question guided data collection for this paper: *What views do Physical Science teachers have with regards to infusing indigenous knowledge into Chemistry teaching?*

2. The purpose of the study

The purpose of this study was to solicit teachers' views on infusing IK in the teaching and learning of Chemistry concepts. A four-week intervention based PDI on indigenous knowledge integration in the teaching of Chemistry concepts by junior secondary schools Physical Science teachers was ran to provide guidance. The world over, indigenous knowledge (IK) has been alienated from school curricula for a long time (Ogunniyi, 2007; Battiste, 2018). It is seen as odd and limited in the eyes of Western science. This view downgrades IK importance in societies as cultural values and local wisdom are marginalised (Handayani, Wilujeng & Prasetyo, 2018). Additionally, Cronje (2015) argues that majority of learners in Southern Africa come from indigenous background, but the science they are taught in schools is informed by Western culture, using Western teaching strategies. Similarly, most of Namibian learners hail from indigenous background but their teachers were trained through a western science curriculum. Hence the need to find out from teachers how they deal with the infusion of IK in their classrooms.

3. Research design

The study utilised interpretive qualitative case study research design. This is a single case study in which the schools involved are from one regional directorate of Education, Omusati region, in rural Namibia. Teachers who participated used the same syllabus, resources and circuit-based tests and examinations. Therefore, all schools represent one phenomenon and only one unit of analysis is used. The 5 grades 8 and 9 Physical Science teachers were purposively selected to investigate multiplicity of perspectives (Ritchie & Lewis, 2003) of the phenomenon within its real-life context (Yin, 2003). This assisted to gather different views from diverse backgrounds and experiences of the research participants. Moreover, using case study design assisted to gain in-depth insight of this case's current issues within its real-life setting.

4. Method

4.1. Data collection instruments

Data were collected through open-ended questionnaires, one-on-one interviews, lesson observations, and document analysis. Instruments used included VNOIK and SDLI questionnaires, interview protocols, and observation schedules.

The instrument (VNOIK) was adopted from Cronje, De Beer and Ankiewicz (2015) developed to determine the views of science teachers on Indigenous Knowledge in South Africa. It consists of ten open-ended questions regarding teachers' opinions about the nature of indigenous knowledge. The other instrument (SDLI) was adapted from Cheng, et al. (2010). This instrument was used to measure the self-directed ability of Grade 8-9 Physical Science teachers in integrating IK when teaching Chemistry. It measures self-directed learning in four domains of learning motivation (LM), planning and implementing (PI), self-monitoring (SM) and interpersonal communication (IC). The two instruments were administered pre and post intervention to solicit the teachers' views of infusing IK into Chemistry concepts teaching. It is worth mentioning that adapting this instrument could not compromise the reliability and validity of the instrument (Daunert & Seel, 2020). The adaptation of the instrument involved slight modification of terms to contextualize it to suit the Namibian participants. Otherwise, all factors were identical to the original SDLI. For the lesson observation, the Reformed Teaching Observation Protocol (RTOP) developed to provide a standardized means for detecting the degree to which classroom instruction in mathematics or science is reformed, was adopted for data collection (Sawada et. al., 2002). For this study, the 25 aspects of this instrument were grouped into five categories namely, lesson design and implementation, content- propositional pedagogic knowledge, content- procedural pedagogic, classroom culture - communicative interaction and learners-teacher relationship, which helped to evaluate classroom instruction and teaching approach. It provided insight into whether the five (5) teachers observed and created an atmosphere conducive for SDL, and elicitation of indigenous knowledge to enhance learning of Chemistry concepts. Like the questionnaires, this instrument together with interview protocols were also administered pre and post intervention.

4.2. Data collection procedure

The 5 teachers completed the questionnaire of the two instruments before intervention in a common location but individually. No one influenced the other, everyone answered and expressed themselves from their own knowledge and experience.

4.3. Presentation of the results

Data coding and categorization gave 67 codes and 11 categories. Though six themes emerged from the 11 categories, the results reported for this paper focused only on the two themes that were directly related to the teachers' views. The two themes reported on are: (i) operational definitions of Indigenous Knowledge (IK) and (ii) Generation and validation of IK deemed suitable to address the views of teachers.

Theme (i): Operational definitions of Indigenous Knowledge

This theme relates to the definition of IK as such this study operationalised IK as defined by the 5 participants. Different definitions emerged from different teachers, for example: Pre-intervention from VNOIK, teacher 1 defined IK as: "*the knowledge that is based on people's understanding and beliefs.*" Similarly, pre-intervention interview, she mentioned that indigenous knowledge looked familiar, but she did not know how to define it. However, post intervention, this teacher's response was surprisingly impressive, including her examples. Her definition was as follows; "*IK is knowledge possessed by indigenous people and communities, which is originally culturally oriented, and it is essential to the cultural identity of the society in which it is regulated and secured. For example, the process of making Ombike as a traditional drink from different foods such as eembe and palm fruit can be used in the teaching of distillation which is an example of separation of mixture or sieving as a method of separating mixture of mahangu grains and flours when pounding.*" Unlike pre-intervention lesson on compounds and Bohr structure, her post-intervention lesson on physical and chemical change, to a certain extent, incorporated certain aspects of IK as she brought in class local materials (ice blocks, bean seeds, small stones, wood, etc.) for learners to explored in groups of 3. Interestingly, she focused only on what she brought to class. She appeared hesitant to ask the learners about their knowledge and experiences on IK.

Pre-intervention, Teacher 2's response to IK definition on VNOIK, was so brief; "*...skills that are practised by elders traditionally.*" Despite teacher 2 attending the whole intervention, his definition remained almost the same. "*... a diverse knowledge and its efficacious in particular contexts in which it is used.*" He added; "*...it's different from any other types of knowledge because it is not universal but relates to a particular group of people.*" Like his textbook driven lesson on ionic bonding, post-intervention he taught the topic "writing formulas for ionic compounds" and still did not involve learners. Though he could explain in detail how Ombike is made traditionally during intervention, it appeared he was confined to his old ways of teaching, his exclusion of IK in teaching Chemistry did not change.

Teacher 3's definition pre-intervention (VNOIK) saw IK as knowledge with no origin but emerged from a long history of people and their natural surroundings. Post intervention when asked about the difference between IK and western knowledge, she replied, "*...[IK] does not strive for a universal set of explanations but is particularistic in orientation and often contextual.*" Generally, she does not consider IK as concrete knowledge, she believes more in western science and does not associate IK with science. Post intervention, her definition still did not show any consideration to IK. Her pre-intervention lesson was on chemical and physical change, characterized by lack of learner active participation or real-life examples from the learners' environment except the textbook examples. She was the sole knowledgeable person, portraying learners as 'tabula rasa.'

Pre-intervention, Teacher 4's response on VNOIK indicated that he had an idea about IK. He responded "*...[IK] is traditional knowledge based on many aspects that a specific community depends on their day-to-day preparation and survival.*" Similarly, pre-intervention interview he responded "*...[IK] is not obtained from school but obtained from elders, families, communities and passed on from generation to the next through traditional methods.*" His pre-intervention lesson was on physical and chemical change. It was interesting and learner engaging. He afforded learners an opportunity to engage in IK using (warm and frozen water, cooked food, burning of firewood and brewing of traditional home-made Oshikundu). Post-intervention, he used learners' home experience to contextualise the lesson. He taught "Acids and bases in everyday life", using home-based materials which included sour milk, vinegar, mouthwash, ondjove (marula oil), and wood ash. He also strove to create context for the learners.

Teacher 5's pre-intervention response on VNOIK, defined IK as "*...[IK is] knowledge that everyone is born with and inherited from our forefathers and mothers. For instance, a boy is groomed to do manly work (cut trees, herding livestock) while a girl is groomed to do household chores (cooking, cleaning, looking after the young siblings).*" Her view seemed aligned with traditional inheritance practices, not much of scientific connection. However, her post-intervention lesson on acids and bases

was interesting. Learners sat in small groups, testing the degree of acidity or alkalinity of home-based materials (marula fruits, lemon, salt, sugar) using scientific methods (universal indicator solution and litmus paper). The lesson was learner-centred and inquiry-based. She exhibited a comprehensive appreciation and understanding of IK.

Theme (ii): Generation and validation of IK deemed suitable to address the views of teachers.

In this theme participants were asked through VNOIK if elders, herbalists and traditional healers do experiments and test to verify and validate IK. Participants responded differently: pre-intervention, Teacher 3 indicated that IK is never tested, it is just a belief. This is the same teacher who saw IK to be just peoples' practice, and nothing scientific. However, other participants indicated that test and validation were done long ago by elders as some products made from certain IK practices have yielded similar to same products as the western science, for an example making Ombike using traditional means, the product is alcohol. Through observation this knowledge has been passed on from generation to generation (Teacher 2 and 4). Teacher 5 concurred with Teacher 2 and 4, adding that it was the San people, who carried the test on herbs and food, as they were first people to live in Namibia in their nomadic way of life. An interesting and stimulating discussion emerged when Teachers 2 and 4 gave explicit explanations on how 'Ombike' is produced and tested for quality traditionally. A flame of light is set on the surface of the liquid. When it burns with a blueish flame it indicates the magnitude of strength and if fit for consumption and market. When it burns with a whitish flame, it confirms the weaker strength of alcohol content and as such can be consumed by children at home or given to neighbours at no cost. Moreover, like western science, they also used their animals to test their herbs, though this was not documented, Teacher 5 mentioned in support of others. Post-intervention interview, it appeared that all 5 participants believed that IK is generated and tested through careful observation using trial and error method. Teacher 1 and 5 even provided some names of the plants which have been used to cure diseases such as Lagundi and Sambong which have been recently approved by the Department of Health in Namibia. These inputs indicated that intervention also created awareness of some sort to teachers about the importance of using learners' environments to teach science.

5. Discussion of findings

Pre-intervention there was limited knowledge in defining the term IK amongst all the teachers. This was also observed at the beginning of their professional development intervention. Post intervention there was knowledge build up and refinement on IK definitions, this showed positive attitude as teachers defined the term correctly using scientific terminology with practical examples to clarify their definition. Four (4) of the five (5) teachers demonstrated significant improvement in the definition of IK, except for Teacher 3 who still could not make sense of IK as science. VNOIK and interviews showed that some teachers believe that IK was generated and validated a long time ago through trial-and-error method. Other teachers (including Teacher 3) felt that IK can be validated using western knowledge to create a sense of respect. This view resonates with De Beer and Van Wyk's (2019) opinion that validation of IK by western scientists is empowering and creates respect for the rigor of IK in the broader society. Few participants of this study through interview and intervention showed that some of indigenous knowledge and practices could not be validated but can only be experimentally observed. Though not all-indigenous knowledge practices can be scientifically validated, traditional alcoholic drink Ombike's level of alcohol content could be tested traditionally.

6. Conclusion

Based on the findings, although Physical Science teachers had basic knowledge about indigenous knowledge pre-intervention, they could not fully integrate it into their teaching. All the 5 teachers picked up IK definition from their discussions during the intervention. Even though two of the 5 struggled to incorporate IK into their classroom post intervention, 3 teachers (1, 4, and 5) managed to fulfil the sociocultural aspects of NCBE (2015), which encourages the use of cultural and social aspects of learners' environment as meaning–making tools and teaching resources for a knowledge-based society. Based on the results given here, this study opines that teachers attitude towards IK influences their effort to integrate it into their classrooms. Fortunately, post- intervention things were not as severe as pre-intervention. At least 3 of the 5 teachers showed a general improvement in their views of infusing IK into teaching Chemistry. As such, teachers were able to identify appropriate indigenous knowledge and practices that can fit into the teaching of Chemistry concepts.

Observations also showed an improved willingness to learn from each other's experience. This indicated a shift in terms of self-directed learning dimension of learning motivation and self-monitoring.

Post intervention interviews indicated continuous communication and interaction amongst the community, this shows an urge for continuing professional development that may see effective implementation of revised curriculum (NCBE, 2015). Thus, this study recommends, ongoing professional developments trainings.

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REMINISCING TRAINING AND SPECIAL NEEDS CHILDREN

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Abstract

Reminiscing, a conversation between child and caregiver about past events experienced together, has been extensively studied with parent-child dyads of preschool and school-age children (Sales & Fivush, 2005). Researchers have proposed interventions to enhance the elaborative style and emotional aspects associated with caregivers' reminiscing, with positive effects on children's socio-emotional and cognitive skills (Corsano & Guidotti, 2019). Nevertheless, research within extra-familiar contexts is still limited (Andrews et al., 2019). This study aims to verify the efficacy of training aimed at improving the reminiscing skills of psychologists working with Special Needs children on psycho-educational topics and academic skills. The decision to explore this theme concerning these children was dictated by the awareness that they often present a psychological profile characterized by emotional difficulties, low self-esteem, social and cognitive problems connected to their peculiar condition, which can be improved by reminiscing. Participants were divided into an experimental group (twelve dyads) and a control group (eight dyads). Each dyad comprised of one psychologist and one child with SN aged between 8 and 10 years. The psychologists in the experimental group took part in training (3 meetings) about reminiscing, while those in the control group took part in training (3 meetings) about play. Tools proposed to psychologist in the pre and post-test were Caregiver Child Reminiscence Scale (Kulkofsky & Koh, 2009); Children's Coping Strategies (Goodvin & Romdall, 2013). Tools proposed to children were Test of Emotion Comprehension (Pons & Harris, 2000); Self-Description Questionnaire (Marsh, 1990); Narrative speech evaluation (BVL_4-12, Marini et al., 2015). During an audio-recorded reminiscing conversation in pre and post-test, reminiscing style, presence of emotional terms and references to the Self were measured for each member of the dyad. In the experimental group, the non-parametric ANOVA highlighted, at the post-test, an increase in reminiscing habits and in the use of elaborative style, both for psychologists and children. In general, no increases in children's skills emerged; however, from an analysis of individual children's profile it was found that for some of them training improved their socio-emotional abilities. Training promoted greater awareness of the use of this practice among psychologists, confirming what had already been found in the literature on the effectiveness of training among caregivers.

Keywords: Reminiscing, training, children with special needs, intervention, psycho-educational skills.

1. Introduction

Reminiscing is a caregiver-guided conversation about past events experienced by the child and caregiver together (Fivush & Nelson, 2006). Parental reminiscing has been extensively studied, especially with mothers, with preschool and school-age children (Sales & Fivush, 2005). More than 20 years' research has shown that caregivers use different styles when they talk about past experiences. Researchers currently place the reminiscing style along a continuum ranging from more elaborative styles to less elaborative ones (Fivush, 2007). To reminisce with an elaborative style means using "wh- questions" to enrich the conversation, stimulating the child's active participation, encouraging and validating their contributions, and adding new information. A less elaborative style creates few opportunities for conversation and gives rise to short and redundant speeches (Salmon & Reese, 2016). Several studies have shown that the continuous use of elaborative and emotional reminiscing has positive effects on acquiring socio-emotional and cognitive skills among children, such as: construction and consolidation of the sense of the Self, emotional competence, increasing in appropriate coping strategies, and creating coherent narratives (Laible, et al., 2013; Van Bergen & Salmon, 2010). Researchers began to propose to caregivers, in the family context, interventions aimed at enhancing the conversational techniques associated with an elaborative and emotional style, with positive results (Corsano & Guidotti, 2019). In a review, Neale and Pino-Pasternak (2016) began to reflect on the possible application of reminiscing even

within some extra-familiar contexts, such as psycho-educational ones, in which adults have multiple opportunities to reminisce with children about shared experiences. Nonetheless, research is still limited (Andrews et al., 2019). It could be interesting, for theoretical and practical implications, to extend the effectiveness of reminiscing training to other contexts and other populations that could benefit from it.

2. Objectives

The study examined the effect of training aimed at improving the reminiscing skills of psychologists who work on psycho-educational issues and the academic skills of Special Needs children. The choice to explore this theme in this population was dictated by the awareness that Special Needs children often present a psychological profile characterized by emotional difficulties, low self-esteem, social and cognitive problems (Celi, 2017); the literature on training to do with reminiscing has demonstrated effectiveness in enhancing some of these skills (Valentino et al, 2022; Van Bergen et al, 2018). In line with prior research, it was hypothesized that training would have a positive effect on awareness using reminiscing in the psychologists' experimental group. It was also expected that participants belonging to experimental group would reminisce more frequently with an elaborative style, with a greater use of emotional terms, interventions of emotional regulation and references to the Self, in the post-test phase. It was also hypothesized that, by the end of training, children in the experimental group would improve their emotional understanding, coping strategies, self-esteem, in particular regarding school learning, and their narrative competence.

3. Methods

3.1. Participants and setting

The study took place in Italy, in centres specialized in special educational needs. Twenty dyads participated, divided into an experimental and a control group. The experimental group comprised of twelve dyads. In each one there was a psychologist (M=1; F=11) aged between 25 and 34 years (M=28.6; SD=3.42) and a child with SN (M=5; F=7) aged between 8 and 10 years (M=9; SD=0.83). Eight dyads were in the control group; in the latter there was a psychologist (F=8) aged between 25 and 35 years (M=28.6; SD=3.66), and a child with SN (M=5; F=3) aged between 8 and 10 years (M=9; SD=0.75).

3.2. Procedure

A pre-test/training/post-test design was used.

In the pre- and post-test, data collection was analogous in both the experimental and the control group. Psychologists filled out: • CCRS (Caregiver Child Reminiscence Scale, Kulkofsky & Koh, 2009), which evaluates the reminiscing habits and the value attributed to it; • CCS (Children's Coping Strategies, Goodvin & Romdal, 2013), an 18-item questionnaire completed by the adult to investigate the frequency with which the child implements coping strategies in difficult situations. Children filled out: • the TEC (Test of Emotion Comprehension) (Pons & Harris, 2000), designed to evaluate the child's understanding of nature, causes and possibility of emotional control; • QDS (Questionnaire for the Description of Self, Marsh, 1990), self-assessment questionnaire comprised of 76 items that evaluate the concept of the Self concerning "physical appearance", "physical abilities", "relationships with parents", "relationships with peers", "skills and interest in Italian", "skills and interest in Maths", "ability and interest in school" and "global concept of the Self"; • The "Multilevel Assessment of Narrative Speech" test, from the Battery for Language Assessment (BVL_4-12, Marini et al., 2015). Finally, a psychologist and a child from each dyad had a conversation about a mutually shared past event that was audio-recorded, transcribed and, then, encoded, measuring reminiscing style, presence of emotional terms and references to the Self for each member of the dyad (Corsano et al., 2014; Reese et al., 1993). The analysis of 20% of the transcripts was performed by two independent judges and an agreement index was calculated (Cohen's K > .80).

During the training, psychologists in the experimental group attended three meetings. The one-hour workshops were about describing the reminiscing construct and styles, the effects associated with the use of an elaborative and emotional style. Examples of conversations with different styles and role-playing were used. Finally, the psychologists were asked to continue the training, involving the children of the dyad, during their usual support activities. They had to create, in each day of the child's attendance, for a period of three weeks, at least one occasion to reminisce about an episode of the past experienced together. The psychologists were provided with some materials to guide them in this second phase of the training (e.g., a brochure with the "good reminiscing practices," examples of conversation with different styles, a sheet in which to write down, together with child, some events of the past experienced together; an observation grid to mark whether the reminiscing activity had been done and

whether the suggestion of that conversation had been made by the child or psychologist). The control group's psychologists were also involved in three meetings focused on the importance of play in psycho-educational practice. This theme has been selected as it had already been used for control groups in other experimental studies (Cleveland & Morris, 2014; Taumoepeau & Reese, 2013). During the one-hour meetings, the use of play to improve school learning and to develop different skills (executive functions, tolerance to waiting, exposure to loss) were discussed. At the end of the training, the psychologists were asked to involve the children of the dyads, creating, for a period of three weeks, at least one shared play opportunity for each day of the child's attendance. Materials shared with the psychologists were a list containing the play experienced during the meetings and an observation grid where they were asked to mark whether the shared play activity had been carried out, the type of play and whether the game proposal had been made by the child or psychologist.

At the end of the three weeks, a post-test was conducted.

4. Results

First, descriptive analyses of all variables were carried out. Later, non-parametric ANOVA was used (Wilcox, 2017). A profile analysis was carried out to identify any peculiarities related to the performance of each dyad.

CCRS data shows, for the psychologists of the experimental group, an increase in the use of reminiscing, during usual work practice, at the end of the training (Q $(1,5) = 18.03$, p=.01). No significant differences were found for the other variables investigated by the questionnaire (Table 1).

In reminiscing conversations, a significant difference in elaborative style emerged between the two groups of adults [Q $(2,6) = 7.94$, p =.02] (Table 2). Also, for the performance of children in reminiscing conversations, the comparison between the two groups shows, in the post-test phase, a statistically significant difference in the use of sentences attributable to an elaborative style [Q $(2,6) = 9.71$, p =.01] (Table 3). No significant differences were found vis-à-vis the other variables investigated by tests.

Regarding the profile analysis, the variables in which the highest increments were found for each member of the dyad were: use of emotional terms and references to the child's Self. In the post-test, five dyads of the experimental group used emotional terms more frequently (values ranging from 1 to 10); only three dyads of the control group showed an increase (values ranging from 1 to 2). Three dyads of the experimental group increased the use of references to the child's Self (values ranging from 2 to 32); no control group dyads showed an increase.

5. Discussion

The first result that clearly emerges is that the psychologists in the experimental group, at the end of the training, use reminiscing more frequently.

The training has probably promoted a greater awareness in the use of this practice during conversations with children. Moreover, only for the psychologists and children in the experimental group, a significant increase in use of elaborative style was detected at the end of the intervention. This confirms what has been found from previous studies with parents (Reese & Newcombe, 2007; Van Bergen et al., 2009), and it is important given the effect of this style for skills development. The lack of statistically significant differences between the experimental and the control group regarding emotional terms and references to the child's Self deviates from previous studies (Valentino et al., 2022; Van Bergen et al., 2009). Perhaps during reminiscing training, the focus was particularly on aspects related to style. Profile analyses have identified that some children of the experimental group achieved greater increases in certain variables. This may well suggest that, with a larger sample or longer training, statistically significant differences between the two groups could emerge. Moreover, the training did not have the same impact on all the participants of the experimental group: indeed, some dyads show more marked increases than others. This suggests that some dyads benefited more from the training, probably due to inter-individual differences between the participants, which were not considered in this study. Future studies could focus on this aspect. The lack of statistically significant results in tests related to children's skills is not in line with the literature (Taumoepeau & Reese, 2103; Valentino et al., 2022; Van Bergen et al., 2009). It could be attributed to the specific context in which the study was conducted. Future research could evaluate changes in skills more related to metacognitive aspects. Moreover, it may be that changes related to these macro-competences will take longer to consolidate and manifest themselves consistently (Leonard et al., 2022; Reese & Newcombe, 2007).

Table 1. Mean, standard deviation and ANOVA results for the CCRS (Kulkofsky & Koh, 2009).

	Control group		Experimental group		Group-Time			
	Pre-test	Post-test	Pre-test	Post-test	Interaction			
	M (*SD*)	M (*SD*)	M (*SD*)	M (*SD*)	Q	df1	df2	*p*-value
CCRS Total	4.5	4.62	4.00	5.92	18.03	1	5	.01
	(0.53)	(0.74)	(0.74)	(0.79)				
Problem solving	5.38	5.17	5.22	5.42	0.31	1	5.88	.60
	(1.19)	(1.52)	(1.28)	(1.19)				
Emotional control	4.77	4.75	5.33	5.50	0	1	10	.99
	(1.34)	(1.19)	(0.80)	(0.94)				
Maintaining of relations	4.56	4.57	4.76	4.76	0.05	1	6.5	.83
	(0.53)	(0.54)	(1.08)	(1.06)				
Behavioural control	4.54	4.62	4.56	4.56	0.26	1	6.3	.63
	(0.87)	(0.90)	(1.37)	(1.48)				
Functions relating to the Self	3.62	4.15	4.53	4.83	0.33	1	9.89	.58
	(1.04)	(1.11)	(1.21)	(1.08)				
Conversation	3.73	3.50	4.60	4.60	0.29	1	5	.61
	(1.21)	(1.36)	(1.10)	(1.10)				
Cognitive skills	3.10	3.08	3.78	4.73	3.15	1	5.57	.13
	(0.88)	(0.90)	(1.55)	(1.24)				

Table 2. Mean, standard deviation and ANOVA results for psychologists' reminiscing conversation.

	Control group		Experimental group		Group-Time			
	Pre-test	Post-test	Pre-test	Post-test	Interaction			
	M (*SD*)	M (*SD*)	M (*SD*)	M (*SD*)	Q	df1	df2	*p*-value
Elaborative style	6.60	6.25	8.83	14.84	7.94	2	6	.02
	(2.88)	(2.60)	(4.02)	(6.55)				
Repetitive style	2.75	1.38	4.08	2.58	1.72	2	8	.24
	(1.58)	(0.92)	(2.15)	(1.93)				
Evaluative style	1.62	3.00	1.42	2.08	0.39	2	9	.67
	(1.60)	(1.20)	(1.31)	(1.62)				
Emotional references	0.75	1.12	0.75	2.92	0.97	2	7	.42
	(1.75)	(0.83)	(1.22)	(3.29)				
Psychologist Self	1.38	1.38	0.92	2.17	3	2	8	.10
	(1.06)	(0.74)	(1.38)	(1.47)				
Relational Self Dyad	2.62	3.25	3.25	4.92	0.70	2	7	.53
	(1.19)	(0.46)	(1.60)	(2.31)				
Self-referred Child	3.12	2.88	3.67	8.00	1.32	2	5	.34
	(1.46)	(0.35)	(2.64)	(8.30)				

Table 3. Mean, standard deviation and ANOVA results for children reminiscing conversation.

	Control group		Experimental group		Group-Time			
	Pre-test	Post-test	Pre-test	Post-test	Interaction			
	M (*SD*)	M (*SD*)	M (*SD*)	M (*SD*)	Q	df1	df2	*p*-value
Elaborative style	3.75	4.25	4.75	10.42	9.71	2	6	.01
	(1.67)	(1.58)	(2.70)	(5.28)				
Repetitive style	2.75	1.50	2.33	1.25	0.07	2	8	.93
	(2.05)	(1.07)	(1.83)	(1.36)				
Evaluative style	2.88	4.00	4.33	4.17	1.46	2	8	0.28
	(2.17)	(1.60)	(2.81)	(3.33)				
Emotional references	0.38	0.88	0.17	1.58	2.38	2	7	0.16
	(1.06)	(0.35)	(0.39)	(1.56)				
Child Self	1.88	2.12	1.42	4.25	1.08	2	7	0.39
	(1.46)	(0.99)	(1.51)	(4.81)				
Relational Self Dyad	0.75	2.38	0.92	2.33	0.60	2	8	0.57
	(0.89)	(0.92)	(0.79)	(1.50)				
Self-referred Psychologyst	0.00	0.25	0.08	0.58	-	-	-	-
	(0.00)	(0.46)	(0.29)	(0.79)				

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LIFE SCIENCES TEACHERS' UNDERSTANDINGS OF INTEGRATION OF INDIGENOUS KNOWLEDGE WHEN TEACHING BIODIVERSITY OF PLANTS

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Abstract

Although the South African Curriculum and Assessment Policy Statement (CAPS) document embraces local Indigenous Knowledge (IK), it does not specify how this should be implemented in the classrooms. As a result, little to no integration of IK is enacted in many of the Life Sciences classrooms. It is against this background that the study reported herein explored Grade 11 Life Sciences teachers' understandings of IK when teaching biodiversity of plants and related concepts. This study employed a qualitative research approach, which is underpinned by the interpretive paradigm. A case study research design was employed. Data was collected from five purposefully selected Grade 11 Life Sciences teachers in the Nkangala District in Mpumalanga, one of the nine provinces of South Africa. The selection of the participants was largely because they were easily available and that they were Grade 11 Life Sciences teachers at the schools where they were teaching. The teachers had a wide range of teaching experience (at least five years), meaning that they were assumed to be familiar with the CAPS document requirements on the integration of IK into teaching and learning process and the implementation gaps thereof. To generate data, open-ended interviews were employed. Each teacher was interviewed twice, firstly to determine their conceptualisation of IK integration, and secondly to explore their understandings of the integration of IK when teaching the topic Biodiversity of plants and related concepts. Vygotsky's social constructivism was adopted as the theoretical framework informing the data collection methods that addressed the research question. The data was analysed using the constant comparative method and three themes emerged from the patterns depicting teachers' understandings of the integration of IK when teaching biodiversity of plants and related concepts in Grade 11 learners' classrooms. Firstly, the findings of the study revealed that teachers understood the integration of IK as an effort to mainstream IK so that it could be given the same recognition as Western knowledge. Secondly, teachers viewed integration of IK as an additive to Western knowledge and not as a standalone legitimate form of knowledge. Thirdly, teachers viewed integration of IK as a way of fostering empowerment and justice to the marginalised communities who strive to utilise their own community heritage to solve own problems and develop their families and communities. The findings have implications for both teacher professional development and classroom practices.

Keywords: *Biodiversity of plants, grade 11 teachers, indigenous knowledge integration, life sciences, teachers' understandings.*

1. Introduction

The past decade witnessed several international voices calling for the inclusion of indigenous knowledge in the Life Sciences classrooms. The South African education system is no exception. There is emphasis in the Curriculum and Assessment Policy Statement (CAPS) on the integration of indigenous knowledge in science teaching and learning, aimed at achieving better learner understanding and therefore enabling learners to appreciate the affective dimension of science education (Department of Basic Education, 2011). This epistemological border–crossing, between science and indigenous knowledge hold many affordances for science education.

Various views exist about what IK entails. Khupe (2014) describes IK as specific forms of knowledge that is local, specific to place and could be synonymous to ways of knowing. The claims regarding the inclusion of IK in education is substantiated based on insights from neurobiology, and embodied, situated and distributed cognition (Wilson, 2002). Distinctions between perception, cognition and action (mind, body and world) have changed over the last number of years. Cognition is not only

embodied (brain embedded in the body) and situated (in an environment), but also distributed among agents (people) artefacts and external structures (Hardy-Valee & Paytte, 2008). The mind must be understood in the context of its relationship to a physical body that interacts with the world. The authors argue that capitalising on the cultural context of the learners holds affordances for more meaningful science education. While promoting IK, teachers should consider the fact that South Africa is a multicultural society. In the same classroom, learners from different cultural backgrounds and different social settings together engage in the learning process. Multicultural education does not alienate learners from their own culture, rather it enables learners to have a broader view and respect for other cultures without losing their roots (Pius, 2005). By including IK in education, recognition is given to diverse ways of knowing as well as the value of IK. However, research shows that teachers do not have the pedagogical content knowledge to incorporate IK in their teaching (De Beer & Van Wyk, 2012). Consequently, the current study sought to explore Life Sciences teachers' understandings of the integration of IK while teaching biodiversity of plants and related concepts in Grade 11 learners' classrooms.

2. Literature review

Teachers play a pivotal role in curriculum planning and implementation since they determine the success of any curriculum innovation. According to Keane, Khupe, and Seehawer (2017) several studies show that most teachers especially science teachers from all cultural backgrounds in South Africa have their own reservations about integrating IK in classrooms because they perceive Western science as being more powerful than IK. An example is of a study in KwaZulu-Natal Province where teachers admitted that they had never thought of introducing IK into their classes owing to their concerns about finishing the formal Western science curriculum in time and the heterogeneous cultures of their classes which poses challenges in respect of selecting the IK to teach (Keane, Khupe, & Seehawer, 2017). In sharp contrast to the assertions by the teachers, Keane et al. (2017) reiterates that in another study elders in South African communities complained about the irrelevance of the formal school curriculum of the Western science as they argued that for the improvement of the school curriculum through integration of traditional culture.

Similarly in a critical analysis to determine problems primary school teachers in Zimbabwe encountered when incorporating IK into science teaching, Shizha (2007) found that teachers' negative attitudes towards IK is the major inhibiting factor towards the incorporation of IK into the formal school science curriculum. Teachers in Shizha's study completely dismissed the integration of IK. For those teachers, social knowledge or cultural knowledge had no place in the teaching of science. The teachers saw Western science as rational, dynamic, and more modern, while IK was viewed as being static, traditional, and coming from a mythical African continent whose cultural forms should be civilized or corrected (Shizha, 2007). The teachers alluded to the hierarchical structure of science, where Western science occupied a superior hierarchy than indigenous science. Such negative attitudes of teachers towards IK are a big barrier for the incorporation of IK into the school curriculum, especially if such incorporation is not guided by policy or curriculum reform process.

3. Methodology

3.1. Research design
The study followed a qualitative case study research design (Creswell, 2014). It was underpinned by the interpretive paradigm () which allowed the researcher to write thick descriptions (Cohen, 2011). Cohen (2011) adds that while qualitative data often focuses on lesser numbers of people compared to quantitative data, the data tend to be in depth and rich. Though qualitative studies do not lead to data that can be generalised, they yield data collected from naturalistic settings situated in the backgrounds in which the phenomenon is being studied (Rallis & Rossman, 2003).

3.2. Selection of the participants
This study was a small-scale study consisting of five Grade 11 Life Sciences from the Nkangala District in the Mpumalanga Province of South Africa. The five were selected using convenience and purposive sampling (Cohen, 2011). Convenience and purposive sampling can be used by the researcher to select the most easily accessible candidates possessing the desired characteristics (Cohen, 2011). Their selection was largely because they were easily available and were teaching Life Sciences at their schools. The selected teachers had taught for at five years within their schools hence they were deemed knowledgeable about the surrounding respective communities and their indigenous practices and were familiar with the Curriculum and Assessment Policy Statement (CAPS) requirements on the integration of IK into the teaching and learning of Life Sciences.

3.3. Data collection

Data was collected through interviews. Each teacher was interviewed once using an open-ended interview schedule to explore teachers' understandings of the integration of IK when teaching biodiversity of plants to Grade 11 learners. Open-ended interviews allowed the respondents to express their feelings, attitudes, and understanding of the subject (Creswell, 2014). All the interviews were conducted outside teaching time in a quiet venue to avoid distractions and disruption of the teaching and learning process. Interviews were audio recorded with permission from the participants so that information could not be lost.

3.4. Data analysis

Interview recordings were first transcribed verbatim. The data was then was analysed using the constant comparative method (Merriam & Tisdell, 2016) which is an analytic procedure closely associated with the grounded theory. Grounded theory is a package of research methods that includes recent data collection, analysis, categorising, theoretical sampling, coding, constant comparison, comparing, memoing, saturation and promoting quality standards (Diaz, 2021). Constant comparative method of data analysis is an interactive and reflective process that begins as the data is being collected rather than at the end when data collection is finished (Stake, 2000). Therefore, data collection and analysis occurred concurrently. Analysis therefore involved identifying patterns in and reasons for the ways in which events happened (Henning, Van Rensburg, & Smit, 2004). The themes that were formed were used as the basis for argument when discussing and interpreting the data in relation to the research questions.

4. Research findings

From data analysis three themes emerged in response to the research question. Each theme is presented under the three upcoming subsections.

4.1. Theme 1: Teachers understood IK integration as a way of legitimizing it

The findings of the study revealed that teachers understood the integration of IK as an effort to mainstream IK so that it can be given the same recognition as Western knowledge. They understood that specific aim 3 of the CAPS document for Life Sciences focuses on the need to integrate IK in Life Sciences to ensure learners appreciate the relevance and applicability of the learned scientific concepts in their lives. This is evident from the following teacher's response.

Mrs Welman: *IK in Life Sciences teaching and learning attempts to legitimise local knowledge and establish a niche for IK in the overall education system focus. Learners need to understand that what they are taught as "Science "is not something created out of nowhere. So, integrating IK will allow learners to involve their parents or other members of community when they do their research on a given topic, to incorporate cultural knowledge and practices.*

4.2. Theme 2: The teachers viewed integration of IK as an additive

The integration of IK in Life Sciences was understood by the teachers to be an addition to the Western knowledge that is taught at school. This is reflected in the response by Ms Mahlangu who view the integration of IK in life sciences teaching and learning as follows:

Ms Mahlangu: *IK adds to the western knowledge that we teach learners; hence IK is used to understand, strengthen, and explain scientific knowledge.*

It should be however noted that the Life Sciences CAPS is not meant to present the integration of IK as an addition to western knowledge, but rather as an opportunity for IK to interact with Western knowledge. In the process of integration, the two knowledge systems are reconciled and mediated. The teacher's idea of the integration of IK implies the addition of IK to science knowledge is therefore somewhat contrary to the policy documents.

4.3. Theme 3: The teachers viewed IK integration as a way of fostering empowerment and justice

The teachers viewed integration of IK as a way of fostering empowerment and justice to the marginalised communities who strive to utilise their own community heritage to solve own problems and develop their families and communities. The teachers perceive the integrating of IK into Life Sciences to

encourage diversity in the knowledge learned at school and empower learners to explore IK in formal schooling. This view is captured in the following quotations of the teachers:

Mr Zulu: *IK integration recognises the richness of indigenous knowledge systems and their contribution to transforming the learners' thinking and instilling pride in the learners as Africans for instance.*

Ms Mahlangu: *We are given the opportunity to teach science as a subject and to look at our own beliefs and try to compare the two knowledge domains. This encourages us Africans not to look down upon our beliefs.*

The teachers are of the opinion that when learners learn about their own IK in formal schooling, they become more confident in exploring and valuing their own traditional ways of doing things including. The findings revealed that it is important to integrate IK in the Life Sciences teaching and learning because learners need to know where they come from. They should be able to know their roots before they are able to know where they are going. Their traditional knowledge is important for their future. The findings indicate that learners will appreciate Life Sciences content if it is linked to their cultural heritage. On the other hand Mrs Welman thought that IK integration is important though there are issues that impede the implementation.

Mrs Welman: IK integration brought fear to us as teachers because we do not know how to approach it as we were never trained about it. Some teachers attempt to do it whilst others brush it off.

Mr Naidoo: IK integration helps to make learners aware of the scientific methods and ideas that were used in the past and that they do not differ from the ones they learn in class. The aim here should however not be misconstrued as aligning our science to Western science.

The same sentiments were shared by Mr Zulu who pointed that learners should relate experiences from home with those acquired at schools e.g. baking bread and brewing traditional beer and alcohol from Amarula plants as scientific processes.

5. Discussion

What emerged from the findings is that the participant teachers understood IK as beneficial to the teaching and learning of Life Sciences as it makes learners understand concepts and develop interest in the subject and at the same time assisting teachers to identify misconceptions learners bring to the science classrooms. The teachers' positive attitudes towards IK integration contradict the picture painted in previous studies (e.g., Dziva, 2012; Mothwa; 2012; Shizha, 2007) where teachers held a negative attitude towards IK INTEGRATION.

Teachers understood the benefits of IK integration in Life Sciences classrooms. These views resonate with the observations made by Aikenhead (1996) and Le Grange (2007) that IK integration enables learners to establish the link between school science and their everyday life experiences. There were, however, varied conceptualisations amongst teachers which could be attributed to their diverse sociocultural backgrounds.

Teachers observed the integration of indigenous knowledge in the teaching and learning of biodiversity of plants and related concepts as a means to promote equality, diversity and social justice in the knowledge taught in formal education. This notion is in accordance with De Beer and Whitlock (2009) and Ng'asike (2019) who explained integration of indigenous knowledge as a way of promoting transformation, social justice, and equality. The teachers perceive the integration of IK into Life Sciences as a way to encourage diversity in the knowledge learnt at school and empower learners to explore IK in formal schooling. This view supports that of Semali and Kincheloe (1999), where the authors mentioned the integration of IK as a means of addressing social inequalities and promoting equity.

6. Conclusion

From the findings, there are both negative and positive aspects from the way teachers understood IK integration in the Life Sciences classrooms. It should be noted that there is a misunderstanding that IK integration is an attempt at giving IK the same status as Western science. Neither should IK be viewed as an addition to an already established scientific knowledge. Such a stance tends to devalue IK and promotes the marginalisation that has been in existence. A point to note is IK has been there and utilised amongst its holders for a very long time hence in that context, it has been an established knowledge way before Western scientific knowledge. On the positive side is the teachers' understanding of IK integration as a way of restoring justice, embracing diversity, and equality amongst humanity. These findings have implications for both science teacher professional development and classroom practices. Teacher

educators and in-service teacher providers need to develop pre-service and in-service science teachers respectively not only on how to integrate IK in science classrooms, but also in transforming their views towards the status and role of IK in relation to Western science.

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TEACHER'S VIEWS ON CHALLENGES WITH THE FOSTERING OF SELF-REGULATED LEARNING SKILLS AND SUPPORT FROM SCHOOL MANAGEMENT TEAMS

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Abstract

The aim of this study was to explore the challenges teachers experience with the fostering of self-regulated learning skills in intermediate phase learners as well as how the school management teams support them in their attempts to develop and enhance self-regulated learning skills. Self-regulated learning skills have become increasingly crucial in the 21st century, both within education and beyond, as it equips learners with knowledge and skills that improve academic performance and lifelong learning. In curriculum meetings with departmental officials and school management teams, the focus invariably centers on identifying methods to enhance outcomes and mitigate learner underperformance. Within these deliberations, the proposed solutions consistently revolve around actions by teachers, such as increasing classwork, homework assignments, and offering additional classes. The strategy of fostering learners' self-regulated learning skills is never proposed to improve academic achievement and pass rates. Teachers' pivotal role in fostering self-regulated learning skills is hindered by various factors. Without effective engagement from teachers and the entire school community in cultivating these skills from primary education onwards, learners will persist in struggling throughout their academic journey, unable to meet the evolving demands of the world. School management teams have an impact on teacher control, power and educational initiatives, resources and innovations. Therefore, support from school power structures such as principals and heads of departments in the development of self-regulated learning needs to be explored. The qualitative study is located within an interpretivist philosophical orientation to enable the researchers to explore a real-life situation and the experiences teachers encounter in their daily teaching and learning contexts. Fifteen participants from three primary schools were convenient and purposively sampled to participate in the study. Data was collected through single semi-structured interviews with each participant. Data was analysed inductively through a thematic approach. The findings revealed that participants' beliefs about their roles in the holistic development of learners and the aims of teaching and learning are linked to their positive beliefs about the value of self-regulated learning skills. Participants face challenges including inadequate pedagogical content knowledge to develop some self-regulated learning skills, overcrowding, time constraints, limited resources, and lack of parental involvement. They lack professional development and training from school management to enhance their ability to foster self-regulated learning skills. Their only support comes in the form of documents like textbooks and teaching plans from the Department of Basic Education.

Keywords: Self-regulated learning, teachers, school management teams, professional development.

1. Introduction

Zimmerman and Moylan's (2009) cyclical model of self-regulated learning (SRL) highlight the self-regulated learning skills self-regulated learners demonstrate and the skills teachers should develop for learners to function effectively in the twenty first century. Examples of these skills include, goalsetting, strategic planning of learning strategies, resources, and time management to complete learning tasks successfully (Loeng, 2020). SRL skills have become increasingly crucial in the 21st century, both within education and beyond, as it equips learners with knowledge and skills that improve academic performance and lifelong learning (Bandura, 2015). Vandevelde, Vandenbussche and Van Keer (2012, p. 1563) report that SRL is strongly influenced by classroom practices and teachers are considered the most important source from which learners can learn how to create learning environments that foster SRL. Geduld (2017) also avers that while teachers play a crucial role in promoting SRL, several external

factors hamper their efforts to develop SRL skills in learners. Likewise Van der Velde et al. (2012), reported that a lack of time, work pressure and diversity among learners as prevalent challenges for teachers to foster SRL skills. Many teachers in schools of poor communities feel that the general education and development of learners' rests solely on their shoulders (Geduld, 2017).

Wolters and Hussain, (2015) argue that the development of SRL skills must not be viewed as solely a classroom topic or the teacher's responsibility. A school-wide approach is needed to stimulate and develop SRL skills in learners. School management teams (SMT's) such as principals and head of departments significantly influences teacher authority and educational innovations and should therefore support teachers with the development of twenty first century skills such as SRL skills. Teachers thus need continuous support from the SMT's and the Department of Education for them to be self-directed and to develop SRL skills in their learners. This implies that school management teams must create school environments conducive for effective teaching and learning that enhance the development of SRL skills (Wolters & Hussain, 2015).

This study explored the challenges teachers experience as well as the support, if any, from SMT's with development of SRL skills in the intermediate phase. In the South African schooling system, the intermediate phase includes Grades 4, 5 and 6 in a primary school. In this phase teachers are required to use different teaching modalities to accommodate learners and to ensure that they adapt to the transition from the Foundation Phase. The intermediate phase is a crucial phase, even more so for certain mother tongue groupings that are required to make transition to learn and be taught in English. Learners' abilities in effective reading, writing, and speaking the language of instruction in a manner which facilitate their own learning and knowledge base are vital aspects to be considered in creating awareness amongst teachers about the development of SRL skills.

Teachers' pivotal role in fostering SRL skills is hindered by various factors. Without effective engagement from teachers and the entire school community in cultivating these skills from primary education onwards, learners will persist in struggling throughout their academic journey, unable to meet the evolving demands of the world.

Against this context the following two research questions guided this study: (a) What challenges do intermediate phase teachers experience with the fostering of self-regulated learning skills? and (b) What support, if any, do intermediate phase teachers receive from the school management teams to develop self-regulated learning skills of learners?

2. Literature review

Persico, Milligan and Littlejohn (2015) report that the changing teaching and learning environment, teachers' lack of knowledge of SRL, workload, time and overcrowded classes, teachers' lack of self- efficacy beliefs, lack of collaboration between learners, teachers and parents as the challenges teachers face in attending to individual learners' SRL skills in class daily. Kartika and Maina (2017) also found that teachers facing difficulties with the development of SRL skills often contend with heavy workplace demands like large workloads and overcrowded classes. These conditions impede teachers' ability to manage their workload while fostering SRL skills in class. Additionally, intermediate phase teachers teach multiple subjects, each requiring individual planning due to varying content knowledge. These challenges necessitate committed teachers who can adapt teaching strategies and self-regulation techniques to different subjects. Overcrowded intermediate phase classes exacerbate this issue, hindering teachers from addressing individual learner needs effectively.

Another challenge found by Panadero and Alonso-Tapia (2014) is many teachers' lack of pedagogical content knowledge to develop SRL skills. Triquet, Peeters and Lombarts (2017) indicate that teaching and learning environments are dynamic and evolve, becoming more complex and causing more challenges for teachers in general. Therefore, the authors maintain that teachers need to improve their own SRL skills continuously so that they will be able to manage and overcome the challenges they encounter in class and address the diverse and individual needs of their learners. Hasanoglu and Girmen (2014) highlights a significant challenge faced by teachers: the lack of time and training to support learners with special needs and develop their self-regulated learning (SRL) skills. Equipping teachers with SRL knowledge enables them to effectively assist learners with special needs, thereby enhancing their academic abilities and contributing to the national pass rate.

Given the challenges teachers face in attending to individual learners' SRL skills on a daily basis, particularly regarding the changing teaching and learning environment, teachers' lack of knowledge of SRL, and the need for continuous professional development, the roles and responsibilities of the School Management Team (SMT) in supporting teachers become increasingly vital.

The roles and responsibilities of the School Management Team (SMT) are outlined in the Personnel Administrative Measures (PAM) document (Department of Basic Education, 2016). According

to the Personnel Administrative Measures, SMTs should provide teachers with the latest ideas, techniques, evaluations, and resources in their fields. They should assist with planning and managing teaching and learning and cooperate with colleagues to maintain good teaching standards and learner progress. SMTs are responsible for quality teaching and learning and should know the prescribed National Curriculum, including its values and goals. This knowledge supports effective teaching and learning, helping schools develop a learning culture and raise achievement levels. Mogashoa (2013) states that SMT's are the backbones of a school, and they carry all the responsibilities to support and develop teachers to ensure that SRL is implemented effectively in the school. SMT's are responsible for quality teaching and learning and should be able to manage their roles effectively to ensure that teachers are equipped with the relevant skills and knowledge of SRL. Overall, the roles and responsibilities of the SMT imply a commitment to supporting teachers in developing learners' SRL skills through collaboration, professional development, and effective management of teaching and learning activities.

3. Research design and methodology

A qualitative research design located within an interpretivist research paradigm was followed in this study. Mohajan (2018) define qualitative research as a situated activity that locates the observer to the world. It involves an interpretative, naturalistic approach to the world. We decided to use a qualitative, pseudo-phenomenological study to explore the teaching strategies used by teachers to develop self-regulated learning. Pseudo-phenomenological implies that this study has some elements of a phenomenological study that enabled us to explore a real-life situation, namely the daily experiences of teachers in their classrooms, and to develop a composite description of the essence of the individuals' experiences (Emiliussen, Engelsen, Christiansen, & Klausen, 2021).

The population of this study was all the primary school teachers in the Lejweleputswa district which consists of 213 schools and 4 528 teachers. We used purposive sampling to select fifteen participants from three primary schools. The first author of the study collected data collection via single, semi-structured interviews with participants.

We used content analysis and a thematic approach to analyse the data by means of inductive coding. We applied for ethical clearance from the North West University and gained permission for the research from legal authorities such as the Department of Basic Education and school principals. The ethical guidelines provided by the University were always observed.

4. Discussion of findings

We used verbatim quotes, which are printed in italics to present the understandable descriptions of the teachers' (participants') perceptions about their challenges with developing SRL and the support, if any that they receive from SMT's. Reference codes are placed after each verbatim quotation to identify the participants and the schools, where 'P' represents the participant and 'S' represents the school.

4.1. Theme 1: Challenges do intermediate phase teachers experience with the fostering of self-regulated learning skills

Next follow some of the participants' responses when asked about the challenges they experience with developing SRL skills in intermediate phase learners. Six participants (*P1S1, P4S1, P3S1, P4S1, P5S2, P4S3*) responded that they had not heard of or had no knowledge of SRL. One participant stated: *I do not know anything about self-regulated learning, or even heard about it (P4S1).* Seven participants (P1S1, P2S1, P4S1, P5S1, P2S2, P5S3) indicated that time constraints are a challenge. P2S2 responded: *Time is a challenge because we are forced to cover the curriculum, when it is like that you are forced to rush to complete the syllabus and now it is worse because of COVID 19. There is no longer time to enhance learners to work on their own.*

The other two factors that were mentioned as a challenge by most of the participants are insufficient teaching and learning resources and lack of parental involvement. The following are examples of their responses: *Lack of resources, in terms of textbooks, posters, atlases, because I am also teaching Social Sciences, we don't have a globe to show learners the world (P5S3).* Another participant clarified: *I don't really involve parents because it's actually a waste of time for me because you call parents, sometimes they don't come, when they come, they will just say they will be involved but they don't. I normally do things on my own (P4S1).*

Three participants (*P1S1, P4S1, P2S2*) indicated that one challenge they encounter is that learners do not do their homework, as well as overcrowded classrooms. Furthermore, one participant indicated that one challenge most teachers experience is that the system of education is more focussed on results than giving quality education to learners: *It plays a huge role because no child should fail... I feel*

that their marks are not a reflection of their understanding, the marks are just what we are expected to give because we want good numbers that is why in the next grade, they do not know what they have learned (P1S2).

Participants noted that most primary schools lack internet access, available only in administration offices off-limits to teachers and learners. Kartika and Mania (2017) confirm these challenges, highlighting that primary schools in lower quintiles are overcrowded and lack sufficient time for effective teaching, making it hard for teachers to address each learners' needs and focus on the fostering of self-regulated learning skills.

In the second theme below, the participants' perceptions of the support they receive from school management teams are discussed.

4.2. Theme 2: School management team support to develop self-regulated learning

Participants responses revealed they receive varied support from the SMT's. Some other participants *(P3S1, P1S2, P3S2, P5S2, P1S3, P2S3, P4S3, P5S3)* disclosed that their head of departments give them emotional support by giving them hope and comfort when they cannot cope with the workload and discipline of learners. This type of support can indirectly be linked to the development of SRL, because emotional support keeps teachers motivated to teach as indicated by the following response: *I was once in a position where I see my learners failing. I was emotionally drowning, my Head of Department (HOD) gave me emotional support, she gave me teaching strategies and slowly and surely, I saw improvement (P5S3).*

Another type of support mentioned by the participants was support with teaching and learning resources and documents in the form of textbooks that should be used by learners, timetables, annual teaching plans, circulars, and policy documents from the Department of Basic Education. The participants revealed that they attend meetings with the SMT and the subject advisors where the main discussion is learning content, assessment, and planning instead of teaching strategies that develop SRL.

However, nine participants (P2S1, P3S1, P4S1, P5S1, P1S2, P3S2, P5S2, P3S3, P4S3) revealed that they do not receive support from the SMT's. Some participants expressed their frustration with the limited support in saying the only thing that matters is pass rates, and the SMT and the Basic Department of Education put pressure on them for high pass rates. This is how one participant explained: *Not at all, as long as learners pass that's what matters, they put pressure on us, and all that they want is results (P3S3).*

Some participants, (P3S1, P4S1, P5S1, P1S2, P3S2) also mentioned that the SMT is interested in learners getting good grades but places no emphasis on how to assist teachers with teaching and learning strategies that can assist learners to pass. One participant noted that after every formal assessment, they must conduct an item and error analysis and create a subject improvement plan to address underperformance and devise intervention strategies. Although these analyses are submitted to the SMT and subject advisors, no feedback or discussions on the intervention strategies occur. Consequently, the participant perceive that these plans are merely submitted for compliance rather than being used to develop pedagogical knowledge beneficial for SRL skills in various subjects.

5. Conclusion

The findings revealed that most of the participants indicated lack of pedagogical content knowledge to develop SRL skills, insufficient time, overcrowded classrooms, insufficient teaching and learning resources, and the result- rather than quality-orientation of education are challenges to developing SRL skills in their learners. All the challenges mentioned by the participants have a substantial impact on creating a classroom atmosphere that is conducive for the development of SRL. Based on the roles and responsibilities outlined for the School Management Team (SMT), the following recommendations are offered. SMTs should disseminate the latest teaching approaches, including strategies for SRL to help teachers integrate these into their instruction. SMTs should support teachers in planning lessons that promote SRL through activities encouraging goal setting, self-monitoring, and reflection, and support classroom management for SRL. SMT should provide professional development courses for intermediate phase teachers to foster a culture of collaboration where teachers share strategies and resources for the promotion of SRL. This might involve facilitating professional learning communities or providing time and space for teachers to collaborate and reflect on their practice. The issue of overcrowded classrooms and heavy teacher workloads, which hinder the development of SRL skills in intermediate phase learners, should be addressed.

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LEVERAGING ICT TOOLS FOR TEACHING AND LEARNING IN THE DOMAIN OF PHYSICAL SCIENCES

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Abstract

This study delves into the effective utilization of Information and Communication Technology (ICT) tools to enhance teaching and learning experiences within the field of physical sciences. By examining the integration of diverse ICT resources, such as simulations, virtual laboratories, and interactive multimedia, this research aims to evaluate their impact on student engagement, comprehension, and overall academic achievement. The study adopted a mixed methods design to gain a comprehensive understanding of the integration of ICT tools in physical sciences teaching and learning. Through a thorough investigation of pedagogical approaches and technological applications, this study seeks to identify optimal strategies for leveraging ICT tools to facilitate deeper understanding and mastery of key concepts in physical sciences education. Additionally, considerations for addressing potential challenges and maximizing the benefits of ICT integration in the learning environment were explored. Participants reported that ICT tools facilitated a deeper understanding of complex scientific concepts by providing visualizations, simulations, and interactive demonstrations that made abstract ideas more tangible and accessible. ICT tools allowed for personalized learning experiences tailored to individual student needs and preferences, enabling students to progress at their own pace and access additional resources to support their learning. Despite the benefits, participants also identified challenges and barriers to leveraging ICT tools in physical sciences education, such as limited access to technology, inadequate technical support, and concerns about digital equity and inclusion. Ultimately, this research endeavors to contribute valuable insights to educators, policymakers, and stakeholders seeking to enhance the quality and effectiveness of teaching and learning in the domain of physical sciences through ICT integration.

Keywords: ICT tools, teaching, learning, physical sciences, technology integration.

1. Introduction

In the contemporary educational landscape, the integration of Information and Communication Technology (ICT) tools has become increasingly prevalent, reshaping traditional teaching, and learning methodologies across various disciplines. In the domain of physical sciences, the utilization of ICT tools presents a promising avenue for enhancing teaching effectiveness, enriching learning experiences, and fostering deeper conceptual understanding among students (Sharma, Gupta, & Agarwal, 2023). This study seeks to explore the potential of leveraging ICT tools for teaching and learning in the realm of physical sciences. Physical sciences encompass a diverse array of disciplines, including physics, chemistry, astronomy, and earth sciences, which are characterized by their empirical approach to understanding the natural world. The integration of ICT tools holds great promise in facilitating hands-on exploration, data analysis, and theoretical modelling within these disciplines (Baako & Abroampa, 2023). By harnessing the power of digital technologies, educators can engage students in dynamic learning experiences that transcend the confines of traditional classroom settings.

The purpose of this study is to investigate the pedagogical practices, challenges, and outcomes associated with the integration of ICT tools in teaching and learning within the domain of physical sciences. By examining the strategies employed by educators, the impact on student engagement and achievement, and the barriers encountered in implementing ICT-enhanced instruction, this research aims to provide insights into effective approaches for leveraging technology in physical sciences education. Through a qualitative research approach, including interviews, classroom observations, and document analysis, this study will delve into the experiences and perspectives of educators, students, and stakeholders involved in ICT-integrated physical sciences instruction. By exploring the diverse applications of ICT tools, from interactive simulations and virtual laboratories to data visualization

software and collaborative online platforms, this research seeks to identify best practices and recommendations for optimizing technology-enhanced teaching and learning experiences in the physical sciences.

In addressing the evolving needs and challenges of physical sciences education in the digital age, this study contributes to the ongoing discourse on innovative pedagogical approaches and technology integration strategies. By illuminating the potential of ICT tools to transform teaching and learning practices in the domain of physical sciences, this research endeavors to inform curriculum development, instructional design, and professional development initiatives aimed at preparing students for success in an increasingly technology-driven world.

2. Research design and methodology

2.1. Research design

This study employed a mixed-methods research design to investigate the utilization and impact of ICT tools for teaching and learning in the domain of physical sciences. By combining qualitative and quantitative approaches, the study aims to provide a comprehensive understanding of the pedagogical practices, challenges, and outcomes associated with the integration of ICT tools in physical sciences education.

2.2. Sampling strategy

Purposeful Sampling: Physical sciences educators with experience in integrating ICT tools into their teaching practices were selected as participants. The sample also included students and stakeholders involved in ICT-enhanced instruction.

2.3. Data collection methods

Semi-Structured Interviews: In-depth interviews were conducted with physical sciences educators to explore their experiences, perceptions, and strategies related to the integration of ICT tools. Interviews were also conducted with students to gather their perspectives on the effectiveness of ICT-enhanced instruction.

Classroom Observations: Observations were conducted in physical sciences classrooms during ICT-integrated lessons to document teaching practices, student interactions, and the use of ICT tools. Observation protocols were developed to capture qualitative data on instructional strategies and student engagement.

Surveys: Surveys were administered to physical sciences educators and students to gather quantitative data on the frequency of ICT tool usage, perceived benefits and challenges, and student outcomes associated with ICT-integrated instruction.

2.4. Data analysis

Qualitative Analysis: Thematic analysis was employed to analyze qualitative data from interviews and classroom observations. Codes and themes related to pedagogical practices, technological challenges, and student outcomes were identified and interpreted.

Quantitative Analysis: Descriptive statistical analysis was conducted on survey data to examine patterns, and trends related to the usage and impact of ICT tools in physical sciences education.

Triangulation: Data triangulation was utilized to corroborate findings across multiple data sources (interviews, observations, surveys) and enhance the validity and reliability of the study results.

Trustworthiness: Strategies such as member checking, peer debriefing, and prolonged engagement with the data were employed to enhance the credibility, dependability, and transferability of the study findings.

By employing a mixed-methods research design, this study aims to provide a nuanced understanding of the role of ICT tools in physical sciences education, offering insights for educators, policymakers, and curriculum developers seeking to optimize technology-enhanced teaching and learning experiences in the domain of physical sciences.

3. Findings

The results of the study revealed several key findings regarding the utilization and impact of ICT tools in physical sciences education:

Extent of ICT Integration: The study found that ICT tools are widely integrated into teaching practices in the domain of physical sciences. Educators utilized a variety of digital resources, including

interactive simulations, virtual laboratories, multimedia presentations, and online collaboration platforms, to facilitate instruction and enhance student learning experiences.

Pedagogical Strategies: Educators employed diverse pedagogical strategies when leveraging ICT tools in physical sciences education. These strategies included inquiry-based learning approaches, flipped classroom models, and blended learning environments, tailored to the specific needs and objectives of the instructional context.

Student Engagement: ICT-integrated instruction enhanced student engagement and participation in physical sciences classrooms. Interactive simulations, multimedia presentations, and virtual laboratories captivated students' interest, promoted active exploration of scientific concepts, and facilitated hands-on learning experiences.

Conceptual Understanding: The study found that ICT tools contribute to deeper conceptual understanding and retention of physical sciences concepts among students. Visualization tools, data analysis software, and interactive simulations helped students visualize abstract concepts, conduct virtual experiments, and apply theoretical knowledge to real-world scenarios.

Technological Challenges: Educators encountered various technological challenges when integrating ICT tools into physical sciences instruction. These challenges included limited access to technology resources, technical issues with software and hardware, and the need for ongoing professional development in ICT skills and pedagogy.

Teacher Professional Development: The study highlights the importance of teacher professional development in supporting effective ICT integration in physical sciences education. Training workshops, mentoring programs, and collaborative learning communities can enhance educators' technological proficiency and pedagogical practices, ultimately improving the quality of instruction and student learning outcomes.

Overall, the results of the study underscore the transformative potential of ICT tools in enhancing teaching and learning experiences in the domain of physical sciences. By addressing technological challenges and investing in teacher professional development, educators can optimize the integration of ICT tools to promote student engagement, deepen conceptual understanding, and foster inquiry-based learning in physical sciences education.

4. Discussion

The results of the study provide valuable insights into the utilization and impact of ICT tools in physical sciences education. The study reveals that ICT tools are widely integrated into teaching practices in the domain of physical sciences. Educators leveraged a diverse range of digital resources, including interactive simulations, virtual laboratories, multimedia presentations, and online collaboration platforms. This indicates a recognition among educators of the potential of technology to enhance instruction and enrich student learning experiences. Educators employed various pedagogical strategies when leveraging ICT tools in physical sciences education. These strategies included inquiry-based learning approaches, flipped classroom models, and blended learning environments. By adapting instructional methods to incorporate technology, educators can cater to diverse learning styles and engage students in active exploration of scientific concepts.

ICT-integrated instruction enhances student engagement and participation in physical sciences classrooms (Baako & Abroampa, 2023). Interactive simulations, multimedia presentations, and virtual laboratories captivated students' interest and promote active learning. By providing opportunities for hands-on exploration and experimentation, ICT tools created dynamic and immersive learning experiences that resonate with students. The study found that ICT tools contribute to deeper conceptual understanding and retention of physical sciences concepts among students. Visualization tools, data analysis software, and interactive simulations helped students visualize abstract concepts, conduct virtual experiments, and apply theoretical knowledge to real-world scenarios. This indicates that technology can serve as a valuable tool for scaffolding learning and facilitating deeper comprehension (Siadaty, Gašević, & Hatala, 2016).

Educators encountered various technological challenges when integrating ICT tools into physical sciences instruction. These challenges included limited access to technology resources, technical issues with software and hardware, and the need for ongoing professional development in ICT skills and pedagogy (Siadaty, Gašević, & Hatala, 2016). Addressing these challenges is crucial to ensure the effective implementation of ICT-integrated instruction. The study emphasizes the importance of teacher professional development in supporting effective ICT integration in physical sciences education. Training workshops, mentoring programs, and collaborative learning communities can enhance educators' technological proficiency and pedagogical practices. Investing in teacher professional development is

essential to empower educators to leverage ICT tools effectively and maximize their potential for enhancing student learning outcomes.

Overall, the results of the study underscore the transformative potential of ICT tools in physical sciences education. By addressing technological challenges and investing in teacher professional development, educators can optimize the integration of ICT tools to promote student engagement, deepen conceptual understanding, and foster inquiry-based learning in the domain of physical sciences.

5. Conclusion

The study provides valuable insights into the integration and impact of Information and Communication Technology (ICT) tools in physical sciences education. The findings highlight the transformative potential of ICT tools in enhancing teaching effectiveness, enriching learning experiences, and fostering deeper conceptual understanding among students. The widespread integration of ICT tools into teaching practices in the domain of physical sciences underscores educators' recognition of technology's potential to enhance instruction and engage students in active learning. Pedagogical strategies such as inquiry-based learning, flipped classroom models, and blended learning environments demonstrate how educators adapt instructional methods to leverage technology effectively.

ICT-integrated instruction enhances student engagement and participation by providing dynamic and immersive learning experiences. Interactive simulations, multimedia presentations, and virtual laboratories captivate students' interest and promote hands-on exploration of scientific concepts. Moreover, ICT tools contribute to deeper conceptual understanding and retention of physical sciences concepts among students, facilitating visualization, data analysis, and application of theoretical knowledge to real-world scenarios. Despite the benefits of ICT integration, educators encounter technological challenges such as limited access to resources and technical issues. Addressing these challenges and investing in teacher professional development are crucial for empowering educators to leverage ICT tools effectively. Training workshops, mentoring programs, and collaborative learning communities can enhance educators' technological proficiency and pedagogical practices, ultimately optimizing the integration of ICT tools to promote student learning outcomes.

In conclusion, the study underscores the importance of leveraging ICT tools to enhance teaching and learning experiences in the domain of physical sciences. By addressing technological challenges and investing in teacher professional development, educators can harness the transformative potential of technology to create dynamic, engaging, and effective learning environments for students in the digital age.

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TRANSFORMING THE LEARNING ENVIRONMENT THROUGH INTERACTIVE PEDAGOGIES

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Abstract

An interactive learning environment can be understood from diverse angles depending on the nature of the subject or concept taught. Interaction in the science classrooms creates an opportunity for the learner to engage meaningfully with the content. The study sought to explore how pre-service teachers conceptualise an interactive learning environment in the Life Sciences classrooms. Using a qualitative case study research design, 45 students enrolled for postgraduate certificate in education and specialising in Life Sciences, were selected to take part in the study. During the year these participants had been exposed to the teaching and learning of Life Sciences concepts using various interactive pedagogies. They were also engaged in analysing videos of lessons where previous pre-service teachers implemented interactive pedagogies in their classrooms. For data collection, each participant was tasked to critically explore how the use of a selected teaching strategy or approach could foster interactive learning in a Life Sciences classroom during work integrated learning. The work integrated learning period was seven weeks long hence the participants had adequate time to explore and select the strategy they wanted. Whilst the task sought the interactive pedagogies employed by the participants, it also assessed the participants' knowledge of the selected Life Sciences topic; knowledge of the teaching strategy; the suitability of the strategy; and affordances in making content accessible to learners. They then submitted their analysis which formed the data source. Habermas' critical social theory was used to analyse and interpret the participants' conceptions. The findings revealed a wide spectrum in pre-service teachers' conceptions about an interactive learning environment. Some based interactive pedagogies on learner inclusivity, use of what learners bring to the classroom, learner engagement, learner interest, ability to enable application of knowledge in real life, and use of modern learning technologies. The findings have implications for teacher professional development programmes.

Keywords: Interactive learning, learning environment, life sciences, teaching strategies.

1. Introduction

Life Sciences teaching requires the use of interactive pedagogies that involve learners in sharing knowledge and ideas meaningfully. The objective of using interactive teaching and learning is to promote the transfer of knowledge, skills, and values between teachers and learners and between learners and peers (Giorgdze & Dgebuadze, 2017).

The study sought to explore how pre-service teachers conceptualise an interactive learning environment in the Life Sciences classrooms. The study was guided by the research question: How do pre-service teachers conceptualise an interactive learning environment in the Life Sciences classrooms. This was meant to determine how much they have understood the interactive teaching strategies they had engaged in during lectures and the ones they utilised during work integrated learning. Work integrated learning provided them with an opportunity to work in schools under the mentorship of experienced Life Sciences teachers.

2. Literature review

According to Mendezel and Rick (2021) 4IR tools allow for personalised learning, creativity, and problem-solving skills development. In a study to infuse creativity and technology in 21st Century education, Henriksen, Mishra and Fisser (2016) indicated that, "creativity can be learned, but since it is a thinking skill it can only be "learned by doing" or as "learning in action." (p. 34). It therefore shows that technology should be used interactively for meaningful learning to be realised.

Practical work is important in affording learners the opportunity to learn and do science. According to Waite (2011), practical work gives learners an idea on how technicians or scientists work. It assists with enhancing their practical skills valuable in future career or academic routes. Demonstrations illustrates complex concepts and aids learners in the formulation of arguments based on the evidence gathered during the learning process (Strat et al., 2023; Subba et al., 2019).

Learning in social groups develops learners' conceptual understanding through social interaction. Social interaction in the classroom facilitates learners' understanding of the concepts learned (Senior & Howard, 2014). The form of social interaction might be verbal and nonverbal activities, such as experimenting together, conversation, dialogue, and presentation, which will stimulate learners and teacher to pose questions. From a pedagogical perspective, there is evidence from literature that learning is enhanced if it takes place in friendship groups. An example is of Barton et al. (2005) who found that learners working in groups scoring higher marks on an "openness to experience" scale that is significantly associated with a deep approach to learning (Zhang, 2003) compared to learners who studied alone. In another study, it was found that learners who completed a coursework task in a group significantly scored higher marks than those who completed a coursework task on their own (Senior et al., 2012).

Demonstration as a strategy provides visual display of the action and activities or practical work associated with the facts and principles of a lesson presented by the instructor in the classroom with the objective of facilitating the process of teaching and learning (Basheer, Hugerat, & Hofstein, 2017). When used effectively, demonstrations improve learners' performance and ability to handle any instruments or materials used during the demonstration. Earlier Giridharan and Raju (2006) indicated that demonstrations could play a significant role in helping learners develop comprehension skills and analytical skills during the learning process. Basheer, Hugerat, and Hofstein (2017) found in their study that demonstrations promote learner interest hence they are useful in facilitating and developing learning, promoting thinking skills and to enable learners to think more creatively.

Lule (2022) explains illustrations as decoration, interpretation or visual explanation of a text, concept, or process, designed for integration in print and digital published media, such as posters, flyers, magazines, books, teaching materials, animations, video games and films. The author views the technique as useful in helping learners attain knowledge (Lule, 2022). Illustrations are more of a traditional way of teaching as the teacher talks more than learners, especially when they give the visual explanation of what is presented on the picture. This method requires the teacher to be creative by being able to align the illustrations with the content being taught to avoid confusion (Lule, 2022).

Teaching science topics in school can be very difficult, especially when the topic is of controversial nature. Certain abilities that are not given much emphasis in schools will be essential as the world becomes more varied and developing. Hence argumentation can engage learners in today's knowledge era which demand knowledge and abilities or skills, as well as moral sense and values (Ozdem et al., 2017). It can be an effective method for improving learners' knowledge retention and understanding of a topic with a focus on explanation, with learners aiming to create evidence that supports a certain account or claim (McNeill et al., 2006). To get a better understanding of science, learners of all ages must therefore engage in argumentation and enhance their argumentation and reasoning skills (Ozdem et al., 2017).

2.1. Theoretical framework

The study was underpinned by Habermas critical social theory. Habermas believes that scientific knowledge and its acquisition should be based on social interactions. This theory is captured by Hill (1972)'s interpretation that (scientific) knowledge is a social question, and is a social phenomenon; hence the way humans live is based on what they know and how they know. Figure 1 shows the four types of social interactions.

Figure 1. The four types of social interactions in Habermas typology of action.
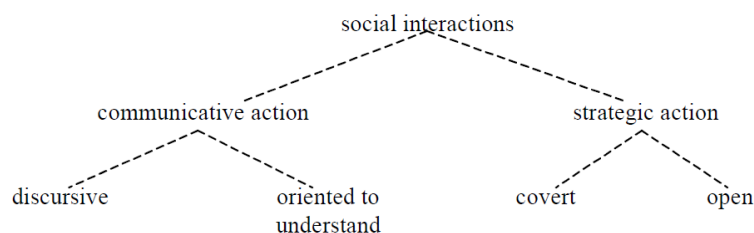
Such a theory emphasizes the need to consider social interactions in the science classrooms, which can only be achieved using interactive teaching strategies.

3. Methodology

The study was located within an interpretivist paradigm. According to Creswell (2014), an interpretivist paradigm enables the researcher to gain profound comprehension of the phenomenon in its unique context. This paradigm was appropriate for the study because the researcher obtained valuable insights about the conceptions of the Life Sciences pre-service teachers who had taught in diverse school contexts whilst enacting different interactive pedagogies in grade 10-11 classrooms. The study employed a qualitative case study design (Creswell, 2014), which involved a purposefully selected group of 45 students (Patton, 2001) herein referred to as pre-service teachers who were enrolled in a Post Graduate Certificate in Education programme specialising in Life Sciences. The unit of analysis was the pre-service teachers' conceptualisations.

Before data collection, these participants had been exposed to the teaching and learning of Life Sciences concepts using various interactive pedagogies. They were also engaged in analysing videos of lessons where previous pre-service teachers implemented interactive pedagogies in their classrooms. They had also been involved in seven weeks long work integrated learning hence the participants had adequate time to practise teaching whilst using the different teaching strategies. Due to this exposure in teaching, it can be assumed that the participants were knowledgeable and had experienced teaching using some of the interactive pedagogies learned during lectures.

To collect data, the researcher tasked the pre-service teachers to critically explore how the use of a selected teaching strategy or approach could foster interactive learning in a Life Sciences classroom during work integrated learning. Whilst the task sought the interactive pedagogies employed by the participants, it also assessed the participants' knowledge of the selected Life Sciences topic; knowledge of the teaching strategy/approach; the suitability of the strategy; and affordances in making content accessible to learners. Each participant made a submission which formed the data for the study. Each textual data was subjected to deductive and thematic analysis (Blum, Stenfors, & Palmgren, 2020).

4. Findings

Table 1 shows the analysis that was made from the participants' submissions. A clear depiction of the topics, reasons for identification of such topics, the selected teaching strategies, and their affordances in ensuring interactions amongst learners are presented.

Table 1. Results from the analysis of data from participants' submissions.

Life Sciences topic	Reason for selection	Teaching strategy	Affordances
The history of life on earth	-Complex topic -A lot of theoretical concepts -Historical events learners cannot relate to.	-Use of 4IR tools e.g., videos and animations. -Available on learners' gadgets.	-Allows for flipped classroom. -Can be watched anywhere: in class, at home, during break, in the bus when going home.
Nervous system: Reflex arc	Abstract concepts	Use of illustrations	Helps make the unseen visible and the complex simple. Can be traditional or digital.
Classifying microorganisms	Categorised based on different traits e.g., genetics, physiology, and morphology yet invisible with naked eye.	Use of practical work or investigations.	-Use of microscopes -Enlarges images on micro slides -Comparing images on slides with pictures in texts or micrographs. -Develops visual and manipulative skills.
Human reproduction	-A controversial topic to teach to learners from strong cultural and religious backgrounds. -Discussing human reproductive organs, menstruation or fertilisation is taboo in some cultures.	Using inquiry-based activities.	-Allowing learners to research concepts and share their cultural beliefs. -Promoting intense discussions and enhancing the quality of social interaction. -Engaging learners interactively. -Discussing cultural and religious issues to mitigate prejudices.
Nervous system: Reflex activities	-Need for practical demonstration before learners follow suite.	Use of demonstrations	-Provides interactive, hands-on learning opportunities. -Caters for various learning styles. -Attracts learners' attention.
Circulatory system in mammals	-Involves too many processes and terminologies. -Abstract concepts involved.	Use of an analogy	-Use of contextual cases familiar to learners. -Identifying analog and target.

	-Microscopic structures that learners cannot visualise using naked eye.		-Demystifies concepts and processes. -Mapping develops learners' understanding.
Genetics e.g. genetic disorders and diseases	-Controversial issues. -Evokes emotions in learners. -Can also be a source of stigma in affected learners in class and in communities.	Use of argumentation	-Allows learners to make informed decisions. -Creates awareness amongst normally shied away issues in society. -Helps to build rich information that may dispel misconceptions and stigmatisation.

From the analysis in Table 1, the participants identified topics that are either abstract or controversial in the sense of evoking mixed feelings in learners. Because of that complexity, the participants also identified teaching and learning strategies they considered suitable in engaging learners in meaningful interactions in the Life Sciences classrooms. In most of their choices, the use of 4IR tools were identified as useful when teachers employ most of the strategies for example demonstrations, practical investigations, and inquiry-based activities. Thus said, it means technology should always be used when teaching Life Sciences concepts in conjunction with the teaching strategy used.

Notably, the participants explained not only their reasons for choosing specific Life Sciences topics, but they also discussed the affordances of each of the identified teaching strategies in increasing interactivity during the teaching and learning process. An example is the use of demonstration as a teaching strategy which they considered suitable in catering for the different learning styles, thereby accommodating learners who have specific styles. One of the participants pointed the following:

Participant: Demonstrations provide for visual learning, auditory learning and those who learn through manipulation because the aim of it is to break down or bring theory into practice.

Another example is of illustrations, which participants considered as important in aiding memory. Picture illustration provides powerful visual tools that facilitate learning. According to the participants, illustrations help to develop learners' visual literacy, critical thinking skills and sharpen many more skills. The following are excerpts from participants' submissions:

Participant: Illustrations enhance many aspects of learning like comprehension, recall, problem solving, etc. Illustrations include diagrams and graphics which help learners understand a large amount of data using minimal and apt visual language.

Participant: Illustrations such as pictures capture the attention of the learners and make them want to know the story behind it. This is where most of the learners learn to interpret the illustrated pictures and improve their vocabulary by reading the stories that are written next to the illustrations.

The study shows that the use of illustration develops the cognitive behavior of learners by increasing their reasoning capacity.

5. Discussion

The use of 4IR tools together with other teaching strategies was found to be useful in developing creativity in learners as they engage and manipulate the technological tools in class. This finding is echoed in the findings by Henriksen, Mishra and Fisser (2016) and Mendezel and Rick (2021). The participants identified concepts they considered as controversial. These included genetic disorders and diseases, which can be a source of stigma in affected learners in class and in communities. As such the participants selected argumentation as a suitable strategy that allows learners to share, justify and oppose some beliefs and practices in an interactive learning environment. Ozdem et al. (2017) support the engagement of learners in argumentation to develop their reasoning skills.

The ability of the identified pedagogical strategies to enhance interactivity in the Life Sciences classrooms can be explained by Habermas critical social theory which emphasises the need to consider social interactions in the science classrooms. In this case, communication through discussions is of essence in enhancing learner understanding of Life Sciences concepts.

6. Conclusions and recommendations

The study sought to answer the research question: How do pre-service teachers conceptualise an interactive learning environment in the Life Sciences classrooms? The findings of the study showed the pre-service teachers conceptualised an interactive Life Sciences learning environment as that which enables learners to engage meaningfully when learning concepts that are abstract, difficult to understand, or those that evoke emotions due to them being controversial in challenging learners' belief systems or

practices. The following teaching strategies were considered to be suitable to engage learners interactively: inquiry-based teaching, use of demonstrations, investigations, illustrations, and argumentation. Such findings inform both pre-service and in-service teacher development initiatives to consider development of teachers in the use of interactive pedagogies.

Acknowledgments

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EXPLORING THE ONTOLOGICAL BOUNDARY OF METACOGNITIVE AWARENESS OF PRE-SERVICE EDUCATORS

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Abstract

The pre-service educator preparation period is crucial in developing the competencies necessary for effective educators who succeed in the classroom. Consequently, it becomes imperative for pre-service educators to develop their awareness of self-regulatory and metacognitive skills to become effective in the classroom. Therefore, the process of developing pre-service educators' metacognitive awareness is important if we are to produce self-directed learners with well-developed cognitive skills. However, the designing and development of Bachelor of Education programmes that enhances teaching with metacognition is a neglected area in higher education institutions. The concept of Ontology is applied in this presentation because it constitutes an explicit specification of a conceptualization of the levels of interpretation of metacognitive awareness. This presentation reports on part of a larger quantitative study on the relationship between metacognitive awareness, teaching perspectives, and sense of efficacy of pre-service educators. On the theoretical component, the presentation aims to explore a framework for analysing the level of pre-service educators' metacognitive awareness, building on the self-directed learning theory and its application in the context of pre-service educators. A sample of 683 pre-service educators completed the Metacognitive Awareness Inventory for Teachers. To present and describe data, mean scores, standard deviations, Cohen's effect size for interpretation of results, and Spearman's correlation coefficients to determine correlations between concepts using multiple regression analysis were calculated, this was done to determine the nature of the relationship between the constructs (variables) of metacognitive knowledge and the effect of specified contextual components such as gender, Language of instruction, Mode of delivery Programme enrolled for and Area of specialisation as well as Campus of the respondents in relation to metacognitive awareness. There are two levels of interpretation of the findings presented here: (i) the manifested component of metacognitive awareness, and (ii) the contextual components of gender, language of instruction, programme enrolled for, area of specialisation, mode of delivery, and campus. This study is of particular interest to tertiary institutions, who are charged with the task of developing educators who can influence student achievement in a positive way.

Keywords: Metacognition, metacognitive awareness, pre-service educators, ontological boundary, self-directed learning.

1. Introduction and background

Teaching is one of the careers that is considered ideal (Mundiri & Bariroh, 2019), and as such becoming an educator is "often seen as a noble profession as it strives for the country's high-quality education and establishes a foundation for the future generation" (Ingarianti et al., 2022, p. 56). To this end, pre-service educator preparation period becomes crucial in developing the competencies necessary for effective educators who succeed in the classroom. Consequently, it becomes imperative for pre-service educators to develop their awareness of self-regulatory and metacognitive skills to become effective in the classroom.

Ontological boundaries make no sense as brute items above and beyond properties and relations but make sense as subset of properties and relations (Azzouni & Azzouni, 2017). Ontology is a Greek neologism coined in early modern times, *"on"* is the present participle of Greek *"einai"* , which means "to be," and *"logos"* derives from *legein*, "to talk about" or "to give account of" something (Hennig, 2008). According to Gruber (1993, p. 1), an *Ontology* is "an explicit specification of a conceptualization" of notions that are presumed to exist in some area of interest and the relationships that hold them together. Therefore, the concept of *Ontology* is applied because it constitutes an explicit specification of a conceptualization of the levels of interpretation of the findings presented here. According to Larsen (2006, p. 2) any boundary implies at least two levels; tangible *manifestations,* and the *conditions*

(i.e., contextual components) of this manifestation. The tangible manifestations relate to things or to a given situation, and their interconnection with natural process and forces. Meanwhile, the conditions relate to theories of why and how the manifestations occur. Thus, "a boundary is a meaning-producing difference between at least two domains" (Larsen, 2006, p. 3). In line with this understanding and the results presented later, there are two levels of interpretation of the findings presented here: (i) the manifested components (i.e., metacognitive awareness components which are metacognitive knowledge and metacognitive regulation), and (ii) the contextual components (i.e., gender, language of instruction, programme enrolled for, area of specialization, mode of delivery, and campus).

The purpose of this paper is to explore the ontological boundary of metacognitive awareness of pre-service educators with the aim of designing a framework for analysing the level of pre-service educators' metacognitive awareness. The presentation reports on the nature of the relationship between the variables of metacognition (metacognitive knowledge and metacognitive regulation) and the effect of specified contextual components such as gender, Language of instruction, Mode of delivery Programme enrolled for and Area of specialisation as well as Campus of the respondents in relation to metacognitive awareness.

2. Conceptual-theoretical framework

2.1. Metacognitive awareness

According to Flavell (1979), knowledge of one's cognitive processes (or metacognitive knowledge) and awareness of one's thinking play a vital role in learning. To this end, Dunlosky and Kane (2007) indicate that metacognitive awareness supports the learning process as a necessary motivation in the learning process itself. Studies on the relationship between metacognitive awareness and student academic achievement confirm a noteworthy relationship between metacognitive awareness and student academic achievement (Erlin et al., 2020). Thus, one can conclude that metacognitive awareness plays a major role in teaching and learning.

Researchers in the field of metacognition (Jacobs & Paris, 1987; Schraw & Moshman, 1995; Efklides, 2001; Tanner, 2012; Doyle, 2013) operationalized metacognition as having two main variables: metacognitive knowledge (knowledge of cognition) and metacognitive regulation (regulation of cognition).

- *Knowledge of cognition*, meaning the extent to which the learner knows (i) how they learn and what influences their performance (*declarative knowledge*), (ii) different strategies and procedures that can be used to solve problems (*procedural knowledge*), and (iii) when and how to use these strategies (*conditional knowledge*).
- *Regulation of cognition*, which includes (i) *planning*, i.e., activating prior knowledge, setting goals, and selecting appropriate strategies, (ii) *monitoring*, i.e., checking how well the learning processes and strategies used are, and (iii) *evaluation*, i.e., checking the outcomes of one's learning.

Metacognitive knowledge, which is an awareness of one's thinking, "occurs consciously and deliberately when the teaching-learning content and the knowledge about the thinking process involved coincide (Jagals, 2021, p. 131) Meanwhile, metacognitive regulation, which describes the ability to manage one's own thinking processes, (Taasoobshirazi & Farley, 2013; Adagideli et al., 2015), "involves the actions that arise from the intentional thinking of metacognitive knowledge" (Jagals, 2021, p. 132).

2.2. Self-directed learning as standard theory

The study is underpinned by Self-Directed Theory as a standard theory, which is appropriate for this study as it promotes Lifelong learning skills and encourages reflective practice (Bosch, 2019). Self-directed learning as a teaching and learning approach has been studied since the publication of a book entitled *Self-directed learning: A guide for learners and teachers* by (Knowles, 1975). Since then, this concept has gained wider interest as researchers and policy makers world-wide have advocated for empowering learners with metacognitive awareness, self-regulation, and knowledge of the learning process skills to promote lifelong learning. Knowles (1975, p. 18) defined Self-Directed Learning (SDL) as "a process in which individuals take the initiative, with or without the help of the others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes". Therefore, SDL is "an approach to education where learners take responsibility for their own learning" (Bosch, 2019, p. 2). In line with the SDL approach to teaching and learning, pre-service educators could benefit significantly if they are taught the skills to identify their own learning needs, how to formulate learning goals, and how to choose appropriate learning strategies and even evaluating their own learning.

3. Research paradigm and approach

This study utilized the post-positivism paradigm and a qualitative research approach. The choice of this research paradigm and approach was informed by Creswell and Creswell (2017) who argue that the post-positivist assumptions apply more to quantitative research than to qualitative research.

4. Population and sample

The target population for this study was the pre-service educators registered for a Bachelor of Education degree in the Foundation Phase, Intermediate Phase, Senior Phase and the Further Education and Training Phase at one University with three campuses across the North-West and Gauteng Provinces of South Africa.

For this study, a stratified purposeful sampling scheme was used as it "increases sample representatives by dividing the study population into strata based on characteristics that are of interest to the researcher" (Howell et al., 2020, p. 2). This is a sampling scheme whereby a "sampling frame is divided into strata to obtain a relatively homogenous subgroup and a purposeful sample is selected from each stratum" Collins et al. (2006, p. 85). For example, in the case of this study, the target population was organised according to campus and programme enrolled (Foundation phase, Intermediate phase, and Senior/ Further Education training phase).

5. Data collection

Data was collected through a close-ended online questionnaire, the Metacognitive Awareness Inventory for Teachers (MAIT) by (Balcikanli, 2011). The questionnaire was typed into a google form, the researcher then identified generic modules and the link to the questionnaire was uploaded on eFundi site by an independent person.

6. Reliability

Reliability in a research study refers to "the extent to which a measuring instrument is repeatable and consistent" (Pietersen & Maree, 2019, p. 260). In this study, the researcher used standardised questionnaires (MAIT) that had already gone through rigorous reliability and validity tests in previous studies. The Cronbach's Alpha reliabilities values for this inventory vary from 0,79 to 0,85, indicating that the inventory displays high alpha scores (Balcikanli, 2011).

7. Data analysis

The services of a statistician were employed to use the Social Packages for the Social Sciences (SPSS) in the analysis of data. Data was converted from Google sheets into Microsoft Excel. To present and describe this data, mean scores, standard deviations, Cohen's effect size for interpretation of results, and Spearman's correlation coefficients to determine correlations between concepts using multiple regression analysis were calculated.

8. Results and discussion

The following table outlines the manifested components and provides a summary of the inter-item correlations means, and the Cronbach values for the MAIT.

Table 1. Manifested components: summary of inter-item correlation means, and the Cronbach Alpha values for the Metacognitive Awareness for Teachers Inventory.

Variable	Perspective	Inter-item correlation means	Cronbach Alpha
Metacognitive Knowledge	Declarative knowledge	0,304	0,636
	Procedural knowledge	0,317	0,645
	Conditional knowledge	0,291	0,620
Metacognitive regulation	Planning	0,329	0,654
	Monitoring	0,319	0,651
	Evaluation	0,363	0,694

The results presented in the table above illustrate that the inter-item correlation means for metacognitive knowledge ranges between 0,291 and 0,317, whilst the inter-item correlation means for metacognitive regulation ranges between 0,319 and 0,363. Meanwhile, the overall inter-item correlation means for MAIT items ranges between 0,291 and 0,363. This suggests that the items for the metacognitive awareness inventory are well correlated and can be used for further analysis. The Cronbach Alpha reliabilities for MAIT are as follows, 0,620 – 0,645 (metacognitive knowledge) and 0,651 – 0,694 (metacognitive regulation). The overall Cronbach's Alpha ranges between 0,620 (metacognitive knowledge-conditional and 0,694 (metacognitive regulation-evaluation), indicating Cronbach Alpha values equal to 0,70. According to Gil-Gómez et al. (2017), this implies a high level of consistency of the inventory.

Figure 1. Ontological boundaries: Manifested and contextual components.
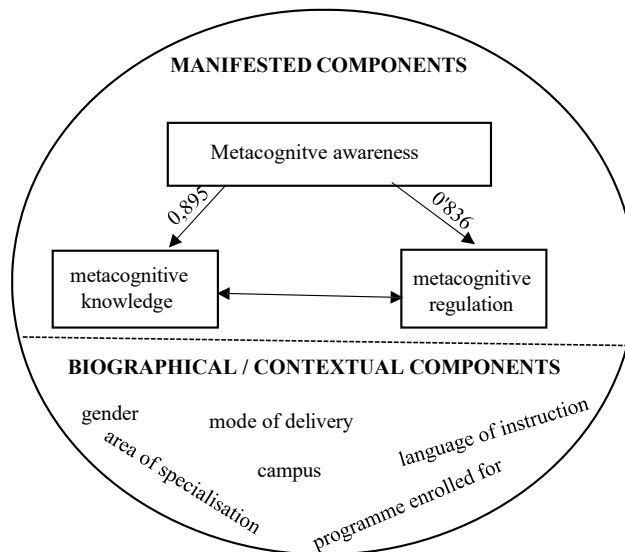
Figure 1 is a depiction of the reality as (co)-constructed by the respondents in this study. It illustrates a direct and/or indirect relationship between the manifested and contextual components. The manifested components stand in relation with one another, because one component can cause or affect the other, the relationship is therefore mediated. The mediated relationships were determined through correlations, whereas the conditions of these were measured by effect sizes.

9. Findings

There is an implicit relationship between the manifested and the contextual components as observed from the effect sizes. This suggests that contextual factors such as age, language of instruction, area of specialization, programme enrolled for, campus affiliation, and mode of delivery play a role in the pre-service educators' metacognitive awareness.

10. Conclusion

The development of pre-service educators' metacognitive awareness skills can contribute to the promotion of self-regulated learning. This suggests that pre-service educator programmes should be underpinned by pedagogies that enhance metacognitive awareness skills which will contribute to the promotion of self-directed learning.

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SPECIFIC COMPETENCIES OF STUDENT TEACHERS: IDENTIFICATION OF PROFESSIONAL EDUCATIONAL NEEDS

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Abstract

This study aimed to explore how student teachers assess the extent of their acquired specific competencies during their studies (acquired competencies) and their need for further acquisition of these competencies (necessary competencies) and to determine the relation between their achieved success in the chosen field of study and their real educational needs. Teachers' competencies are one of the determinants of orientation and readiness for professional learning and development, and self-assessment of competencies acquired during studies is an indicator of the quality of the study programme. The research focuses on identifying and analysing the educational needs of student teachers based on a self-assessment of their acquired and necessary specific competencies in the areas of learning and teaching, classroom management, assessment, inclusion and community action. The questionnaire was developed based on the theoretical construct of the Global Teachers' Key Competences Framework (TKCOM (2018)), which consists of 28 items. The study was conducted on a purposive sample of N=26 student teachers in their final year of teacher education at the Faculty of Teacher Education, University of Rijeka, Republic of Croatia. The results of the descriptive analysis made it possible to measure educational needs from two aspects: acquired and necessary specific competencies. On average, student teachers assessed their acquired competencies higher in the area of learning and lesson planning and lower in the areas of inclusion and community action. Student-teachers' self-assessed competencies indicate a pronounced need for further acquisition of specific competencies to a very high degree in all competence areas. The identified educational needs relate in particular to supporting students with difficulties and gifted students during the learning and teaching process, as well as to cooperation and collaboration with families, professionals, the school and the community. The results show that prospective teachers must acquire competencies to respect students' diversity and interculturality, provide them with equal educational opportunities and build effective relationships with families, colleagues and other community organisations. The results are valuable indicators of student-teachers' educational needs in the area of specific competencies as a first step in the methodological process of improving the teacher education programme. In addition, the results form the foundation for developing a curriculum for continuing professional development/learning based on the analysis of professional development needs, conditions and opportunities as critical factors for improving teachers' specific competencies.

Keywords: Student teachers, educational needs, specific competencies, competence dimensions, professional development.

1. Introduction

One of the fundamental questions that should be continuously asked and answered is: Why is it important to research educational needs in the area of teachers' professional competencies? The Republic of Croatia, like other countries, is undergoing significant changes in its educational landscape. Teachers are responsible for expanding the boundaries of professional knowledge and systematically engaging in continuing professional development (Čepić et al, 2019). Teachers' competencies are one of the determinants of orientation and readiness for professional learning and development, and self-assessment of competencies acquired during university studies is a kind of indicator of the quality of the study programme. There are different competence models, and according to the Global Teachers' Key Competencies Framework (TKCOM, 2018), key primary education teachers' competencies are organised into two main types: specific and cross-curricular. The specific competencies that are explored in this paper according to this theoretical model are classified as characteristic of the teaching profession, while cross-curricular competencies is understood as a competence that is necessary for the comprehensible development of the individual, that is, it provides learning that is necessary in all professional fields

(p. 7). In her analysis of the approaches to the research of educational needs, conditions, and opportunities and their relationship as the most critical factors for the planning of teachers' professional development, Čepić (2020) calls for their continuous research and curriculum planning for teachers' professional development based on the obtained findings. As Čepić and Pejić Papak (2021, p. 97) emphasised, "Raising the quality and efficiency of education depends on teachers' professional development – initial education and continuing professional development – and requires the highest level of professional competence that a teacher can achieve." The continuous development of teachers' competencies is necessary "because only a competent teacher can develop the competencies that the students will need to integrate themselves and successfully engage with their environment" (Blanuša Trošelj et al., 2021, p. 75).

With this in mind, this paper aims to explore how student teachers assess the extent of their acquired specific competencies during their studies (*acquired competencies*) and their need for further acquisition of these competencies (*necessary competenc*ies) and to determine the relation between their achieved success in the chosen field of study and their real educational needs. On average, student-teachers are expected to provide higher assessments for each examined statement when assessing the need for further acquisition of specific competencies than when assessing the level of acquired specific competencies during their studies. Also, there is expected to be a connection between the students' socio-demographic characteristics (success in studies) and the participants' educational needs, whereby students with lower success in studies will express more significant educational needs.

2. Methodology

2.1. Participants
This pilot study included (N=26) student-teachers (all female, age range 22 to 28 years, M=23.44, SD=1.15) who were enrolled in their final academic year of teacher education studies at the Faculty of Teacher Education, University of Rijeka, Republic of Croatia. In this convenient sample, 73% (N=19) of student-teachers graduated from grammar school, and 27% from secondary vocational school before enrolling in the studies. For 46% (N=12) of participants, Teacher Education studies were the first choice when enrolling in tertiary education, and for 54% (N=14), it was not the first choice. The achieved average of student-teachers' success in the studies was (M=4.27, SD=0.37), with (min=3.4, max=5.0).

2.2. Instrument for data collection
A questionnaire was developed based on the theoretical construct of the Global Teachers' Key Competences Framework (TKCOM, (2018, pp. 7-10). The competencies which have been classified as specific are characteristic of the teaching profession and include the following five areas: Planning (Teaching practice – innovative, varied and dynamic tasks/Knowledge of the pedagogical content), Classroom Management, Assessment, Inclusion (Inclusive attitude), and Community Action (Cooperation and collaboration with families). Based on each area's descriptive elements, a questionnaire consisted of two columns with 28 identical statements. For each item, student-teachers assessed on a 5-point Likert scale (from *1 – not at all* to *5 – very much*) to what extent they have acquired competencies in the mentioned areas during their studies (first column) and their need for further acquisition of competences in the mentioned areas (second column). We relied on the functionalist approach to examining educational needs (Čepić, 2020; Čepić & Tatalović, 2021), according to which educational needs are considered as a measurable difference between the existing and the desired or necessary state. This covered the first dimension of the examination of educational needs at the empirical level, which consists of identifying the level of (inadequate) satisfaction of the participants' educational needs and the second dimension of the examination of educational needs at the empirical level, which is a self-assessed need for further acquisition of competencies with regard to each specified area (aspiration level). The two parallel columns were created to measure educational needs by calculating the difference between the participants' answers in the "I have acquired" column and the "I need" column. In this way, educational needs are operationally determined and represent the foundation for further consideration and analysis of the researched problem (third column in Table 1). Each specific competence assessment was calculated as the mean value of the corresponding statements. This paper presents part of the research results on descriptive and correlational analyses of self-assessed specific student-teacher competencies. The following research stage involved determining the basic metric characteristics of this instrument and whether this questionnaire, based on the theoretical construct TKCOM (2018), can be generalised to the Croatian educational context.

2.3. Procedure and Data Analysis

Before conducting the study, we explained the purpose of the study to the participants and asked them to participate, explaining that they could withdraw from the research at any time. Data were collected via an online questionnaire through the open-source tool LimeSurvey at the beginning of February 2024. The survey was group, voluntary, and anonymous, and it was conducted at the end of the first semester of the final year of Teacher Education studies in an IT classroom. Descriptive and correlational analyses were carried out with SPSS 24. In the statistical data processing, a descriptive statistical analysis was applied to assess student-teachers' acquired and necessary competencies and Spearman's correlation coefficients to examine the relationship between student-teachers' success in studies and their educational needs.

3. Results and discussion

Table 1 shows the descriptive data regarding the assessment of the specific competencies acquired during the study programme, the need for further acquisition of these competencies and the real educational needs.

Table 1. Descriptive statistics for the assessment of student-teachers' acquired and necessary competencies and educational needs.

CODE	STATEMENT	$M_1 (SD_1)$	$M_2 (SD_2)$	$M_3 (SD_3)$
SC_23	Support students with learning, behavioural, emotional or socio-economic difficulties and gifted students in the learning and teaching process.	2.923 (1.164)	4.615 (0.804)	1.704 (1.589)
SC_27	Collaborate with other organisations in the community and the school environment and foster the relationship between the school and its environment.	3.077 (1.197)	4.423 (0.758)	1.407 (1.338)
SC_21	Plan teaching and assessment to meet students' needs, taking into account their different origins, abilities, interests, families and communities.	3.577 (0.987)	4.500 (0.762)	1.000 (1.414)
SC_26	Collaborate with colleagues to recognise the diverse needs of students and provide support that is aligned with the principles of inclusive education.	3.538 (1.174)	4.385 (1098)	0.889 (1.695)
SC_20	Respect student diversity and interculturality by providing equal educational opportunities.	3.615 (1134)	4.346 (0.977)	0.852 (1.725)
SC_19	Inform parents about assessment results and their children's progress and difficulties in the learning process.	3.538 (1.272)	4.269 (0.962)	0.815 (1.798)
SC_24	Involve the family in educational activities and decision-making for the progress and well-being of their children.	3.500 (1.334)	4.269 (0.874)	0.815 (1.688)
SC_11	Encourage the teaching practice in the classroom context, according to the learning situations, to create opportunities for accidental learning and intrinsic motivation.	3.654 (1.056)	4.385 (0.941)	0.741 (1.430)
SC_18	Adapt assessment strategies to the different characteristics of students.	3.808 (1021)	4.385 (0.941)	0.556 (1.450)
SC_28	Participate in the school's planned educational activities.	3.885 (1.211)	4.269 (1.185)	0.407 (1.907)
SC_22	Encourage autonomous learning by overcoming barriers to achievement.	4038 (0.916)	4.154 (1.255)	0.259 (1.873)
SC_10	Manage group dynamics in the classroom that fosters inclusiveness and overcoming conflicts in a constructive way.	4.000 (0.894)	4.192 (1.059)	0.185 (1.520)
SC_17	Provide effective verbal and written feedback to students on the achievement of learning outcomes.	4.038 (0.871)	4.192 (1.059)	0.148 (1.379)
SC_25	Develop a professional, collaborative relationship to work with colleagues.	3.885 (1.366)	3.962 (1.371)	0.111 (2.025)
SC_15	Use summative assessment that contributes to ensuring the quality of the learning and teaching process.	4.077 (0.796)	4.038 (1.148)	0.074 (1.615)
SC_16	Use of different assessment methods, strategies and tools.	4.231 (1032)	4.308 (1.123)	0.074 (1.639)
SC_08	Facilitate students' experiential learning through the application of curriculum principles (understanding specific areas of teaching subjects, research, collaboration and communication).	4.038 (0.871)	4.00 (1.058)	0.000 (1.074)
SC_13	Evaluate applied organisational and didactic approaches that differ from traditional classroom approaches.	4.038 (0.871)	4.00 0 (1.265)	-0.037 (1.652)
SC_14	Use formative assessments to improve the learning and teaching process.	4.038 (0.916)	4.115 (1.143)	-0.037 (1.506)
SC_02	Encourage creative problem solving.	4.231 (0.514)	4.115 (1.243)	-0.111 (1.368)
SC_01	Identify student needs to select methods and strategies of learning and teaching that contribute to the achievement of educational outcomes.	4.192 (0.694)	4.038 (1.113)	-0.111 (1.396)
SC_07	Implement the basic didactic-methodical knowledge of the teaching profession at the appropriate teaching level and programme by linking and integrating teaching topics.	4.192 (0.801)	4.077 (1.017)	-0.111 (1.34)

		M1	M2	M3
SC_03	Use of resources and didactic materials that support profound learning/deep learning.	4.038 (1076)	3.885 (1.177)	-0.148 (1.725)
SC_09	Develop collaborative relationships based on trust (teacher-student and student-student).	4.269 (0.874)	4.038 (1.280)	-0.222 (1.601)
SC_06	Consider students' prior knowledge to plan learning and teaching strategies that support quality learning.	4.154 (0.732)	3.885 (1.366)	-0.259 (1.583)
SC_04	Introduce innovations into own teaching practice (e.g. new methods, multimedia, etc.).	4.269 (0.667)	3.962 (1.148)	-0.296 (1.564)
SC_12	Organise space, time and forms of work to promote student learning, interaction and communication	4.192 (0.939)	3.885 (1.336)	-0.296 (1.683)
SC_05	Encourage students to actively participate in the learning and teaching process.	4.500 (0.762)	3.923 (1.262)	-0.556 (1.553)

Legend: CODE: Specific Competence (SC1-28); DIMENSIONS: Planning (SC1-SC8); Classroom management (SC9-SC13); Assessment (SC14-SC19); Inclusion (SC20-SC23); and the Community Action (SC24-SC28).; M1 –acquired competencies; M2 – necessary competencies; M3 - real educational needs

Average assessments of existing specific competencies varied from 2.923 to 4.500, with the lowest average score for supporting students with disabilities and gifted students and the highest for encouraging active student participation in the learning and teaching process. In most cases, the average assessment results were above the value of 3.500, except for the areas of inclusion and cooperation with different organisations/associations/institutions from the community. Although the average assessments are somewhat lower for the mentioned statements, overall, the statements for the acquired competencies were high to very high for all areas. These findings provide insight into the perception of student-teachers about the competencies acquired during their studies and indicate a generally high degree of satisfaction with acquired competencies, except in the areas of inclusion and community action.

The results of the average assessment of the needs for further improvement of competencies varied between 3.885 and 4.615, with the highest assessed needs being related to support for students with difficulties and gifted students. Although it was expected that student-teachers would assess a higher level of the need for further improvement of competencies than the level of acquired competencies during their studies, the results showed the opposite. Specifically, in the areas of planning, classroom management, and assessment, students assessed that they have achieved a higher level of competence than what they think warrants further training. This discrepancy between the perceived level of acquired competencies and the assessed needs for further training provides an important insight into their perception of their own competencies and needs for professional development.

The results of the assessment of real educational needs indicate needs in the field of Inclusion (SC_23, SC_21, SC_20) and Community Action (SC_27 and SC_26). Although it was expected that student-teachers would give a higher average assessment for each examined area when assessing the level of the need for further acquisition of specific competencies than when assessing the level of acquired specific competencies during studies, this was not confirmed with the overall area of Planning (SC 1-8), on statements SC_13, SC_09, SC_12 from the area of Classroom Management, and on statement SC_15 from the area of Assessment. Namely, student-teachers assessed the level of specific competencies acquired during their studies as higher than the expressed need for further acquisition of competencies. Interestingly, in the study conducted in Latvia (Āboltiņa et al., 2024), students self-assessed their competencies of learning process planning relatively high, based on which it could be concluded that future teachers have sufficiently developed the competencies mentioned above. However, as pointed out in the study, "focus group participants pointed to the fact that this evaluation could be misguided; many teachers start to work in school parallel to their studies, and therefore their views on lesson planning could be based on their experiences as students rather than the latest research findings" (pp. 3-4). In the Croatian educational context, teachers start working after obtaining a master's degree in primary education; hence, the results cannot be interpreted in the manner mentioned in the previous study, and the views on acquired competencies during studies could be based on their experiences during school and methodical practice. In order to help students in modern teaching to learn independently in the process of active learning, an environment must be provided in which "teaching is characterised by a stimulating classroom atmosphere, where the teacher has positive attitudes towards students' success and adapts learning activities to fit student abilities and interests" (Pejić Papak et al., 2021, p. 503).

The correlation analysis (Spearman's correlation coefficients) has shown that success in studies is negatively related to most educational needs, which means that the higher the success in studies, the lower the educational needs in most cases. In short, students achieving greater academic success often demonstrate a greater need for active participation, experiential learning, collaborative relationships, and creative problem-solving in class. Considering the values of the correlation coefficient (rho), which are between -0.410 and -0.501, the correlation can be described as medium to strong. The results suggest a significant relationship between success in studies and educational needs, which means that students with higher success in studies are often less inclined to express specific educational needs.

4. Conclusions

On average, student-teachers assessed their acquired competencies higher in the area of learning and lesson planning but lower in areas such as inclusion and community action. Their self-assessment highlights a significant requirement for further developing specific competencies across all areas. The identified educational needs primarily revolve around supporting students with diverse needs, including those who face challenges and those who are gifted, throughout the learning and teaching process. Additionally, there is a need for improved collaboration with families, professionals, the school, and the broader community. The findings underscore prospective teachers' need to acquire competencies in respecting student diversity, promoting intercultural understanding, ensuring equal educational opportunities, and fostering effective relationships with families, colleagues and community organisations. Correlation analyses indicate that students achieving higher academic success also exhibit fewer educational needs, particularly in the area of planning. These results serve as valuable pointers to the educational requirements of student teachers concerning specific competencies, marking the initial phase in enhancing the methodology of teacher education programmes. The limitation of this pilot study is its small sample. However, the results have revealed valuable findings for identifying and analysing educational needs as the first step in the methodological process of developing the curriculum of student-teachers' continuing professional education. These findings are essential for everyone who participates in the process of lifelong teacher training in order to create higher-quality curricula by introducing different forms of education (for example, micro-qualifications, lifelong learning programmes, etc.) that acquire new and improve existing specific competencies.

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COLLABORATIVE MATHEMATICAL PROBLEM-SOLVING WITH CHILDREN: AN ILLUSTRATION OF SHARED AND SELF-REGULATION IN INITIAL TEACHER TRAINING

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Abstract

This presentation aims to examine the perceptions of kindergarten and primary student teachers regarding shared regulation and its influence on nurturing these skills in children, namely, when solving mathematical problems. We will focus on the first phase of shared regulation, the "preview of the formative process". This study involved five students pursuing a master's degree in preschool education and primary teaching, along with the respective groups of children they worked with in internship contexts. Given the qualitative nature of this exploratory study, which involved different methods and techniques – focus groups and training narratives -, data analysis is descriptive and interpretive. The results indicate that students identify facilitating aspects in the shared regulation of tasks, with group support playing a relevant role. They also consider that the kindergarten or the primary teacher can intervene, having an active role in the promotion of these competencies, insofar as they can create conditions for children to learn to solve mathematical problems together.

Keywords: Shared regulation, self-regulated learning, training narratives, solving mathematical problems, initial training of kindergarten and primary teachers.

1. Introduction

In these unpredictable times of rapid societal and economic change, pedagogical innovation is crucial—not as an end, but to enhance learning. Adopting educational approaches that engage learners and develop competences such as information-seeking, knowledge appropriation, and problem-solving is essential. Shared regulation is vital in collaborative learning, enabling learners to develop self-regulatory competences through interaction. Education systems should emphasize these skills with intentional curriculum changes, new teaching models, and innovative pedagogical practices. In math, shared regulation fosters interaction and collaboration, enhancing understanding of concepts and encouraging critical thinking and collective knowledge construction. Involving future teachers in instructional cycles is challenging but necessary. To help learners use their resources effectively, future teachers must learn strategically, incorporating self-regulation and shared regulation principles into their training (Veiga Simão & Frison, 2013). Deepening our understanding of these topics can enhance future teachers' ability to promote learners' self-regulatory processes, both during their initial training and in their subsequent teaching practice.

2. Mathematical problem solving, self-regulation of learning and shared regulation in a collaborative context in initial training

According to authors Järvelä and Hadwin (2013), regulating learning is the most important competence in collaborative learning, because working together means co-constructing representations of shared tasks, setting shared goals and devising shared strategies. It also means having to regulate learning by monitoring shared metacognition, such as by controlling motivation, cognition and behaviour. Shared regulation then refers to the collective processes that occur when individuals interact and collaborate with each other to achieve a common goal. For this reason, one of the main characteristics of shared regulation identified in the literature refers to how it occurs in collaborative work. Thus, what stands out most in the way groups work is the articulation between cognitive and metacognitive regulation strategies (planning), motivational efforts and the group's emotional regulation (Panadero, Klug, & Järvelä, 2015). On the other hand, these strategies and efforts are regulated together so that the goal of collaborative learning is

fulfilled, and the principle of collaborative work is to provide a social context in which new knowledge can be created.

The characteristics inherent in collaborative work will allow members to develop not only their self-regulation skills through interaction and mutual support within the group, but also to help with what they bring to the group, thus developing collectively regulated learning. Sharing ideas and accepting others as professionals leads to new experiences that teachers might not have had access to on their own and closed off in their own universe (Cadório & Veiga Simão, 2013).

Regarding the regulation of collaborative learning, when members work in groups, at least three types of learning regulation come into play. Thus, for collaborative learning to be successful, each person needs to be responsible for regulating their own learning (i.e. self-regulation of learning), each person needs to support their colleagues so that they can successfully regulate their learning (i.e. co-regulation of learning) and each person needs to support their colleagues so that they can successfully regulate their learning (i.e. co-regulation of learning)and, finally, to achieve success in collaborative work, the group together regulates learning processes in a synchronized and productive way, sharing representations and establishing a common learning goal (i.e. shared regulation of learning) (Jeong & Hmelo-Silver, 2016). Since collaborative work appears to be a favourable context for the development of shared regulation of learning, there is an urgent need to explore it further in teacher training, particularly in the teaching and learning of mathematics in the early years. Mathematical problem solving based on self-regulation and shared regulation has emerged as a powerful teaching and learning tool for both learners and teachers. This approach encourages learners to become actively involved in problem solving, while the teacher acts as a facilitator and guide in the process. During shared regulation, learners are encouraged to express their ideas, raise questions, and collaborate with their colleagues, promoting the collective construction of knowledge.

This methodology puts learners at the centre of the teaching and learning process, allowing them to develop competences, including transversal mathematical skills in line with the new essential learning in mathematics, critical thinking, problem-solving and mathematical communication (Canavarro et al., 2021). By sharing resolutions with each other, learners analyse different approaches/strategies, discuss their options, and reflect on the different processes used. In addition, self-regulation and shared regulation encourage metacognition, i.e., learners' ability to monitor and evaluate the way they think, identify their difficulties, and implement self-regulation strategies to overcome them.

3. Methodology

3.1. Type and relevance of the study

This exploratory study of a qualitative nature with descriptive and interpretative data analysis is part of initial teacher training in which future teachers, in the context of supervised teaching practices, are challenged to co-construct strategies to achieve a common and shared goal, where in the process they are able to jointly regulate shared tasks, more specifically tasks in the field of transversal mathematical skills and consequently develop self-regulatory learning competences.

3.2. Research questions and objectives

Hargreaves (2003) makes a convincing case for the need to create opportunities for teachers to become knowledgeable professionals, orientated towards research processes, attentive to the problems of practice and able to identify the means and evidence needed to promote a culture of producing and sharing knowledge.

Therefore, this study seeks to analyse how future teachers perceive shared regulation and how, based on experience in the context of pedagogical practice, they promote these skills in children, particularly when solving mathematical problems that are proposed to children. The aim is also to analyse how apprentices in initial training jointly regulate the shared tasks to be implemented and how they support each other, to answer two questions:

How do future teachers perceive shared regulation and self-regulation of learning?

How does the experience of shared regulation in supervised teaching practice promote competences related to solving mathematical problems in a collaborative context in pre-school and primary education?

3.3. Context and participants

This study involved five 1st year learners in the master's programme in Pre-School Education and Primary School Teaching as part of their Supervised Teaching Practice.

3.4. Data collection and processing processes

3.4.1. Instruments. The instruments used to collect data in this study were focus groups and training narratives. The focus group is a research technique that involves the interaction of a group of representatives from a specific population to discuss a predetermined topic, under the guidance of a moderator. This approach makes it possible to capture a variety of perspectives and processes related to the topic in question, quickly identifying similarities and differences between the participants. Composed of a moderator, an assistant moderator, and a variable number of participants, usually between six and seven, the focus group is a type of interview that seeks to obtain meaningful information within the context of the group's interaction (Amado & Ferreira, 2017). In the context of master's programmes in teaching in Portugal, training narratives from internship reports play a crucial role in the training of future teachers. These narratives allow for in-depth reflection on teaching practices, the development of research skills and a contextualised understanding of the educational reality. They are also a valuable tool for the self-analysis and professional improvement of future teachers (Dias & Pinho, 2020).

3.4.2. Data collection procedure. In this study, a methodology was co-constructed with a group of learners in initial teacher training, focused on promoting self-regulation of learning in children, called "observing and reflecting by narrating in strategic cycles of self-regulated action" (Piscalho, 2021). This method involved collaboration between the participants over a period, based on the idea of shared regulation, mobilising reflective and self-regulation skills, such as planning strategies, action plans, and evaluation, as described by Swartz et al. (2013) as reflective autonomy. In summary, this study was inspired by the self-regulated learning model to describe the participants' collaborative involvement in cycles of instructional change (Zimmerman & Schunk, 2011).

Figure 1. Spiral of strategic cycles of self-regulated action in research.
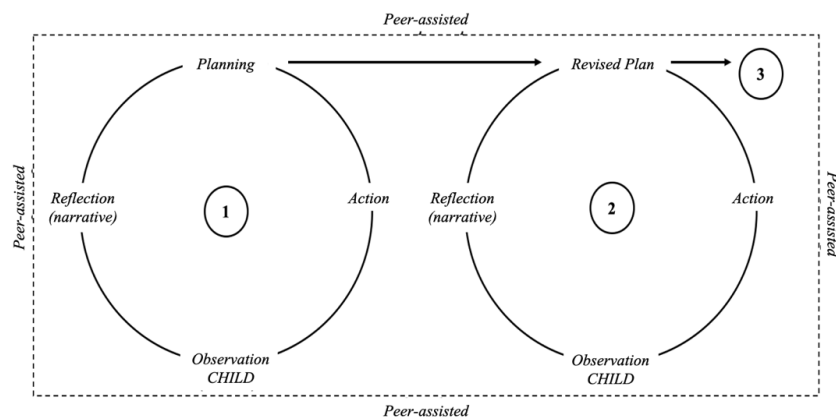
The spiral of cycles adopted in this study covers the stages of planning, action, observation, and reflection, centered on the interaction between the social and the individual, differentiating it from models of self-regulation that are more focused on the individual. The methodology aims for a dynamic between social and individual learning, influencing the participants' pedagogical practices with the children (Piscalho, 2021). Shared regulation is essential in this process, where group members regulate their collective activity in an interdependent way, sharing strategies, monitoring, evaluation and motivation. This approach is not limited to investigating problems, but seeks effective interventions, approaching action research and allowing flexibility and dynamism throughout the process. The internship participants' investigative process began with the focus group and the training narratives.

3.4.3. Data processing procedure. The purpose of data processing in this study was to analyse and interpret the content of a set of textual data systematically and objectively. This data analysis involved content analysis based on Bardin's (1977) approach. In this context, it is also planned to triangulate the data being collected at different points in the research and using different instruments, thus enabling confirmation and/or validation of the results obtained. We consider that triangulation allows for a comprehensive and robust approach, providing a more complete view of the results and consequently of the study's conclusions.

3.5. Data collection and processing processes

Shared regulation proves to be a crucial element in collaborative training, offering opportunities to develop self-regulatory skills through interactions with others, while at the same time playing a fundamental role in stimulating collective learning.

> *"I think I'll feel more accompanied in the supervision process, having the opportunity to evolve in a collaborative way." (participant A)*

> *" By better understanding the effects of self-regulation on learning, we will be more committed to teaching these skills to children in this age group. This way we'll become more aware of the processes we use when we teach." (participant B)*

It is remarkable to observe how, faced with a challenge, future teachers collaboratively construct possible pedagogical approaches. An example of this is the challenge faced during the distribution of biscuits to the children, a mathematical problem of equitable sharing in the kindergarten context.

> *"I'd probably choose a child and give them the bag of biscuits and say: now we're going to have to distribute biscuits to all the children and if there are any left-over, we'll give them out again and then we'll see how many biscuits each child got. [The leftover biscuits] could be left over for the next day or I could hand them out again and some children could eat more than others." (participant A)*

We believe that training processes based on collaborative learning communities, aimed at improving teaching practices and the quality of student learning, can generate valuable knowledge for maths teaching. The methodology centered on collaborative processes presupposes joint decision-making, information sharing and communication, where the participants, without hierarchy, work together to achieve common goals. Based on a shared task, the future teachers plan to follow an action plan, monitoring progress and collectively evaluating the results obtained.

> *"In terms of self-regulation, it's important to practise the stages of anticipation, monitoring and evaluation with the children. How are we going to do it? What have we already done? Did it go well or badly? It's important that they actively participate in this process of reflection." (participant B)*

> *"By sharing ideas with each other, we can reach conclusions more easily than if we were alone. It's the same with the children. For example, I think a lot about how they think. Sometimes, instead of giving direct answers, we must respond with questions to stimulate their thinking. Everything is connected, it's a cycle." (participant C)*

> *"When we learn on our own, we start to develop a voice in our head that guides us, remembering previous experiences and helping us to improve. It's similar to children. A secure, self-regulated child is able to fulfil their needs and interests, which often translates into success at school and personal development." (participant E)*

The results highlight the importance of this collaboration for the personal, social and professional development of future teachers. The exchange of ideas between participants with different competences was extremely beneficial, breaking down the isolation often felt in individual contexts. The results also indicate that the participants, feeling supported by their colleagues, are better able to regulate the group's activities, making collaborative work a positive experience. However, some challenges were also highlighted, such as false collaboration, which occurs when working together with interests without a common sense of action, and the lack of time for collaboration and reflection.

> *"This collaborative work will have implications for our practice... this relationship between theory and practice, through shared reflection and discussion, the questioning of practice together alongside the development of our research." (participant A)*

> *"Dialogue, trust and negotiation are fundamental. I even feel safer to take risks, to share my fears and insecurities." (participant C)*

> *"Collaboration provides joint learning, sharing experiences, triggering shared reflection and greater security in our teaching practice." (participant D)*

It is essential to emphasise the importance of teachers playing a leading role in the training of their colleagues. There will be no significant changes if the teacher training communities and the teachers and future teachers themselves do not become more permeable and involved. Through pedagogical movements or communities of practice, a sense of belonging and professional identity is reinforced,

which are fundamental for teachers to assimilate the processes of change and transform them into concrete intervention practices.

> *"It's easier to learn this way. I get very shy when it's individual, but in a group, it gives me some confidence. We learn and become much more confident in the process of practice and research, it makes me feel more comfortable to talk and discuss ideas." (participant A)*

> *"I think that when we're learning in a shared and collaborative way, and even the issues of self-regulation of learning... We have to discuss ideas and, by discussing ideas, we deepen the learning and concepts we already had." (participant C)*

> *"By questioning together, by thinking about our thinking and our actions, we are promoting our self-regulation... We're also working on this skill in ourselves. The five of us are regulating ourselves." (participant E)*

4. Conclusions

Shared regulation, involving self-regulation influenced by group support, occurs in collaborative groups and this research has enhanced our understanding of its role in initial and ongoing teacher training. It develops essential skills for (future) teachers to handle collaborative work challenges, fostering creativity and autonomy in problem-solving. Collaborative work is a valued learning resource in education (Ministério da Educação, 2017). Promoting peer support helps regulate shared tasks, making collaborative work an effective learning opportunity. This participant experience should extend to their groups of children in pre-school and primary school. Future research will delve deeper into participant narratives and subsequent stages.

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THE NATURE OF LEARNING TASKS FROM PERSPECTIVE OF CHILDREN FROM MARGINALISED ROMA COMMUNITIES

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Abstract

The Slovak Republic is a country of permanent or temporary residence for many nations and ethnic groups. The dominant language in schools is Slovak and although members of national minorities have the legal right to be educated in their mother tongue, this is not the case. The most controversial group is children from marginalised Roma communities, whose mother tongue is different from that of the majority society. The different living conditions that characterise their environment and the high degree of segregation from the majority affect their cultural experience. When entering institutionalised education, they face failure and misunderstanding. The complex language of school can affect their adaptation to school, as well as their success. Statistics show that these children often repeat the first year of school. Based on these facts, we decided to investigate the nature of language, which, according to sociocultural theory, is a fundamental determinant of a pupil's cognitive development. The object of analysis is the textbooks for the first two years of primary education. We aim to identify the most frequent words in the written lessons and to assess their potential comprehensibility from the perspective of children living in marginalised Roma communities. The results indicate the validity of the basic thesis of the French sociologist Pierre Bourdieu's theory of cultural reproduction. It seems that the dependence of school performance on the socioeconomic situation of the pupil's family, which has been repeatedly demonstrated in PISA measurements, may be related to the inability of the school to adapt the language to the needs of children whose linguistic code is underdeveloped. The research findings provide a basis for the development of an effective language programme for the acquisition of Slovak as a second language and call for the development of a comprehensive national strategy for the language support of children with a different mother tongue.

Keywords: Different first language, primary education, cultural reproduction theory, inclusive education, learning tasks.

1. Introduction

Slovakia is one of the smaller countries in terms of size and population. Less than 5.5 million inhabitants live on approximately 49 thousand km². Historical border shifts as well as intensive migration have made Slovakia a multicultural country, which has become a place of permanent or temporary residence for many nations and ethnic groups. According to the latest Slovak Population and Housing Census, the population is composed of at least 29 different nationalities, and at least 26 language groups have been identified in terms of mother tongue use. The dominant language of the school is Slovak (ŠÚ, SR, 2021). In the school year 2023/24, 93 % of primary school students were educated in the Slovak language (CVTI, 2024). Children of Hungarian, German, Ukrainian, and Ruthenian nationalities have the opportunity to learn in their mother tongue. The greatest controversy is caused by the unresolved issue of education of Roma children who do not have the opportunity to learn in their native Romani language. However, Roma is the preferred language in almost 50% of Roma communities. Only 35% speak Slovak at home (Ravász, Kovács, & Markovič, 2020). The educational paths of Roma children are in many ways locked and, in many cases, very short.

1.1. Equality of educational opportunities from the perspective of Roma children

According to qualified estimates, 417,000 Roma live in Slovakia, which represents 7.6% of the total population. Roma is not a homogeneous group, even in terms of their social situation. The fact is that half of them experience some type of spatial segregation - 14% live in isolation outside the village, in so-called settlements. Another 36% live in gated communities on the periphery of villages (Ravász, Kovács, & Markovič, 2020). The issue of education of Roma children from socially excluded backgrounds is very

complex. It cannot be satisfactorily analysed within the scope of this paper. However, for a deeper understanding of this study, it is necessary to point out several facts:

1. The educational level of the Roma population is generally low. The highest incidence of people with incomplete education or only primary education is in those regions of Slovakia where the Roma population lives (Statistical Office of the Slovak Republic, 2024).

2. Generations of Roma children from marginalised communities (hereafter MRC) have not been adequately included in preschool education programmes. While the overall enrolment rate for children aged 3-5 years was 75% in the 2018/19 school year, it was only 32% in the MRC setting (Hellebrandt et al, 2020). Several barriers contribute to the low attendance of these children (Vančíková, 2019a), which have not been fully eliminated even after the adoption of the law on compulsory pre-primary education for all 5-year-olds in 2021.

3. A large group of Roma children from the MRC do not meet the school readiness criteria at the schooling threshold, as a result, they repeat a grade in the first years of schooling (Vančíková, 2019b).

4. School failure will accompany them for years to come. A significant group of these pupils do not continue their studies in secondary school. The proportion of pupils who complete compulsory schooling and do not continue their education is significantly higher in socially disadvantaged groups than in the rest of the population (Hellebrandt et al, 2020).

5. Higher education is more of a rarity in these communities. According to older data, only 0.14% of all Roma living in rural areas have achieved higher than secondary education (Mušinka, & Matlovičová, 2015).

1.2. Education of Roma children from the perspective of respecting their linguistic rights

Although the Education Act No.245/2008 Coll. (§12) states that members of national groups have the right to education and education in their language, a large group of children in Slovakia are educated in a language other than their mother tongue or are in the situation of acquiring another language and learning in it at the same time. In terms of the application of linguistic human rights, subdimensional, so-called' sink or swim' programmes are applied to children of several minorities in Slovakia (cf. Skutnabb-Kangas, 2000). Pupils entering the school from a foreign language background are forced to acquire the language of the school, which represents the language of the majority society, literary Slovak. Children from the MRC mostly encounter this form of language only while watching television or playing games at a school run by older children (Kubánik, 2015). For them, entering school is not only an encounter with a new linguistic reality but also with a new approach to language learning. In the home environment, language acquisition occurred in natural communicative situations that they experienced or were part of. At pre-school age, they acquired Romani, the local dialect of Slovak and other languages spoken in their primary environment. Thus, they became bilingual or plurilingual naturally, without learning vocabulary, correcting, etc. The school approaches language learning in a radically different way. The basis is targeted language education through learning individual concepts and grammatical rules, which contradict natural and unguided acquisition (Hajská, 2015). Thus, these learners have to acquire not only a new language but also a new form of learning. The school expects every pupil entering its grounds to know the rules of behaviour and communication, or to understand the language they are being taught. It does not respect the diversity that is natural as each pupil comes from a different background. It demands uniformity and thus creates barriers that pupils from poor backgrounds find difficult to overcome.

1.3. Linguistic competence capital of children from excluded localities

The main thesis of the Theory of Cultural Reproduction by the French sociologist Pierre Bourdieu is that the school, as a social institution, should contribute to the levelling of social inequalities. However, it does just the opposite, widening the gap and applying the Matthew effect[1]. It privileges those who have acquired skills, tastes, or ways of spending time - the cultural capital of the middle and upper social classes. It presents the values of these parts of society as the most perfect, universal ones and demands them from everyone who wants to participate in its education (Prokop, 2005). Acquisition of the cultural capital of the majority is impossible for children from segregated Roma settlements because their contact with the majority happens rarely, if at all. Thus, they continue to live in a space where they have been revolving in the same circle of poverty for several generations, with low educational levels and ingrained patterns of behaviour that are undesirable and judged as insufficient in the school environment. Linguistic capital is an important part of cultural capital. In both spoken and written form, the school speaks to all pupils in the same language, which may not be comprehensible to them. The British sociologist Basil Bernstein in his

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[1] Matthew 25:29: "For whoever has will be given more, and they will have an abundance. Whoever does not have, even what they have will be taken from them.."

sociolinguistic theory demonstrated that the social conditions of life create at least two forms of language use: a limited language code typical of lower social classes and a developed language code characteristic of middle and upper social classes (Prokop, 2005). The language of the school speaks to children with a developed linguistic code. It is not mentioned that children bring with them different cultural and linguistic capital from their home environment. The latter also influences parents' contact with teachers. Parents in the lower social classes do not feel competent enough to communicate with teachers. They are uncomfortable communicating with teachers and believe that school is separate from home. In their perception, education is the responsibility of teachers, so they avoid contact with the school (Dumais, 2006). Their limited cultural experience and language code affect their competence capital, which reflects their competence in social communication and orientation to socially relevant topics (Vančíková, 2011). Therefore, schools should take into account the cultural and linguistic background of each child and adjust their approach to education accordingly.

1.4. Research problem and objective of the study

The previous section highlights that the education system in the Slovak Republic does not cater for all children. Children from poverty-stricken foreign language backgrounds face issues such as poor educational performance and early school leaving, which raises concerns about the conditions in schools. Therefore, we have decided to investigate the language teaching tasks in textbooks for the first and second years of primary education. Our objective is to identify the most used words and evaluate their potential clarity for children living in MRC.

2. Methods

The research set consisted of textbooks for the first and second years of primary education[2], which have the so-called clause of the Ministry of Education. Therefore, they are among the state-supported teaching resources used by many primary schools. The subject of the analysis was 6 textbooks and workbooks for the 1st grade, in which 1735 statements of the nature of the teaching instructions were recorded. For Grade 2, we analysed 7 textbooks and workbooks in which we identified 4231 statements. The initial transcript created a corpus with a total of 5966 teaching assignments.

The analysis was carried out in cooperation with the Ľudovít Štúr Institute of Linguistics of the Slovak Academy of Sciences using the tools MorphoDiTa, NoSketch Engine, Charcount and tools Sort, Grep, Uniq of the UNIX system. The analysis consisted of several steps:

1. Morphological analysis.
   Words have been sorted into 4 categories – nouns, verbs, adjectives, and adverbs.
2. Frequency analysis.
   In each category, frequency lists have been created based on which we can judge the frequency of occurrence of individual words in the learning resources.
3. Comparative analysis 1.
   Identification of vocabulary specifics when comparing grades (comparison of 1st- and 2nd-grade textbooks) and specifics when comparing vocabulary within subjects (Mathematics, Slovak language, Natural Science). The result of the analysis is the so-called unique vocabulary, which is found only in one set (for example, only in mathematics textbooks, etc.)
4. Comparative analysis 2.
   Identification of common vocabulary for monitored categories (e.g. what words can be found in all first-grade textbooks, etc.)

The analysis of the vocabulary of textbooks was the starting point for the next step, identifying the so-called challenging words. In the context of our research goal, we understand as a challenging word any word that potentially falls outside the scope of the cultural or competence capital of a child living in conditions of social exclusion. The starting set for identifying such words was a set of the most frequent words in four categories: 1) verbs, 2) nouns, 3) adjectives, and 4) adverbs. The condition for the inclusion of the word in the sample set was its occurrence in textbooks of all subjects (so-called common vocabulary).

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[2] Compulsory school education in Slovakia begins at the age of 6. Children who do not meet school readiness criteria may have their school attendance postponed and start school a year later. Thus, in the classes of the 1st and 2nd grades of primary education we find children aged 6-8 years.

3. Results

As can be seen in Table 1, we identified several challenging words in each word type. There were 13 words in the verbs category, 14 words in the nouns category, 6 words in the adjectives category, and 3 words in the adverbs group. The words were identified based on a study of the social and linguistic background of children with MRC living in the Slovak Republic. The words in the table are also given in their original form because the English translation does not capture their essence in the Slovak language.

Table 1. Frequent common vocabulary in mathematics, Slovak language, and primary school textbooks with identified challenging words.

Part of Speech	Vocabulary
Verbs	byť (be), doplniť (fill in), mať (have), **vyfarbiť (colour), zapísať (write down),** pozorovať (observe), **zistiť (find out), vyznačiť (mark), nakresliť (draw),** vytvoriť (create), nájsť (find), vymyslieť (invent), **dokresliť (complete the drawing),** pomôcť (help), **napísať (write to),** môcť (able), **prečítať (read), zdôvodniť (rationale),** povedať (say), **pokúsiť (try),** porozprávať (talk), **pomenovať (name) , dopísať (complete), vypísať (write out),** urobiť (to do)
Nouns	číslo (number), **počet (count), príklad (problem), úloha (task),** bod (point), **výsledok (result), pastelka (crayon) ,** vzor (pattern), **tabuľka (chart),** znak (sign), **kocka (cube),** farba (color), dvojica (couple), **rad (row),** veta (sentence), spolužiak (classmate**), rastlina (plant), živočích (animal), informácia (information),** človek (human), **plôška (spot),** voda (water), slovo (word), obrázok (picture), **písmeno (letter),** príbeh (story), **názov (title),** časť (part), meno (name), odpoveď (answer), otázka (question)
Adjectives	veľký (big), rovnaký (same), správny (correct), červený (red), modrý (blue), zelený (green), **slovný (verbal),** ďalší (next), **ľubovoľný (random),** žltý (yellow), **rôzny (various)**, pravdivý (true), prázdny (empty), **jednotlivý (single),** spoločný (common), nový (new), starý (old), potrebný (necessary), **podobný (similar), vhodný (suitable)**
Adverbs	spolu (together), dlho (long time), doma (at home), ešte (yet), najskôr (first), **podobne (similarly), postupne (gradually),** potom (after), **pozorne (carefully),** rovnako (same), spoločne (in common), správne (correctly), teraz (now), treba (be necessary), už (already)
Note: Difficult words are highlighted with a bolt.	

4. Discussion

Based on the results of the content analysis of textbooks of the first and second year of school education, we can establish the assumption that there are teaching instructions with the so-called difficult words, which pose a problem for Roma children who use Romani in the home environment and at the same time live in conditions of poverty and social exclusion. This assumption will be verified in the next phase of the research through interviews with them. We aim to find out how they understand the difficult words and to identify any misconceptions in their grasp. The results of the research are intended to be the impetus for setting up support for children whose language rights are violated and against whom subdirective, so-called "sink or swim" programmes are applied. We believe that improving the school readiness of these children, as well as reducing the risk of their school failure, depends on the existence of quality programmes for the acquisition or improvement of Slovak. At the same time, teachers must be competent to work with this group of children, which inevitably involves understanding their life situation and recognising the competence capital with which they enter school.

5. Conclusion

It turns out that even though we live in the 21st century, Bourdieu's theory of cultural reproduction and his critique of the school are still valid. Despite deepening social differences, the school continues to use a language that is more likely to be understood by children whose cultural capital is compatible with that of the school. In a country with a large group of socially disadvantaged children, it is, therefore, necessary to present research arguments that can not only initiate dialogue on the subject but also develop comprehensive methodological support for teachers who work with this group of children.

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THE METHOD FOR INTERPERSONAL COMMUNICATION ENHANCEMENT AND FOSTERING OF RESILIENCE AND EMOTIONAL REGULATION

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Abstract

Psycho-social skills that help a person to integrate into society are emotional regulation, resilience and interpersonal communication competence. Adolescence is a stage of development of these skills through training and education. The goal of our research is on the bases of scientific theory and empirical research assemble psychoeducational integrative methodology for improving interpersonal communication competence, development of emotional regulation and resilience of students and adolescents and apply it in chosen classes. The sample consisted of 367 adolescents. The respondents were filling out questionnaires The Child and Youth Resilience Measure, modified version of Situational Test of Emotional Understanding and a questionnaire of trait emotional intelligence. The results have shown that adolescents in middle adolescence have lower rates of emotional regulation and resilience. The application of educational activities on the sample of 78 adolescents has raised psychological resilience and emotional intelligence of adolescents.

Keywords: Emotional regulation, resilience, interpersonal competence, integrative methodology.

1. Introduction

A new trend in the investigation of emotional intelligence is also one of the elements of emotional intelligence, namely emotional regulation.

Emotion regulation became the subject of research in the 1980s, initially being incorporated into research dealing with emotions and their development (Thompson, 1994; Cox, 1994; Gross, 1999). According to Gross (1999), we can define emotional regulation as a set of processes enabling individuals to modify the expression and experience of unpleasant and positive emotions. Emotion regulation affects whatever emotions we have when we have them, how emotions are experienced by individuals (Gross, 1999). Thompson (1994) divides emotional regulation based on its regulatory sources into two types: self-regulation and social regulation (parents, friends). The most frequently defined elements of emotional intelligence models written by authors and researchers in their models are: empathy, interpersonal relationships, evaluation and expression of emotions, self-awareness, motivation and communication.

Resilience - psychological resistance is classified as a modern term. Resilience first appeared in the 1980s. to the 1990s (Šolcová, 2009). Křivohlavý (2009) and Šolcová (2009) point to the connection between resilience and social support based on E. Werner's research from 1954. Resilience represents a dynamic process, the ability to become visible later in life after overcoming a problem or an adverse life situation (Newman & Blackburn, 2002). The authors describe the ways in which a child manages a negative life situation as: coping focused on emotions (Coleman & Hendry, 1999), coping focused on a problem (Folkman & Moskowitz, 2000). Masten & Obradovič (2006) defines resilience as the ability to withstand an adverse life situation or gain resilience when overcoming a negative life situation (trauma, death) and continue to develop effectively. He characterizes psychological resilience as a person's ability to successfully adapt despite negative and dangerous conditions in 3 forms (Masten & Obradovič, 2006): at-risk children achieve satisfactory development, children manage stressful situations, children are able to recover from psychological trauma. Despite all these definitions, as stated by McLean and Breen (2009), there is no unified and recognized definition of resilience.

We can define communication competences as abilities that allow us to communicate in interpersonal relationships (Hall & Lindzey, 1997). Liptáková et al. (2011) defines communication competences as human abilities enabling communication based on acquired knowledge, skills, attitudes and values, which are related to compliance with norms, principles, rules and tools of verbal interaction.

According to Hall and Lindzey (1997), the basis for communication skills are innate personality traits, intelligence and emotional intelligence, proven ways of communication that are culturally conditioned from the point of view of the environment in which a person developed and currently develops. Assertive behavior is one of the basic communication skills that help us improve interpersonal relationships and mutual communication (Masarik, Ivanovičová, & Szijártoóvá, 2003).

2. Design and methods

The goal of the thesis is to compile and apply in selected classes a psychoeducational integrative methodology based on scientific theory and empirical research to improve interpersonal communication competences, develop emotional intelligence and resilience of teenage students and adolescents. The partial goals of the work are to determine the level of resilience and emotional intelligence of adolescents.

The first questionnaire is based on an international project that examines resilience led by M. Ungar & Liebenberg (2005). The questionnaire consists of 36 items based on 4 areas: individuality, relationships – family, friends, school; society, culture. These items determine the perception of the uniqueness of the respondent's personality, the influence of the environment. Respondents circle their answers on the appropriate scale. This scale expresses identification with the given statement from complete disagreement (1) to complete agreement (5).

We used the situational test of emotional understanding (MacCann & Roberts, 2008) as the second questionnaire in the research. With this test, we find out to what extent adolescents understand basic emotions and emotional situations. The situational test of emotional understanding contains 42 situations. Situations offer five emotions as a result of a particular situation. Each situation has only one correct answer, which respondents mark at their own discretion.

The third research questionnaire is the Trait Emotional Intelligence Questionnaire (Petrides & Furnham, 2001). The questionnaire examines how adolescents perceive their abilities and skills in various emotional situations, which are included in 4 factors: well-being (mental well-being), self-control, emotionality and sociability. Respondents' express identification with the given statement from complete disagreement (1) to complete agreement (7).

We distributed the questionnaire to the respondents in printed form, adapted to the age of the surveyed persons. Administration of the survey took approximately 30 minutes. The research sample consists of 367 respondents. The age of the respondents ranged from 15 to 18 years, the average age of the respondents was 16.01 years, SD = 2.05. 231 girls and 136 boys in research.

We implemented educational activities in the period from September 2023 to December 2023. The implementation took place at the gymnasium in Bratislava.

The sample consisted of 78 students (46 girls, 32 boys) aged between 15 and 16 years. To increase the effectiveness of educational activities, we divided the students into several groups of 13 students each. We carried out the activities during 45-minute and 90-minute lessons.

3. Results

Research has shown that, despite negative situations, adolescent boys are in greater mental well-being than adolescent girls. When investigating self-control in expressing emotions depending on gender, it was shown that male adolescents have higher self-control than female adolescents. Students in late adolescence are more psychologically resilient than those in middle adolescence.

Research has shown that full-value relationships (family, friends, school) help adolescents to increase their psychological resilience. The result of the research points out that students in the period of late adolescence are subject to their own self-evaluation, on the basis of which negative emotions (fear, sadness, disgust, frustration) come to the fore. The reason for the appearance of negative emotions is also the cognitive evaluation of negative life situations (Stuchlíková, 2007).

Students in late adolescence in our research know how to evaluate negative emotions more adequately, which increases their emotional intelligence. The factor of psychological resistance, individuality, is correlated with the factors of emotional intelligence.

We justify the research result by the fact that the resilience factor individuality contains elements: self-control, ability to solve problems, empathy, social support (Ungar, 2006). These elements are part of the factors of emotional intelligence: emotional self-awareness, problem solving, empathy, interpersonal relationships (Bar-On, 1997).

The implemented educational activities, which focused on the development of emotional intelligence, resilience and interpersonal communication competences, increased the skills of adolescents. A comparison of the entrance and exit test, which determined the level of subjective perception of emotional intelligence and resilience, showed changes in the level of perception of adolescents.

The results showed an increase in the level of all factors of emotional intelligence and resilience after the application of educational activities.

The most significant changes occurred in the factor of psychological resistance, individuality, relationships, and in the factor of emotional intelligence, emotionality. We justify the result by the fact that adolescents had the opportunity to think about themselves, their feelings, and values during the implementation of educational activities.

4. Conclusions

The results showed that adolescents in the period of middle adolescence have a lower level of emotional intelligence and resilience than adolescents in the period of late adolescence. Based on this finding, we created and applied a psychoeducational integrative methodology to a sample of adolescents (15, 16 years old).

By comparing the input and output test after the application, we achieved an increase in the level of emotional intelligence and psychological resilience. The biggest change occurred in the factor of individuality and emotionality.

We attribute the increase in these factors to appropriately chosen psychoeducational activities that enabled students to gain personal integrity, improve interpersonal relationships, and develop social skills necessary for life and cooperation.

The created psychoeducational activities have proven their effectiveness and we recommend their implementation through the Personality and Social Development classes at high schools.

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EXPLORING FACTORS BEYOND PHONOLOGICAL INSTRUCTION IN PRIMARY EDUCATION

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Abstract

It is well known that explicit metaphonological instruction, particularly in the early years, is essential for reading acquisition. Despite the scientific consensus phonics instruction has not always been implemented in the classroom (Castles et al., 2018). The present explored which factors contributed to reading comprehension in primary education students who had not been taught to read using phonological methods, and hence performed poorly on metaphonological tasks (i.e. below normed expected mean per school year). Ninety-two Spanish students completed two reading comprehension tests (sentence and text level) and several reading skills tests: metaphonology, orthography, superficial and deep vocabulary, morphosyntax and reading strategy. Reading strategy refers to extent to which reading is based primarily on semantic content of words but not grammatical information. T-tests contrasting scores on sentence comprehension with the normed expected scores for each children showed that the students were significantly below the norms, but not classed as having a specific reading difficulty. Correlations showed a strong relationship between scores in the two reading comprehension tests in all the other measures (all $ps < .001$). In a backward regression with sentence comprehension as the outcome variable ($r = .835$), the skills that emerge as predictors are age (21.09%, $p < .05$), reading strategy (28.36%, $p < .01$), morphosyntax (22.69%, $p < .01$), and orthography (23.75%, $p < .05$). A similar analysis on text comprehension ($r = .641$) includes age (31,87%, $p < .01$), morphosyntax (27.24%, $p < .01$), deep vocabulary (23.42%, $p < .05$) and superficial vocabulary (21.70%, $p < .05$). These findings indicate that, even with low scores in the metaphonological tasks, the students' reading comprehension scores increase with age, although they do not reach the expected average reading levels. Performance in the comprehension tests seems to be achieved by students using an alternative mechanism based on the combination of grammatical and semantic information. We would also like to point out the slightly higher relevance of deep vocabulary (quality of the semantic relation between words; see Perfetti, 2007) than superficial vocabulary (number of known words) in text comprehension. In conclusion, in the absence of metaphonology, morphosyntactic-semantic information takes a primary role to advance reading skill. More research needs to be done on this topic, especially in secondary education, where the texts' complexity requires that students activate mechanisms associated with expert reading.

Keywords: Metaphonology, grammar, deep vocabulary, reading comprehension, reading strategy.

1. Introduction

Phonology has been included in traditional reading models as crucial to reading (see Simple View of Reading; Hoover & Gough, 1990; Hoover & Tunmer, 2022). Research over years has seemingly reached a consensus: word recognition is based on metaphonological information that readers decode to form the orthographic representations stored in the mental lexicon (as established in dual route models, see (Coltheart, 1978, 2012). Therefore, phonics instruction at the beginning of the primary school (also during last year in kindergarten) increases reading levels and prevents difficulties. Nevertheless, this message about scientific-based way of teaching reading has not been transferred to classrooms (Castles et al., 2018). Most models also take into account that when reading a sentence or a text to recognise words in isolation is not enough. These complex reading structures require the use of other language comprehension skills for a successful reading.

Vocabulary stands out among language comprehension skills. This skill goes beyond lexical recognition, making available all the necessary information to use words correctly. Recent studies have shown it is important to know each word in the text (superficial vocabulary), but the connections between

words (deep vocabulary) are also essential (Perfetti, 2007; Perfetti & Stafura, 2014). It is the deep vocabulary that allows the reader to link words by meaning (same or opposite), to identify the same semantic family and also to recover some previous information to infer from existing in the sentence or text (Oakhill, 2020). Together with vocabulary, morphosyntactic (grammatical) aspects are also necessary for reading, and failure to process them has been associated with lower reading levels (Tsunoda, 2023). Some readers use the keyword strategy (KWS). That is, they focus only on content words while reading, not processing functional words (those carrying most of the grammatical information). Readers, who use the KWS tend to commit important mistakes in comprehension tasks (Domínguez et al., 2016; De las Heras et al, 2022), getting only a small part of the full meaning of what they are reading.

Language comprehension skills mentioned are included in the National Reading Panel as indispensable in reading (NICHD, 2000). Importantly, theories agree that both decoding and language comprehension are not enough on their own (only together) to support effective reading. But what happens when students do not receive phonological instruction? Which skills predict reading comprehension in absence of competent levels in phonology?

2. Method

2.1. Participants

Ninety-two students from a school of Spain were evaluated. Distribution by school year (yr) and descriptive statistics are available in Table 1. None of the participants had been previously diagnosed as having a reading or language disorder. They scored above the reading difficulty cut-off in sentence comprehension test [t(91) = 10.241; p < .001] and none of them had a severe difficulty in text comprehension test (measured with PROLEC, see below). Eight participants presented a mild difficulty in text comprehension (yr1 N = 1; yr2 N = 5; yr3 N =2).

Table 1. Descriptive statistics for describing participants.

		Age			Sex	
	N	M	*SD*	Range	F (%)	M (%)
ALL	**92**	**108.2**	**(20.7)**	**72-142**	**49 (53.3)**	**43 (46.7)**
yr1	14	77.5	(3)	72-82	7 (50)	7 (50)
yr2	14	88.7	(2.9)	84-93	8 (57.1)	6 (42.9)
yr3	15	100.1	(3.5)	95-106	8 (53.3)	7 (46.7)
yr4	16	112.6	(3.5)	107-118	4 (25)	12 (75)
yr5	13	124.2	(3.2)	120-130	10 (76.9)	3 (23.1)
yr6	20	135.6	(3.6)	131-142	12 (60)	8 (40)

2.2. Materials

Tasks assessed reading comprehension at two different levels (sentence and text) and a wide range of reading skills. Most of the assessments belong to the PEALE battery (Domínguez et al, 2013), and the ones that were sourced elsewhere are indicated below. Similarly, we only mention the time limit when included in the assessment.

— **Text comprehension** (PROLEC; Cuetos et al., 2007). Includes four texts, each with four comprehension questions. Participants are asked to read carefully and answer the questions with the correct information. Scores range from 0 to 16 (one point for each correct answer).

— **Sentence comprehension** (TECLE; Marín and Carrillo, 1999). Contains 64 sentences with one missing word. Participants choose one between four possible answers (the three distractors are a meaning inconsistent real word and two types of non-words: one with similar orthography and one with similar phonology to the correct answer). Scores are corrected to control for random choosing ([correct answer – (errors/n-1)])[*]. Time is limited to five minutes.

— **Reading strategy** (DEPC). Similar to TECLE, was created for assessing the KWS (see Introduction). Distractors are words with similar lexical frequency to the correct answer. In order to answer correctly, participants are required to use both grammatical and semantic information in the sentences. The time limit is five minutes.

— **Morphosyntax**. Two tasks were used: syntax (STX) and morphology (MRF). Both are similar to TECLE, but the distractors are functional words in STX (i.e.: "con" [with], "entre" [between]) and incorrectly derived words in Spanish in MRF. These tasks require participants to activate grammatical information while reading. The time limit for each task is five minutes.

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[*] This formula for controlling the random effect is used in every test, unless otherwise stated in the description.

— **Superficial vocabulary** (PPVT-II; Dunn et al, 2006). Includes 156 prints with four images each, only one of them consistent with a word given orally. Participants are asked to choose the picture that best matched the word given orally. Score is obtained by calculating number of correct answers – errors.

— **Deep vocabulary**. Two tasks were used. The definition task (WISC-V; Wechsler, 2015) demands participants to define a word briefly including distinctive information. Scores range from 0 to 54. The synonym task (VOC) presents 42 words and demand participant to choose between three options (correct and two foils) the most meaning-similar.

— **Orthography** (ORT). The task contains 50 pairs formed with the correct an incorrect spelling version of a Spanish word. The task requires that participants activate orthographic representations to answer accurately.

— **Metaphonology**. Two tasks were used: counting syllables (METASYL) and counting phonemes (METAPHON). Both includes 90 items (referring common objects) and requires participants to mentally count both decoding structures. The time limit for each task is three minutes.

2.2. Procedure

All answers were given on paper. Tests were administrated in groups in the children classroom, so some of the tests applied (text comprehension, PPVT-III and definition tasks) were adapted (see Hernández et al., 2023). The whole battery was administered through four sessions (five in the younger groups), up to a maximum of 50 minutes each. Results are part of a collaborative project with the school that made the request. Informed consent forms were used with the families ensuring ethical principles for research on human subjects in the Declaration of Helsinki (World Medical Association, 2013).

3. Results

The reading levels (as direct scores[†]) were low in comparison to the expected mean in sentence comprehension [$t(91) = -2.860$; $p = .005$]. The metaphonological skills were also significantly lower than the expected in both counting syllables [$t(91) = -6.221$; $p < .001$] and counting phonemes [$t(91) = -7.136$; $p < .001$] tasks. For interpretability, the analysis below was done with punctuations converted to percentages (Table 2). All variables included correlated strongly (all $ps < .001$).

Table 2. Descriptive statistics for sentence and text comprehension and reading-skills tests (punctuations %).

	Text comprehension	Sentence comprehension	Reading strategy	Morpho-syntax	Superficial vocabulary	Deep vocabulary	Orthography	Meta-phonology
M	75.5	42.8	40.7	43.9	69	50.1	50.8	28.9
DT	*17*	*22.6*	*24.4*	*21.9*	*7.2*	*16.3*	*33.4*	*12.3*
Range	31.3-100	3.7-100	-1.6-93.8	3.4-93	50-81.9	14.8-83.5	-32-100	3.3-71.5

Parallel backward regression analyses were carried out with each of the comprehension tasks as outcome variable and age, metaphonology, orthography, superficial and deep vocabulary, morphosyntax and reading strategy as predictors. The text comprehension regression also included sentence comprehension as predictor. It has to be noted that first model in both analyses is more significant (see Table 3).; that is because includes all variables. The last model for each outcome variable shows a depurated model only with the most powerful variables in predicting reading.

Table 3. Model summary of backward regression analysis with comprehension tasks as outcomes.

Outcome variable: sentence comprehension					Outcome variable: text comprehension				
Model	R^2	R^2adj	F Change	p	Model	R^2	R^2adj	F Change	p
1	0.850	0.837	67.918	< .001	1	0.672	0.640	21.252	< .001
2	0.849	0.839	-0.364	1.000	2	0.670	0.643	-0.427	1.000
3	0.846	0.837	-2.046	1.000	3	0.665	0.641	-1.401	1.000
4	0.843	0.835	-1.597	1.000					

Age was a significant predictor of reading comprehension (see Table 4), indicating that reading level increases by scholar year. More importantly, reading strategy was included in the final model as the main predictor, following by orthography and morphosyntax.

[†] Sentence comprehension and metaphonology expected means are only available for direct punctuations. See TECLE (Marín and Carrillo, 1999) and PEALE battery (Domínguez et al, 2013) respectively.

Table 4 Model 4 in the regression analysis with sentence comprehension as outcome variable (TECLE).

	B	Std. Error	b	t	p
(Intercept)	-10.011	7.055		-1.419	0.159
Age	0.191	0.090	0.174	2.109	0.038
Reading strategy	0.326	0.115	0.351	2.836	0.006
Morphosyntax	0.308	0.136	0.298	2.269	0.026
Orthography	0.106	0.045	0.157	2.375	0.020

The backward regression analysis for text comprehension also includes age in the final model (see Table 5) but it this case as the strongest predictor. Morphosyntax in the strongest reading skill predictor, followed by the semantic variables: first deep and second superficial vocabulary. Reading strategy and orthography were also included as predictors but with negative (and non-significant for orthography) index.

Table 5. Model 3 in the regression analysis with text comprehension as outcome variable (PROLEC).

	B	Std. Error	b	t	p
(Intercept)	-9.687	14.288		-0.678	0.500
Orthography	-0.086	0.050	-0.169	-1.727	0.088
Age	0.331	0.104	0.402	3.187	0.002
Reading strategy	-0.265	0.132	-0.379	-2.015	0.047
Morphosyntax	0.411	0.151	0.529	2.724	0.008
Superficial vocabulary	0.459	0.211	0.195	2.170	0.033
Deep vocabulary	0.296	0.126	0.284	2.342	0.022

4. Discussion

The present work is one of the few that studies the contribution to reading of a wide range of skills. It should be noted that none in this group had been diagnosed with a reading difficulty, but they scored poorly on the sentence comprehension task (and we found some mild difficulties on the text comprehension task). They also scored lower than expected mean on phonological tasks due to a lack of phonological instruction.

Our results showed that models including all variables could explain 83.7% of the variance for sentence comprehension and 64% for text comprehension. This is more than typically explain by SVR based models (i.e.: decoding and general language comprehension variables) when including in regression analysis, where could explain up to 68% for English primary school children (Ripoll et al., 2014; Savage, 2006; Savage et al., 2015) and up to 55% for a similar group in Spanish (Tapia et al., 2022). That is suporting newer theoretical accounts such as the Active View of Reading (Duke & Cartwright, 2021), which aims to include reading variables with explanatory power on their own and envisages including the relationship between them.

Given the exploratory nature of the present research, we used backward stepwise regression because it allowed us to identify the strongest predictors in the model(s). The main predictor for sentence comprehension was reading strategy (28.36%): not using the KWS was associated with increased reading levels. This is consistent with previous research (Domínguez et al., 2016). Morphosyntax was also a significant predictor (22.69%) for sentence comprehension, also highlighting the importance of processing functional words while reading. The last significant predictor for sentence comprehension was orthography (23.75%), indicating that having enough stored orthographic representations facilitates choosing a semantically appropriate word to complete a sentence.

Regarding reading comprehension both vocabulary variables were significant predictors, with deep vocabulary (23.42%) being slightly stronger than superficial vocabulary (21.70%). This is consistent with previous studies (Perfetti, 2007; Perfetti & Stafura, 2014) showing that vocabulary depth plays an essential role in accessing the full meaning of a text, as well as in inferring information that allows deep comprehension of the message (Oakhill, 2020). Noticeably, morphosyntax was the strongest predictor of reading comprehension (27.24%,), showing that processing grammatical information is indispensable for linking semantic information while reading (Tsunoda, 2023).

One important finding was that metaphonology was not a significant predictor for either comprehension task, although according to traditional models (Hoover & Gough, 1990; Hoover & Tunmer, 2022) it is an essential factor for reading. It is possible that the lack of phonological skills in this group of children who had not received explicit phonological instruction can explain that participant's sentence comprehension was below expected norms and there were some mild difficulties in text comprehension. However, we would like to point out that the text comprehension difficulties were found for children in the

first years of primary education, but not later. Moreover, there was an improvement of reading ability with age in the absence of adequate levels of phonology (i.e. age explained 21.09% of the variance for sentence and 31,87% for text reading). These findings suggest that children have developed an alternative mechanism based in lexical-semantic information due to their low phonological level (Savill et al., 2018; Snowling & Melby-Lervåg, 2016). Our findings suggest that orthographic skill could have an important role in reading comprehension, together with grammatical skills and vocabulary. These findings seem consistent with a use of alternative lexical-semantic mechanisms (Savill et al., 2018). However, more research is needed to understand how these skills interact.

Future research by the authors will be focused in answering the following questions: in a collective which a higher level of phonological processing due to an intensive instruction, does phonology have predictive power in reading comprehension above and beyond the rest of variables included in the present study if it is well developed from the early stages of primary education?

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JOURNEY TO GLOBAL COMPETENCE: TEACHING THROUGH A SUSTAINABLE DEVELOPMENT GOALS LENS

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Abstract

The term 'global competence' has gained prominence in the past 5 years, denoting the comprehensive capabilities essential for students to succeed in a diverse and interconnected world. Educators and scholars alike now increasingly acknowledge the significance of developing learners' global competence, viewing it as a vital component rather than a mere luxury in education. The study aims to investigate how teaching English through the lens of sustainable development goals (SDGs) can enhance students' language learning and global competence. It will commence with a literature review on global competence, exploring its values and significance in the field of education. Subsequently, it will delve into the concept of SDGs and their relevance in education, discussing how SDGs can serve as a valuable lens for teaching and learning. Furthermore, the research will explore practical approaches for language teachers to integrate and leverage SDGs in their teaching practices. This may include collaborative activities such as brainstorming, group presentations, poster making, as well as curation and reflection. Ultimately, the research is anticipated to provide valuable insights for language teachers, enabling them to effectively engage learners in their language learning process while simultaneously developing their global competence.

Keywords: Global competence, SDGs, collaborative activities, learning effectiveness.

1. Introduction

With the arrival of the 21st century, the world appears to be a tight-knit community, resembling a small village. As globalization and fierce global competition continue to gather momentum, the need for individuals with a global outlook and mindset has become paramount. It is crucial for individuals to seize opportunities for personal development and gain a competitive edge in the international arena. Given that talent development is inextricably intertwined with education, it is essential to prioritize the development of learners' international vision, global awareness, and cross-cultural communication skills. This shared objectivity among researchers and educators is shaping the future of education and global engagement. Global competence, a buzzword in recent years, has gained increasing attention, recognition, and exploration from professional institutions and education experts. It offers valuable perspectives for equipping the next generation with essential knowledge and skills in the era of VUCA (Volatile, Uncertain, Complex, and Ambiguous), enabling them to excel in global competition (Yaccob, Yunus, & John, 2023). This aptitude transcends local, ethnic, and national boundaries, empowering individuals to adapt to the knowledge expansion and a diversified world. It serves as a vital attribute for 21st-century citizens and as a gateway to seamless integration into the evolving global landscape.

2. Understanding global competence

2.1. Defining global competence

In 1988, the American Council on International Educational Exchange (CIEE) released a report "Educating for Global Competence", which signified the sprout of a new concept that gained widespread attention and became a part of the development goals of higher education (CIEE, 1988). Notably, the initial publication did not offer a precise definition of the term, but its essence suggested a transformation in how higher education institutions approach global education (CIEE, 1993). Prior to this, higher education had primarily emphasized domestic success, focusing on imparting students with the necessary academic skills and knowledge. However, as the world became increasingly interconnected and global conflicts and challenges multiplied, it became apparent that a more holistic approach was required.

Consequently, students are encouraged to take international exchange programs and get involved in diversity and multiculturalism, cultivating a global perspective that would prepare their readiness for the complexity of today's world (CIEE, 1993).

The term 'globally competent learner' was introduced at a conference titled "Educating for the Global Community: A Framework for Community Colleges", co-hosted by the American Council on International Intercultural Education (ACIIE) and the Stanley Foundation in 1996. This learner is characterized by a profound understanding of the interconnectedness between human beings and the environment, a shared comprehension of historical and significant international events, and an embrace of multiple values and attitudes, appreciating and recognizing the positive impacts of global diversity (ACIIE & Stanley Foundation, 1996). The report indicated that community colleges should not view the development of global competence as mere "additives" but rather integrate it into their academic curricula. However, a debate emerged regarding whether community colleges could provide sufficient perspectives to define the concept of global competence, potentially constraining the popularity of this definition (Hunter, 2004).

Subsequently, the National Education Association (NEA) stated in its publication "Global Competence Is a 21st Century Imperative" that global competence has evolved from a privilege enjoyed by a select few to a fundamental necessity for all individuals in education, regardless of their age or level (NEA, 2010). Recognizing the significance of this shift, the U.S. Council of Chief State School Officials (CCSSO) EdSteps initiative, along with the Asia Society Partnership for Global Learning, established a Global Competence Task Force in 2011. The Task Force was given the mandate to refine the concept of global competence and develop the global competence matrix, ultimately proposing the concept as "the capacity and disposition to understand and act on issues of global significance" (Boix-Mansilla & Jackson, 2011, p.xiii). In light of this, teachers play a pivotal role in nurturing students' global competence in comprehending and engaging with global issues through global education. This involves cultivating curiosity about the world beyond their immediate surroundings, honing higher-order thinking skills, and encouraging proactive participation in addressing global challenges. By doing so, teachers can contribute to the shaping of a generation that is not only well-versed in global affairs but also actively involved in promoting positive global change.

The Organization for Economic Co-operation and Development (OECD) has long been at the forefront of international education concepts, with its definition of global competence standing out as both impactful and encompassing. The OECD defines global competence as a multi-faceted construct, breaking down the macro domain into four key components, which are knowledge, skills, attitudes, and values (OECE/Asia Society, 2018). The adoption of the singular form of 'competence' is noteworthy as it implies both independent and interrelated relationships among these various elements. According to the OECD, global competence encompasses a broad array of abilities that allow individuals to navigate our hyper-connected world. In essence, globally competent individuals are the ones who can investigate local, global, and transnational cultural issues critically, understand and appreciate diverse perspectives and viewpoints, engage actively with and respect others, and assume responsibility for sustainability and social prosperity (OECE/Asia Society, 2018). The definition provided by the OECD acts as an invaluable framework for guiding education systems and policies, ensuring that they foster knowledge, skills, attitudes, and values needed for development and success in today's ever-changing world (OECE/Asia Society, 2018).

2.2. Its significance in today's interconnected world

The cultivation of global competence equips learners with a profound understanding of the interconnectedness and intricate nature of our global village, thereby fulfilling the demands of the 21st century. To accomplish this, a dynamic, interactive, and integrated approach is imperative in understanding and responding to global affairs and issues. It endows learners with the ability to understand and respect diverse viewpoints, think critically and tackle problems creatively, learn to live together harmoniously as global citizens, and effectively interact with heterogeneous groups of people and cultures. Additionally, it instills a global mindset, a sense of accountability for one's actions, respect for human dignity and cultural differences, as well as an appreciation for the values inherent in "the common good of humanity" (UNESCO, 2015; OECE/Asia Society, 2018). By smoothly and strategically integrating knowledge, skills, attitudes, and values into their educational objectives, higher education institutions may help students build their global competence. This approach encourages students to embrace multiculturalism, draw wisdom from various civilizations, boost cross-cultural interaction, and actively engage in global participation.

Global competence is a valuable means to enhance awareness of global citizenship and participation, a prerequisite for fostering sustainable development in education, a cornerstone for promoting humanistic education, and an important lever for realizing the blueprint of future education.

Global competence involves mobilizing and utilizing a range of transferable high-level abilities, including collaboration with others, cross-cultural communication skills, problem-solving abilities, critical thinking, and creative thinking (OECE/Asia Society, 2018). By nurturing these skills, we empower students to become active local and global citizens, effective communicators who bridge language barriers and culture disparities, creative problem solvers adept at navigating ambiguity and change, critical and versatile thinkers who embrace new opportunities, ideas, and ways of thinking, and open-minded life-long learners committed to a perpetual quest for knowledge. These attributes foster students' independent, intellectual, and resilient growth, bolster their competitiveness and adaptability in the international labor market, and enable effortless and effective interactions with distant regions, people, and ideas. Global competence also reflects a humanistic education, transcending utilitarianism and striving for a balance between individual and social needs, achieving a harmony of purpose and value.

3. Teaching through a Sustainable Development Goals lens

3.1. An overview of the Sustainable Development Goals

The 2030 Agenda for Sustainable Development, a collaborative agreement among 193 member states, was endorsed by the United Nations General Assembly at its 70th session in 2015. This initiative aims to address global development challenges across five dimensions—people, planet, prosperity, peace, and partnership—by the year 2030. The agenda includes a collection of 17 Sustainable Development Goals (SDGs) and 169 targets, providing a comprehensive roadmap for local development and international cooperation worldwide, and outlining a blueprint for a prosperous and sustainable world. The SDGs, an integrated and indivisible collection of global goals prioritizing 'no one is left behind', indicate a heightened focus on personal development and human rights (UNESCO, 2016). The SDGs represent the first instance in human history where nations worldwide have agreed on a shared vision for the advancement of human civilization. While global and collaborative partnerships are essential in achieving these ambitious goals, individuals also play a pivotal role in contributing to this progress.

3.2. How the SDGs provide a lens for teaching global competence

The SDGs are a natural and authentic vehicle to bring global awareness to the classroom, fostering a deeper understanding of the interdependence of our world and the shared responsibility we all bear towards achieving sustainable development. By aligning the SDGs with learning objectives, students can connect with real-world issues, thereby making their learning experience more significant and meaningful. The SDGs offer a holistic framework that can integrate planetary sustainability into any programme, encouraging interdisciplinary and intercultural learning, inspiring critical and creative thinking, fostering an understanding of global challenges and the interconnectedness of society, economy, and environment, as well as enhancing social responsibility and concerted action.

3.3. Integrating the SDGs into teaching and learning practice

Integrating the SDGs into curriculum and classroom activities is crucial in developing a future generation that is both aware of and committed to sustainability. The SDGs provide a holistic roadmap to enlighten students about the intricate interplay between social, ecological, and economic aspects. By skillfully weaving the SDGs in teaching and learning scenarios, we not only further students' understanding of these complex issues but also inspire them to apply critical and creative thinking in devising solutions (Maley & Peachey, 2017). By making SDG-related activities and discussions an integral part of daily pedagogy, teachers can nurture a sustainability-oriented mindset, priming students to become engaged and responsible advocates for a more sustainable world. The following will illustrate how to strategically embed the SDGs into teaching and learning practices via a range of classroom activities, shifting the focus from teacher-led to learner-centered for optimal learning effectiveness.

3.3.1. Group presentation.
When it comes to group presentation, the primary objective differs significantly from individual ones. Group presentations aim to alleviate pressure, bolster confidence, and mitigate jitters when students communicate in a second or foreign language. This collaborative approach allows students to share the responsibility and workload, creating a more supportive and less daunting environment. When the presentation topic is designated among 3 to 4 learners, the collective effort from each group member becomes paramount. Each individual brings their unique strengths and passions, and roles and duties can be allocated accordingly. While one member might take on the lead role during the presentation, it is vital to acknowledge that every member contributes and strives to ensure smooth transitions. Additionally, students may learn to appreciate each other's viewpoints and resolve any disagreements or challenges constructively in the process. As students engage in their tasks, teachers can circulate among the groups, providing guidance and feedback. They can monitor whether students can

craft engaging introductions, utilize their voices effectively, and articulate their ideas clearly. An effective group presentation requires teamwork and coordination, encouraging students to employ the target language to gather, synthesize, and present information in a cohesive manner. This further deepens their comprehension of how the SDGs are interrelated and how each goal supports global sustainability.

3.3.2. Brainstorming. This activity encourages students to map out thoughts and ideas organically with a group of 4 or 5 students, taking a closer look at one of the SDG challenges that resonates deeply with them. A mind map template may be distributed to facilitate the process. This will enable them to visually represent, organize, and compile their ideas, breaking down intricate issues into more manageable components. By participating in this activity, students are able to unleash their creativity, make meaningful associations, and effectively build an intuitive understanding of the chosen topic. This activity fosters collaborative learning, stimulating lively group discussions, critical thinking, and creative problem-solving techniques. Moreover, it establishes a non-threatening atmosphere where students feel free to share their opinions and ideas. This, in turn, encourages active participation in the brainstorming session, allowing everyone to contribute and feel valued.

3.3.3. Poster making. One powerful way to convey messages and inspire action is through a visually impactful poster. Organizing a poster-making competition not only enhances students' understanding and awareness of the 17 SDGs but also brings these global issues alive for them, making them relevant and meaningful in their daily lives. As part of this activity, students are encouraged to make vibrant and imaginative posters, allowing them the freedom to delve into a particular sub-theme within the broader context of the SDGs. The ideation process for this poster-making competition started with understanding different SDGs. Once they have settled on a specific topic, they can embark on the creative process of utilizing images, graphics, and text to convey their understanding of the goal and devise solutions to tackle the challenges. This practice not only fosters the development of visual communication skills but also ignites creativity and critical thinking among students. The finalized posters can serve as a powerful visual exhibition in the classroom, sparking further discussions and reflections among students. Additionally, these posters may be shared with a larger community to ensure the philosophy of the SDGs reaches a broader audience and has a maximum impact. By making these posters visible and accessible, we hope to inspire and motivate everyone to get involved and create positive change.

3.3.4. Curation & reflection. This can serve as a valuable extension to the in-class activities or as a stand-alone assignment for students to practice after class. Given the constraints of class time, it is beneficial to connect the 'ivory tower' and the reality world, inspiring students to pursue their SDG exploration with unwavering enthusiasm. First, students are given a specific SDG topic to delve into. Teachers may provide them with a variety of resources beforehand, including reading materials, infographics, and audio or video clips that are tailored to the topic. However, students are urged to search for alternative sources and perspectives beyond those provided materials. This exploration allows them to develop a deeper understanding of the SDG topic and its implications. Subsequently, students are asked to write reflections on their findings and thoughts, focusing on what they have learned about the topic, how it relates to their personal or local context, and how they might help to achieve it. To facilitate the sharing of ideas and perspectives, students are invited to post their sharing and reflections on an online platform like Padlet. This platform creates a virtual space where it can help students exchange ideas, spark discussions, and connect with peers. It is a vibrant hub of ideas and insights, where they can learn from each other and build upon each other's knowledge and experience. Finally, students are encouraged to read and comment on each other's reflections, creating a lively discussion forum where they can exchange ideas, pose questions, and build upon one another's insights. This collaborative learning experience not only improves their understanding of the SDGs but also cultivates a feeling of community and inclusion.

4. Conclusion

The development of global competence is a lifelong process that cannot be achieved overnight. Despite the challenges along the way, students may embrace the dynamic nature of globalization and persevere with determination and resilience as they progress through their life journey. The SDGs are invaluable avenues for developing global competence among students. These goals serve as a powerful lens, igniting aspiration, inspiration, cooperation, participation, exploration, and reflection in students' learning journeys and beyond. They offer students the opportunity to engage with diverse global contexts, take part in international sustainability dialogues, think outside the box, apply critical thinking to devise solutions to pressing issues, take immediate action, and make their voices heard. Incorporating these

SDG-related activities into English language classrooms not only enhances the language-learning environment, but also promotes them to speak more freely, voicing their concerns, opinions, and viable solutions. By encouraging active participation and commitment, these activities cultivate a sense of responsibility towards global sustainability, enabling students to become advocates for change and preparing them to become informed and reliable global citizens. However, as we introduce the SDGs in the classroom, it is crucial to acknowledge that their implementation may not be without challenges. Nevertheless, utilizing them as an educational framework is a commendable approach to ensure that they are imprinted in students' DNA and that students become enlightened, competent, and responsible global citizens.

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ADAPTING THE VALUES ENGAGED, EDUCATIVE EVALUATION FRAMEWORK TO THE EVALUATION OF A COMMUNITY-BASED PROGRAM

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Abstract

The values engaged, educative (VEE) evaluation framework (Greene, DeStefano, Burgon, & Hall, 2006) was originally conceived for, and implemented in, STEM educational contexts. Its emphasis on responsive engagement with the values of equity and social justice, makes it adaptive to other contexts. This article reports on the extent to which the VEE evaluation framework was culturally responsive when applied to an evaluation of a community-based healthy living program for older adults, a minoritized and underserved population. Findings suggest affordances of using VEE in the context of a healthy living program include engaging stakeholders in the evaluation and addressing content, pedagogy, and equity. The framework's key limitation includes lack of attention to organizational capacity. To facilitate its transferability beyond STEM settings to other context, the inclusion of a new element in the VEE evaluation framework, organizational capacity, is proposed.

Keywords: Values Engaged Educative evaluation, culturally responsive evaluation, evaluation theory, organizational capacity.

1. Introduction and theoretical framework

In this mixed methods evaluation study, I test the applicability of the values engaged, educative (VEE) evaluation approach (Greene, DeStefano, Burgon, & Hall, 2006) from STEM education to community-based, healthy living programs. I examine the framework's affordances and limitations to inform the proposed modification of including organizational capacity as part of VEE.

Figure 1. Engaging with the Intersection of Content, Pedagogy, and Equity.
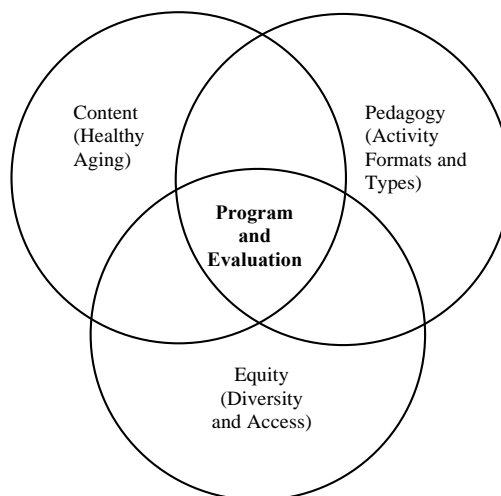
The healthy living program was a six-month program in an organization serving older adults in the Southeastern U.S. This program's purpose was to enhance older adults' quality of life. I conducted the evaluation from a value engaged, educative (VEE) evaluation approach (Greene et al., 2006). This

approach prescribes evaluative engagement with the values of equity and social justice, and includes a framework to engage with the intersection of content, pedagogy, and equity. In my approach as an evaluator, I prominently promoted values engagement by ensuring the perspectives and interests of all stakeholders were included, especially from participants who have been traditionally excluded from evaluation designs (Greene et al., 2006). Prior to conducting the evaluation of the program, I developed a Venn diagram (see Figure 1) to consider the roles that content, pedagogy, and diversity in the design of the program's evaluation. This diagram guided the evaluation design, data collection and analysis, interactions with the program's director, and served as a reminder for me to reflect on the program from perspectives that privileged the perspectives of the program participants.

2. Description of the program

The healthy living program was a six-month program that was effort to systematize the educational classes and activities offered by an active living center serving older adults in the Southeastern U.S.A. This program's purpose was to enhance older adults' quality of life by helping them maintain their health, stay active, remain connected to their communities, and reduce food waste through behavior change. The program was organized using a points system where participants got points for the activities they participated in. At the end of the program, the total points were used to recognize participants according to their participation level. Examples of activities were cooking demonstrations, various types of physical activity (e.g., chair yoga, walking), garden club, presentations on nutrition and sustainability, and volunteering (e.g., labeling items at the local food bank).

The program was led by a director, who coordinated the program's calendar with community partners. The program relied on volunteers, interns, and staff from community partners to facilitate activities and deliver content. Interns from different departments at the local university helped run the program by tracking participants' points and running occasional activities. Community partners periodically facilitated activities in the program, so that every month there was some activity scheduled by each. For instance, the local farmers' market provided presentations about food waste and seasonal foods; the local hospital provided health monitoring sessions and facilitated health prevention presentations; students in a local university conducted cooking demonstrations; and volunteers facilitated gardening activities at the center's garden. Although these were ongoing partnerships, the individuals that facilitated activities from the university and each community organization changed constantly, with activity leaders rarely repeating unless it was a structured series. This lack of consistency often resulted in volunteers having difficulties finding the program, being late, or simply skipping sessions.

3. Methods

With the goal of triangulating the findings from each instrument (Greene et al., 1989), the study included a combination of qualitative and quantitative instruments: a survey, participant observation, participation data, document analysis, photo elicitation focus groups, a picture sort activity, and an interview with the program director. The survey (n=25) was based on an instrument that the program had previously used and was designed so that it would be easy to answer to account for the cognitive decline that was starting to be experienced by some participants. Participation data (n=31) included the information about number of days and type of activities attended. The evaluation included three photo elicitation (Harper, 2002) focus groups (n=8), where participants engaged in an activity where they sorted photos from the program according to their activity preference and talked about what the program meant for them using the photos they selected. All focus group participants chose and captioned a picture that best represented the program from their point of view. The three focus groups were recorded and transcribed verbatim. The 90-minute semi-structured interview with the program director covered topics such as changes noticed in the clients, the program's contribution to clients' health, the most important aspects of the work with the clients, and what they would change if there were starting the program again. The evaluator was a constant presence in the program for its duration through a variety of activities, such as observing regular program activities, running occasional activities and helping with regular program tasks, and having occasional drop-in meetings with the director to plan activities and to reflect. The evaluator had access to a range of program documents, such as monthly calendars that included scheduled program activities and that the director created, activity handouts from facilitators, and socio-demographic data. Survey data was analyzed using descriptive analytics, interview and focus group data was analyzed using deductive analysis (Saldaña, 2015), and documents were analyzed using content analysis (Elo & Kyngäs, 2008).

The 31 program participants were mostly Black women (68%), experiencing impairments to participation, such as mobility, health, and/or cognitive impairments (74%), and extremely low to low-income levels (97%).

This paper answers the following two questions: (1) What are the affordances and limitation of the values engaged, educative framework (Greene et al., 2006) for the evaluation of a community-based healthy living program? (2) How does the values engaged, educative evaluation framework transfer from the evaluation of STEM education programs to the evaluation of community-based healthy living programs?

4. Findings: Affordances and limitations of the VEE evaluation framework

This paper examines the VEE evaluation framework's affordances and limitations based on its implementation to evaluate the healthy living program. Based on these findings, I propose a modification to the VEE evaluation framework to expand its applicability beyond STEM education programs.

4.1. Affordances of the VEE evaluation framework

The VEE evaluation framework provided a framework to engage stakeholders in the evaluation and to analyze how the program addressed content, pedagogy, and equity.

4.1.1. Engaging stakeholders in the evaluation. As part of the evaluation activities, the evaluator regularly met with the program's director to learn about the different elements of the program, to inform her of the evaluators' activities, and to get feedback on instruments, such as the survey. The evaluator regularly brought up the VEE evaluation Venn diagram to center the conversation. As stated in the program description section above, the original purpose of the program was to enhance older adults' quality of life by helping them maintain their health, stay active, remain connected to their communities, and reduce food waste through behavior change. The director was invested in keeping behavior change as the main purpose because she had seen dramatic changes happen with a few of the participants who had fewer mobility, health, and/or cognitive impairments. However, the evaluator was able to see, through participation in the program and conversations with stakeholders, that the program's reality was that the expectation of behavioral change was not feasible for a majority of participants. This was due to several factors, including: (1) the majority of participants experienced impairments to participation, which limited their involvement and their capacity to follow through program recommendations; (2) many participants lived in situations where they did not have control over their food and other living arrangements that would have allowed them to make the behavioral changes promoted in the program; (3) the programming was not structured to shepherd participants through the steps needed for behavior change; and (4) the lack of steady facilitators who were engaged in the program and had relationships with the participants further limited the potential impact of the program. Through engaging the director in the evaluation, and in spite of strong resistance from the director, the original purpose of the program was modified to be more realistic and focus on the goal of keeping participants active.

4.1.2. Addressing Content, Pedagogy, & Equity. Being attentive to the three intersecting elements in the VEE evaluation framework and their intersections was a significant focus for the conception and implementation of the evaluation. This served the purpose of assessing not only how participants were performing in the program, but mainly how the program performed for participants.

Content. The content of the sessions was determined by the program director and by the community partners. The program director cultivated the community partnerships and coordinated the program schedule, which was largely determined by the nature of the work that partners did. The participants voiced that they wanted fun, interesting content that was not repetitive and provided them with practical strategies they could use. The repetitive nature of the activities was particularly frustrating for some of the focus group participants and made them feel that they were not valued by the community partners who facilitated these activities. They also voiced their dissatisfaction with the fact that they were not consulted about the content of the activities in the program, as John (a 66-year-old Black man) and Alice (a 73-year-old White woman) explained:

> John: You got to have stuff that people are interested in, you know.
> Evaluator: So how can [the program] find out what you're interested in?
> John: Ask.
> Alice: Ask. But they don't do that. They never ask for input.

Pedagogy. The program included a broad variety of activity formats, including presentations, exercise and walking groups, hands-on activities, gardening, cooking demonstrations, games,

volunteering at the local food bank, and health checks, to name the most common. The focus groups showed that, although individuals had preferences for one type of activity over another, they also valued the diversity of formats offered, as Ursula (a 75-year-old Black woman with cognitive decline) and Beatrice (an 85-year-old Black woman) explained:

> *I look at it like this. If I'm busy, I feel better. I like staying busy. I like doing things. I like communicating. [...] But you know, I try to participate in a lot of different things. [...] I do have to say I like staying busy. I like volunteering. I like helping people, so that's about it. (Ursula)*

> *I go to anything. Any time I'm here, and they're having something, I go. I'll go and see what it's like. I enjoy all of them. (Beatrice)*

Participants also explained that not everyone was able to attend all activities due to impairments that limited their participation. For example, several participants could not attend the walking group or the gardening sessions because they had mobility limitations. Participants' complaints were mainly related to the repetitiveness of the content, the lack of steady facilitators, and not being consulted in determining the content of the program, not the format of the activities.

Equity. The director was aware of the differences among the program participants in terms of presence or absence of impairments to participation and spent a considerable amount of time and effort trying to schedule sessions in ways that would ensure balance, access, and meaningfulness. Some of the variables that she had to keep in mind were: (a) the activities themselves (avoiding repetition of content, interest in the topic, variety of formats); (b) the facilitators (their availability and popularity); (c) scheduling (scheduling popular activities on days of high attendance, avoiding double-scheduling); and (d) preexisting commitments with community partners. In spite of the director's efforts, the lack of control over staffing meant reduced organizational capacity, which in turn limited the program's responsiveness to its participants. Participants were keenly aware of how the limitations of the program's organizational capacity translated into its everyday realities. The evaluator's field notes from a peer group session noted:

> *We looked over the September calendar. ... They point out that they're going to be doing sprouting <u>again</u>. They did it last month. They said that there's nothing exciting on the calendar for September. ... They complained about: people offering the classes not staying with the dates; people simply not showing up – 'they just need to do it and stick to what they say;' some activities start late because presenters come late, and then they have to rush through because of lunch. ... There are all these things programmed, but then they don't happen.*

4.2. Limitations of the VEE evaluation framework

Using the VEE evaluation framework helped the evaluator identify that the program had difficulties that went beyond the three elements (content, pedagogy, equity) and were related to who implemented the program and how, exposing the need to consider organizational capacity as part of the evaluation. The evaluator did bibliographical research to find a helpful definition of organizational capacity for the program. Hall et al. (2003) stated that "the overall capacity of a nonprofit and voluntary organization to produce the outputs and outcomes it desires is a function of its ability to draw on or deploy a variety of types of organizational capital" (p. 4). The main elements in Hall et al.'s definition of organizational capital included human resources capacity, financial capacity, infrastructure and process capacity, planning and development capacity, and relationship and network capacity.

As we saw earlier, the program did not have human resources capacity since it heavily relied on interns for running the everyday program activities and volunteers from community partnerships for the facilitation of sessions. The educational and professional experience background of volunteers was often unknown, and interns, by definition, were in training. In addition, few interns and volunteers developed a relationship with the program and its participants, pointing out reduced relationship capacity. The program also relied on interns and volunteers because they were free, not requiring financial capacity. The combination of these problems made the evaluator conclude that the VEE evaluation framework needed to be modified to include organizational capacity for it to be applicable beyond STEM and in community-based programs such as this.

5. Discussion and conclusions: Modifying the VEE evaluation framework

The program evaluator proposes modifying the VEE evaluation framework to make it transferable beyond STEM education programs by adding organizational capacity as defined by Hall et al. (2003) as part of it. As we have seen, this definition refers to the overall capacity of an organization to accomplish its purposes through the deployment of human resources, finances, infrastructure and processes, relationships and networks, and planning and development. This new element in the VEE evaluation framework would not be an intersecting circle; it would underlie and encircle the framework

indicating its fundamental role for an organization to adequately address content, pedagogy, and equity at the program level. It would also guide the evaluator's eye towards understanding how organizational capacity sustains the intersection of the three elements at the evaluation level.

Figure 2. Proposed Modification of the VEE Evaluation Framework.
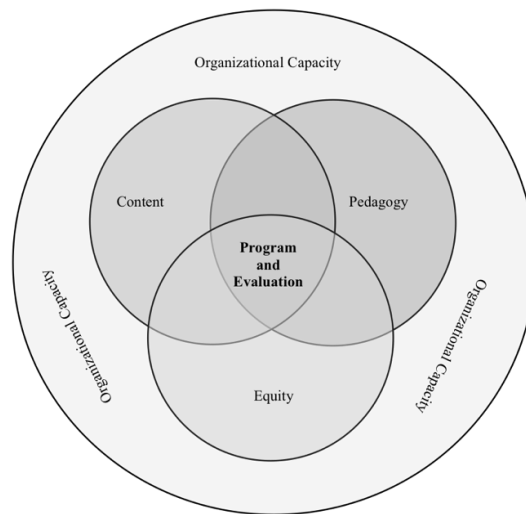
Like in Green et al.'s (2006) original definition of VEE, the application of the modified VEE evaluation framework does not prescribe the use of particular methods or the asking of particular questions. As such, the evaluator may use the modified framework according to the needs of each evaluation project. For example, if early information about the program indicates that organizational capacity may be an issue for the program, the evaluator may want to ask evaluation questions and have instruments that address it. In other cases, the evaluator may use the framework as general guidance for the evaluation, without having specific questions or instruments geared toward this area. In the case of the current study, it would have been useful to include an evaluation question and interview questions for both participants and program director to identify the areas where an improvement of organizational capacity would have been the most beneficial.

The modification of the VEE evaluation framework contributes a framework that is more culturally responsive and more adaptable to different typologies of programs beyond STEM education programs by bringing awareness to the need for organizational capacity to utilize resources to accomplish program purposes. Future research may consider applying this modified VEE framework in the evaluation of other community-based programs to see to what extent it is more culturally responsive and promotes evaluative capacity and evaluation utilization.

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CONSIDERING AUTOMATIC FEEDBACK IN ASSESSMENT FOR MATH LEARNING

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Abstract

In this study, we present the partial results of an ongoing project for teacher training in Portuguese-speaking countries, such as Brazil, Portugal and Cape Verde. The main objective is to identify strategies for evaluation processes using resources with automatic feedback, aiming to contribute to the improvement of students' mathematical learning. Approaching and discussing evaluation implies questioning fundamental aspects of the educational environment, seeking adjustments that improve pedagogical procedures, since the nature of evaluation evolves in methods and purposes, requiring an epistemological change to understand students' "mistakes". Some research pointed that in the evaluation process, especially in the context of learning, the interpretation of students' difficulties in mathematics is identified through the analysis of their "errors". In addition, didactic strategies, such as automatic feedback, are proposed in other studies as an attempt to overcome these difficulties. As it is a study focused on evaluation in mathematics education, the choice of the theoretical framework explores two fundamental areas of research. These include assessment of learning, which takes a comprehensive approach, covering both assessment of learning and assessment for learning. In addition, a theoretical framework is considered, in which assessment in mathematics education is recognized as an essential component in the construction of mathematical knowledge, especially regarding the treatment of errors during the educational process. We believe that the integration of technological resources into the assessment process can contribute significantly to mathematics learning. The involvement of aspects such as automatic feedback makes it possible to make decisions to achieve the objectives proposed in the development of the content. So far, six meetings have been held that indicate, in general, a positive perception of the participants in relation to the potential of automatic feedback in teaching and assessment in Mathematics. They highlight its practical applicability in the development of cognitive skills and in the treatment of errors. Additionally, if teachers have a minimum knowledge to reparametrize the applications built, they can refine the automatic feedback process, incorporating the acquired knowledge into their practice.

Keywords: *Mathematics education, evaluation, automatic feedback, teacher training.*

1. Introduction

This article presents partial results of an ongoing project aimed at teacher training in Portuguese-speaking countries such as Brazil, Portugal, and Cape Verde. The main objective of the project is to identify strategies for assessment processes using resources with automatic feedback, aiming to contribute to the improvement of students' mathematical learning.

The authors of this project conduct research and actions in the context of teacher training for the use of digital technologies, particularly with the use of GeoGebra in public schools in Brazil, Portugal, and, with the support of the OEI, in some African countries such as Angola, Mozambique, and Cape Verde (Dos Santos, Silveira, & Trocado, 2020; Abar, 2020; Abar & Rodrigues, 2020).

The analysis of assessment in education and the interpretation of results highlight challenges faced in pedagogical practice to ensure conditions and didactic means that stimulate students in their studies, promoting an environment without intimidation and facilitating the understanding of mistakes made. Addressing and discussing assessment implies questioning fundamental aspects of the educational environment, seeking adjustments that improve pedagogical procedures, since the nature of assessment evolves in methods and purposes, requiring an epistemological shift to understand students' "errors."

We consider that resources for the assessment process, with the use of technologies, can contribute to students' learning in mathematics by involving aspects of automatic feedback, allowing decision-making to achieve the proposed objectives of the content under development.

The development of training, embedded in the concepts presented above, will allow recognizing the teacher's interpretation in the face of possible errors by students, how they intervene, and what feedback they provide to contribute to an assessment for mathematical learning.

2. Framework

Within the scope of mathematics teaching and learning processes, it is important for assessment to consider data regarding the difficulties present in students' activities and provide support for the reorientation of school practices, considering such difficulties as opportunities for improving assessment.

The rapid transformations of today's society demand differentiated assessment strategies, such as automatic feedback and the use of technologies, so that their mechanisms cater to a generation of students who can be protagonists of their own learning. Analysing the errors and successes of an assessment allows the possibility of understanding how students' appropriate knowledge and, thus, allows for the construction of suitable automatic assessment processes (Abar, Dos Santos, & Almeida, 2022).

In the creation of assessment resources with automatic feedback, the indications of authors Buriasco and Soares (2012) can be considered, as they suggest that assessment "should gauge its ability to find patterns, seek regularities, read tables and graphs, relate data, build schemes, and develop procedures." (p. 111).

As this is a project on assessment in the context of mathematics education, the choice of theoretical framework was made to address three areas of research: (i) learning assessment, which will provide insights into assessment broadly, i.e., learning assessment or assessment for learning; (ii) assessment in mathematics education, which constitutes a specific framework for the construction of mathematical knowledge considering error treatment as an integral part of this construction, especially in the context of educational process; (iii) assessment that can provide resources for its creation with automatic feedback.

The understanding of an evaluative process aimed at contributing not only to the improvement of resources but also to the phases leading to mathematical learning is directly linked to the training of the teacher who will conduct this process in school environments.

The foundations of a mediating evaluative action go beyond studies on assessment theories and require in-depth knowledge of knowledge theories, as well as studies related to specific areas of the teacher's work.

For Buriasco and Soares (2012, p. 110), "the assessment of mathematical learning should be seen in schools as a research process, an activity shared by teachers and students, of a systematic, dynamic, and continuous nature". Thus, "all instruments used in the assessment of mathematical learning should be seen as research instruments, which enable capturing how students solve proposed situations." (Buriasco & Soares, 2012, p. 114). The fact that a student makes an error in solving a problem situation or even in an algorithm already explored by the teacher does not mean the absence of all mathematical knowledge necessary to solve the proposed situation. It can be a revealing fact about which knowledge the student failed to mobilize to succeed in the final response, or rather, how far the student managed to use their knowledge in attempting to solve the problem, or even which knowledge was lacking for them to succeed in the task. Faced with this fact, it can be used as a way to understand which mathematical knowledge needs to be developed by the student.

Error can bring clarity to the teacher and to the student themselves in the tasks of teaching and learning mathematics, respectively. The way assessment is conducted by the teacher is strongly associated with how mathematics teaching and learning are conducted by them.

Published works by researchers present considerations on the assessment process, in and for learning, seeking to interpret students' difficulties in mathematics identified through the analysis of "errors". Investigations conducted point to reflections on the assessment process, especially in the context of learning, interpreting students' difficulties in mathematics identified through the analysis of their "errors". In addition, didactic strategies, such as automatic feedback, are proposed in other studies as an attempt to overcome these difficulties.

In her research, Cola (2015) reveals that the "assessment processes that permeate the school environment are quite superficial" (p. 84) and that in the context of mathematics education, assessments incorporate elements of a "traditional evaluative practice that does not privilege the perspective of error" (p. 84).

The analysis of errors and successes in assessment allows understanding how students appropriate knowledge and thus enables the construction of appropriate automatic assessment processes (Abar et al., 2022).

The role of error becomes fundamental in the assessment process. According to Cury (2007), error should not be seen as something to be avoided at all costs, but rather as a powerful tool for investigation, by both the student and the teacher, to guide the teaching and learning of mathematical knowledge.

As it is a study focused on assessment in mathematics education, the choice of theoretical framework explores two fundamental areas of research. These include learning assessment, which adopts a comprehensive approach, covering both learning assessment and assessment for learning. Additionally, a theoretical framework is considered, in which assessment in mathematics education is recognized as an essential component in the construction of mathematical knowledge, especially concerning the treatment of errors during the educational process.

We believe that the integration of technological resources into the assessment process can significantly contribute to learning in mathematics. Involvement of aspects such as automatic feedback enables decision-making to achieve the proposed objectives in content development.

3. Methods

Teachers from both public and private institutions were invited and encouraged by the authors to join and participate in the project through their respective institutions. Fourteen teachers joined, including one from Mozambique, one from Cape Verde along with three of their students, six from Portugal, and three from Brazil.

The monthly work dynamics, conducted through the Microsoft Teams platform, are guided by active and collaborative participation in practical and theoretical activities. The association between practice and theory is encouraged, as well as the manipulation and analysis of problem situations. Five groups were formed, in which participants are encouraged to deepen their skills in exploring the following freely chosen themes: Calculus and Trigonometry, Music and Computational Thinking, Quadratic Functions, Exponential Functions, and Addition of Integers in the Context of Financial Education.

Six meetings have been conducted so far, indicating a generally positive perception among participants regarding the potential of automatic feedback in teaching and assessment in Mathematics. They highlight its practical applicability in developing cognitive skills and in error treatment. Additionally, if teachers have a minimal knowledge to reparametrize the applications built, they can refine the process of automatic feedback, incorporating the acquired knowledge into their practice.

The resources collaboratively created will be used in teaching practice with their students, and experiences will be shared in other work meetings for possible improvements and dissemination.

The involvement of teachers in synchronous meetings was significant, and some activity proposals were conceived, one of which is outlined in this article, characterizing the three research areas already discussed in this text: (i) learning assessment; (ii) assessment in mathematics education; (iii) assessment with automatic feedback.

The proposals are discussed, in each meeting, with the participants, sharing the steps of activity construction. Figures 1 and 2 present one of the activities for feedback on Exponential Functions developed by one of the groups and the respective guidelines.

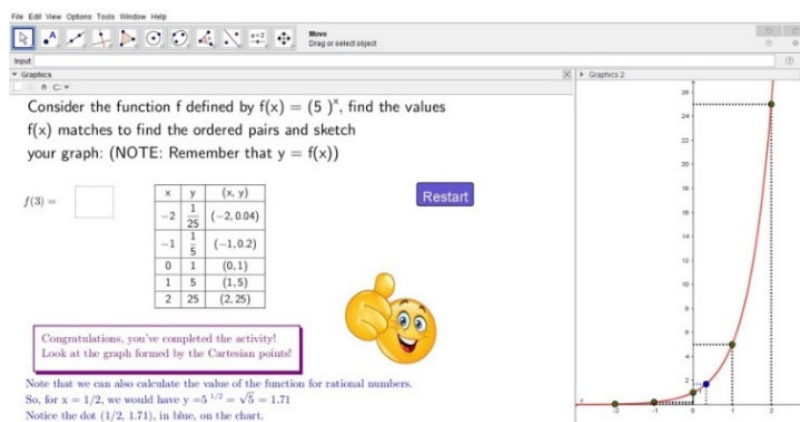*Figure 1. Game with Automatic Feedback.*

Figure 2. Guidelines for building Feedback.

Type of errors	Example	Feedback	Condition
Do not invert the fraction with a negative exponent	$2^{-1} = 2$	Power property: $a^{-n} = \dfrac{1}{a^n}$	$f(n) \doteq 1 / \underline{rv} \wedge n \neq 0 \wedge$ IsSet(rv)
Put result equal to zero (n = 0)	$2^0 = 0$	Remember that every number to the power of zero, except zero, is equal to one.	$\underline{rv} \doteq 0 \wedge n \doteq 0 \wedge$ IsSet(rv)
Put result equal to one (n = 1)	$2^1 = 1$	Remember that every number raised to one is equal to itself.	$\underline{rv} \doteq 1 \wedge n \doteq 1 \wedge$ IsSet(rv)
Put negative result a>0	$2^{-1} = -2$	The exponential function of type f(x) = a^{x} assumes only positive real numbers as a result.	$\underline{rv} < 0 \wedge$ IsSet(rv)
Multiply base and exponent (n > 1) natural numbers	$2^3 = 6$ $2^{-3} = -6$ *	$a^n = \dfrac{a.a.a.\ldots.a}{n\ factors}$ $2^4 = 2.2.2.2 = 16$	$\underline{rv} \doteq a\,n \wedge n > 1 \wedge a \neq 2 \wedge$ IsSet(rv)
Generic error		To find the value of f(n), simply replace x with n in the given function. Here's an example: f(x) = 2^{x}, então f(3) = 2^{3} = 2.2.2 = 8.	$f(n) \neq \underline{rv} \wedge$ IsSet(rv) $\wedge \neg ((f(n) \doteq 1 / \underline{rv} \wedge n \neq 0) \,||\, (\underline{rv} \doteq 0 \wedge n \doteq 0) \,||\, (\underline{rv} \doteq 1 \wedge n \doteq 1) \,||\, (\underline{rv} < 0) \,||\, (\underline{rv} \doteq a\,n \wedge n > 1))$

Following testimonial from one of the members of the Exponential Functions group, regarding the questions posed by the authors, see Table 1, we can observe the understanding of the project proposal.

Table 1. Testimonial from one of the members of the Exponential Functions group.

Question	Participant answers
Reflection on recurring students' errors	
When developing the mathematical topic of your group, did you reflect on the recurring errors that can be identified in student assessment? What errors or difficulties were identified?	"We identified that the main failures could occur due to the improper use of power properties. For example, the student may not pay attention when a power has a negative exponent, confuse the properties when the same number is raised to zero or one, not realize that an exponential function of the form a^x requires a positive codomain, and perform the multiplication of the base by the exponent."
Challenges in develop automatic feedback tasks	
What strategies does your group consider most suitable for overcoming student difficulties? Describe (possible) initiatives adopted to try to overcome them	Yes, it was evidenced that in activities like this, the biggest challenge is to anticipate the possible student failures to give a clue so that he can understand his mistake without giving the answer. Thus, we try to give clear feedback with examples that facilitate the understanding of the content covered."
Auto sufficiency of automatic feedback hypothesis	
Has your group found references in academic articles or research that address similar challenges? If so, how have these sources influenced or enriched your group's proposal?	"Giving specific hints for each possible identified error and examples that help to notice their mistake, as well as a generic tip for a possible error that was not foreseen by the team."

By this way, in this section the authors outline the methodology employed in the research project, including participant recruitment, meeting dynamics, data collection methods, and some of the preliminary findings of one of the trainee's groups.

4. Discussion

In the realm of mathematics teaching and learning, assessment must consider student difficulties and provide insights for reshaping classroom practices, viewing these difficulties as opportunities for improving assessment. As seen in Figure 2, one example among others in this project, participants identify common student misunderstandings and formulate feedback considering them.

Today's rapidly evolving society demands differentiated assessment strategies, including automatic feedback and technology integration, to cater to a generation of students who can take charge of their learning. Analysing successes and mistakes in assessments allows understanding how students appropriate knowledge and helps construct suitable automatic assessment processes (Abar et al., 2022). The example of the GeoGebra Tasks (Figure 1) shows how participants in these groups incorporated their content and didactical knowledge, as seen in Figure 2, to build a scenario for student use. Also, it should be noted the inclusion of feedforward feedback, see the left bottom of Figure 1, given the notice to the calculus of a potency with irrational exponents and a positive base, anticipating students' questions or misconceptions.

The collaborative and participatory nature of our project highlights the significance of teacher professional development in enhancing assessment practices. By engaging teachers from diverse backgrounds and facilitating collaborative discussions, we fostered a supportive community of practice

focused on innovation and improvement in mathematics education. This approach not only empowers teachers to implement effective assessment strategies but also promotes knowledge sharing and co-construction of pedagogical and technological knowledge, as evidenced in Table 1 participants answers.

While our study has provided valuable insights into assessment practices with automatic feedback, several avenues for future research warrant exploration. One promising direction is to investigate the long-term impact of automatic feedback on students' learning outcomes and retention of mathematical concepts.

5. Conclusions

Based on the testimonials of the teachers, we observe that by creating an initial categorization associated with a response, this approach can be replicated in similar situations and automated, going beyond formative assessment. The records of the results of the proposals can be integrated into summative assessments, expanding the reach and effectiveness of the assessment process.

With the continuation of the project, we hope that the proposals of the participants will be further refined so that they can be published and made available online, thus contributing to teacher training in the context of assessment with automatic feedback.

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WORKING WITH PRE-SERVICE TEACHERS: DEVELOPING MATHEMATICS AND SCIENCE RESILIENCE WHILE ADDRESSING MATHS AND SCIENCE ANXIETY LEVELS IN SOUTH AFRICAN SCHOOLS

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Abstract

The current performance of students in STEM subjects has not improved to the desired levels in South Africa. Previous research has demonstrated a strong correlation between the acquisition of mathematical knowledge and individuals' attitudes towards mathematics and physical sciences, as well as their emotional responses, such as experiencing maths/science fear. Over time, compelling empirical data has surfaced, demonstrating that maths/science anxiety has a substantial detrimental impact on mathematical and science ability. Remarkably, several studies have demonstrated that maths/science anxiety may be moderated through mechanisms with students' emotions. However, the suggested interventions have mostly concentrated on learners and teachers rather than pre-service teachers. Hence, there is a need for interventions to address math/science anxiety levels among pre-service teachers. The Self-Determination Theory underpin this study. This study employed action research to design cycles of whole class (n=29) intervention based on three tools designed by Johnson-Wilder and the mathematical network team and the emotional grid to support pre-service teachers in building resilience in math/science as they prepare for fieldwork. Data was analysed through thematic content analysis. The findings revealed that pre-service teachers have math/science anxiety and that maths/science anxiety had a substantial detrimental effect on their proficiency in mathematics/science, aligning with previous research. Furthermore, maths/science anxiety may be successfully reduced through the effective use of emotional tools. These findings suggest a new method of utilising the affective domain in teachers' training in South Africa for educational transformation.

Keywords: Achievement, coaching, maths/sciences anxiety, pre-service teachers, resilience.

1. Introduction

Education systems globally face the challenge of preparing future teachers to navigate the complexities of teaching mathematics and science effectively, particularly in contexts where anxiety towards these subjects among both learners and teachers persists (Fitriati et al., 2024; Wallace, 2015). In South Africa, as in many parts of the world, the effective teaching and learning of mathematics and science are crucial for the development of a skilled workforce and a scientifically literate society (Jojo, 2019; Lelliott, 2014). However, despite efforts to improve educational outcomes in these subjects, challenges persist, particularly regarding pre-service teachers' preparedness to teach mathematics and science effectively. One significant barrier to successful teaching and learning in these disciplines is the prevalence of math and science anxiety among both students and teachers (Griggs, et al., 2013; Megreya et al., 2021). In South Africa, where mathematics and science education outcomes have long been a concern (Reddy et al., 2020), addressing the anxiety levels associated with these subjects is paramount for enhancing teaching and learning experiences. Pre-service teacher education programs play a crucial role in shaping teachers' competencies and attitudes towards mathematics and science instruction. However, there is a need to ensure that these programs not only equip future teachers with subject knowledge but also foster resilience to confront challenges inherent in teaching these subjects.

Mathematics and science anxiety, characterized by feelings of fear, tension, and apprehension when engaging with mathematical and science concepts, can significantly impede academic performance and professional efficacy. Pre-service teachers who experience high levels of anxiety in mathematics and science may struggle to convey these subjects effectively in classrooms, perpetuating a cycle of anxiety and underachievement among students (Gresham, 2018).

Addressing math and science anxiety among pre-service teachers is therefore paramount for enhancing the quality of mathematics and science education in South African schools. Moreover, cultivating resilience in pre-service teachers can empower them to navigate the challenges associated with teaching these subjects, fostering confidence and effectiveness in the classroom. This study aims to investigate strategies for developing resilience among pre-service teachers while simultaneously addressing mathematics and science anxiety levels in South African schools. By exploring the intersection of resilience development and anxiety mitigation within the context of pre-service teacher education, this study seeks to contribute insights into effective pedagogical approaches and support mechanisms for preparing teachers to excel in teaching mathematics and science.

2. Literature review

2.1. Mathematics and science anxiety

Mathematics Anxiety (MA) is commonly characterised as a state of fear that hinders the ability to work with numbers and solve mathematical problems in many everyday and academic contexts (Richardson & Suinn, 1972). Literature on MA evaluates anxiety in math-related scenarios by employing hypothetical or retrospective inquiries. For instance, they inquire about the level of anxiety one might have in a certain math-related event. Alternatively, they measure anxiety specifically connected to the fear of failure in mathematics, such as how concerned one is while encountering difficulties in math. MA is a concern among students since it can have a detrimental effect on their academic achievement and general mindset towards the subject. Research has indicated that prospective primary school teachers generally demonstrate elevated levels of mathematical anxiety in comparison to pupils studying other subjects (Artemenko et al., 2021). Research supports the need for interventions to mitigate MA and enhance math achievement, particularly during childhood (Barroso et al., 2021).

On the other hand, Science Anxiety (SA), is a noteworthy issue among students that can have a detrimental effect on their academic achievements and entire state of being. SA is characterised by the experience of unpleasant emotions and fear specifically related to studying science courses (Megreya et al., 2021). SA can be influenced by multiple factors, such as self-efficacy in science, teaching methods employed in classrooms, and the general perception of science as a difficult discipline.

2.2. Building Mathematics and Science Resilience to reduce MA and SA

Mathematical resilience refers to the ability to sustain confidence and belief in one's mathematical abilities despite challenges or negative influences on one's mathematical well-being, as described by Johnston-Wilder and Lee (2010). Mathematical resilience (MR) refers to a mindset characterised by confidence and conviction in one's ability to solve challenging mathematical issues without any external assistance. Indicators of this include cognitive patterns, challenges, self-assurance, social support, positive outlook, resilience, and the ability to exercise self-discipline in challenging circumstances (Hakim & Murtafiah, 2020; Johnston-Wilder and Lee (2010).

In the context of science education, resilience refers to students' ability to recover from setbacks, persist in the face of challenges, and maintain a positive attitude towards learning science. Research indicates that implementing resilience-building strategies can assist students in managing SA and improving their academic performance (Elmi, 2020). One effective method to enhance science resilience is by integrating social-emotional learning strategies into science education (Elmi, 2020).

2.3. Theoretical frameworks

Self-determination theory (SDT) is a comprehensive theory of human development that specifically examines motivation, personality development, and well-being (Martela, 2020). According to SDT, human well-being is contingent upon the fulfilment of three fundamental psychological needs: autonomy, competence, and relatedness (Breitborde et al., 2014). The idea highlights the significance of providing autonomy support, promoting competence development, and nurturing relatedness to increase intrinsic motivation and overall well-being. SDT has been utilised in several fields, such as education, to examine motivation, conduct, and well-being. By applying SDT concepts, PSSTs may develop resilience as they help their learners develop a sense of independence and influence over their learning, which can help decrease anxiety and improve self-confidence in mathematics and science.

3. Methodology

The study employed a Participatory Action Research (PAR) approach to design a whole-class intervention (MacDonald, 2012). PAR allows for a high degree of participant engagement throughout the research process, promoting a sense of ownership and commitment among those involved (MacDonald,

2012). This study is an active collaboration of eight lecturers who teach Mathematics, Science and Technology. However, this paper reports on interventions at one rural university where the Growth Zone Model, the Hand Model of the brain and relaxation response model tools (Johnston-Wilder et al., 2021) were embedded into classroom practices to promote math and science resilience among third-year university students. In the first cycle of interventions, a series of training sessions which were embedded into their physical sciences teaching II curriculum were conducted for pre-service teachers focusing on resilience-building strategies and addressing anxiety in teaching mathematics and science. These sessions facilitate discussions and activities aimed at enhancing teaching effectiveness and confidence in the subject they will teach in the future. At the same time, during physics III, chemistry III, and mathematics III content lessons, the lecturers engaged in a series of interventions with the three tools as PSST learned physics, chemistry, and mathematics concepts. All the tools were provided to the students for engagement purposes.

Qualitative data was collected at the end of the first semester through focus group discussions and individual interviews. The qualitative data was analysed using thematic analysis as guided by Clarke and Braun's (2016) framework. Quality assurance measures were established by returning the captured responses to the participants for member checking.

4. Results

4.1. Biographical profile of respondents
The sample consists of nineteen males and ten females. All PSSTs are in their third year at the university, suggesting they have progressed through their academic program and are approaching the completion of their teacher education. While specific ages may vary, PSSTs in their third year at university typically range from their early twenties to mid-twenties, although there may be some variation due to individual circumstances. Each PSST brings unique strengths and qualities to the classroom, whether it be leadership abilities, subject matter expertise, creativity, or a passion for working with children and youth.

Theme 1: Motivation for learning complex concepts in math and science
When asked about their experiences and perspectives on the cycle of interventions, the participants were of the view that the tools helped alleviate their doubt and anxiety with mathematics and science as they prepared for teaching practices. As future teachers, PSSTs require a solid knowledge of mathematics and sciences, and a variety of good and effective mathematics and science teaching methods and practices to be able to influence their future students' learning and meet students' needs. Some participants narrated:

"I've struggled with anxiety in math and science for as long as I can remember. The Growth Zone Model has given me a framework to understand that it's okay to feel uncomfortable and that growth happens outside of my comfort zone. It's still a work in progress, but I'm seeing improvements in my confidence and performance (PSST9).

First the first time in my life, I am no longer anxious when I have maths and science tests. I could not belief it when my lecturer announced test dates for Chemistry III and Mathematics III. (PSST29).

Ah, indeed, the GZM has really helped me. I just move my pebbles to appropriate levels during lectures. When I am in my comfort zone, I begin to smile about myself and my achievements. I know within me that I can do this (PSST18).

Theme 2: Cultivating a sense of confidence
When asked about their confidence in mathematics and science contents after the intervention, participants' responses indicated that the interventions have provided a starting point for their confidence in the subjects as they have developed knowledge of the subject with understanding, and they would be able to assist their future learners to develop confidence in mathematics and sciences as they have acquired knowledge and understanding of student resilience. Two PSSTs responded:

The interventions have improved my confidence in math/science. The thought of having "I can do maths" I can do chemistry" lingers in my mind each time the lecturers are teaching complex concepts. I keep saying this to myself to help me get through to each lesson. That has been helpful (PSST1).

My confidence in mathematics, chemistry and physics has improved drastically. Quantum mechanics at the third-year level was very challenging. Now with the relaxation model, I can breathe in and breathe out as if I am releasing too much information out of my system so I can absorb more. But now I'm very confident in myself (PSS4).

Incorporating mindfulness activities into math/science lessons helped students stay calm and focused on the task at hand. Techniques such as mindful breathing allowed them to approach math with a calm and centred mindset.

Theme 3: Personality development

This theme focuses on the personal development of PSSTs as they use these tools to build resilience. Participants responded:

"I've been amazed by the impact of incorporating coping strategies based on the Growth Zone Model, Hand Model of the Brain, and Relaxation Model in our lectures. I have been empowered to approach science and mathematics with a growth mindset, knowing that my abilities are not fixed and that they can improve with effort and perseverance. As a result, I have seen a noticeable reduction in my anxiety levels and a corresponding increase in my academic achievement (PSST20).

The Growth Zone Model has been a game-changer for me in tackling my anxiety around math and science. By understanding that discomfort is a natural part of growth, I've been able to push through challenging concepts with more confidence. It's not about being perfect, but about progressing, and that mindset shift has made all the difference."(PSST15).

5. Discussions

Mathematics and science anxiety can be significant barriers to effective teaching and learning among PSSTs. These anxieties not only impact the teachers themselves but also have cascading effects on the confidence and achievement of their future students. To address this issue, it is essential to explore strategies that not only reduce anxiety but also cultivate resilience and motivation in PSSTs towards these subjects. I explored how integrating intervention strategies using the GZM, the Hand Model of the brain and the relaxation response model vis-a-vis informed by the SDT can help reduce mathematics and science anxiety among PSSTs while simultaneously building their resilience towards these subjects.

The SDT posits that when individual needs are satisfied, individuals experience greater intrinsic motivation, well-being, and optimal functioning. Applying the principles of SDT to the context of PSSTs facing mathematics and science anxiety offers a promising avenue for intervention which improves students' learning and reduces anxieties as they work towards building resilience.

The first theme focused on motivation to learn complex concepts in math and science. The study found that the participants were of the view that the tools helped alleviate their doubt and anxiety with mathematics and science as they studied complex concepts in the subjects. This finding is in line with the study by Barroso et al. (2021) who support the need for interventions to mitigate anxiety and enhance math/science achievement,

The second theme focused on cultivating a sense of confidence as they build resilience. The study found that the interventions provided a starting point for their confidence in the subjects as they have developed knowledge of the subject with understanding and would be able to assist their future learners to develop confidence in mathematics and science. Research supports students' emotional well-being and resilience in science education. Some of its indicators include thinking patterns, self-confidence, having support, optimism, perseverance, and being able to have self-control in difficult situations (Hakim & Murtafiah, 2020; Lee & Johnston-Wilder, 2017).

The third theme focused on participants' personality development. The findings show that implementing coping strategies based on the intervention models has been incredibly effective in helping PSSTs manage anxiety in science and mathematics. SDT highlights the significance of intrinsic motivation, autonomy, and competence in fostering positive outcomes in educational settings (Johnston-Wilder et al., 2021). By following a cycle of interventions, PSSTs can effectively integrate the Growth Zone Model, Hand Model of the Brain, and Relaxation Model into their teaching practice to reduce anxiety in science and mathematics topics and build resilience in these subjects.

6. Conclusion and recommendations

This study explores strategies to enhance resilience and reduce anxiety levels among PSSTs in mathematics and science within the context of South African schools. An important issue emphasised in the study is the significance of reducing anxiety levels among PSSTs in mathematics and science. Studies have demonstrated that anxiety may have a substantial effect on both the effectiveness of instruction and the academic achievements of students. Hence, it is important to implement interventions that target the reduction of anxiety levels and the enhancement of resilience in PSSTs to enhance educational practices and optimise student learning experiences.

Nonetheless, the study recommends integrating experiential learning methodologies into teacher training programmes and implementing mentoring programmes and support structures that can play a crucial role in fostering resilience and mitigating anxiety levels among PSSTs. Through the provision of experienced mentors, resources, and advice, PSSTs can receive the necessary assistance to effectively negotiate the difficulties associated with teaching and learning mathematics and science.

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UNDERSTANDING THE LEARNING SPACE, A REFLECTION ON BLENDED LEARNING IN HIGHER EDUCATION: A BIBLIOMETRIC ANALYSIS

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Abstract

Over the past years, learning in Higher Education was predominantly the traditional face-to-face type of learning. Blended learning has been adopted as the relevant approach to teaching and learning, based on the lesson learned during the COVID-19 period. Blended learning promotes both face-to face and online teaching and learning. Eventually, this means adopting a new learning space in higher education. The concept ''learning space'' refers to a full range of spaces in which learning occurs: that is from real to virtual learning, and from the classroom to chat rooms. Blended learning necessitates an understanding of the learning space and design, pedagogy and curriculum, and their relation to the learning space. The learning space is critical for the realisation of learning outcomes. Online learning cannot replicate everything of value in the face-to-face experience of learning. The researcher's reflection on the blended learning approach is, therefore, guided by the conceptualisation of learning as acquisition, learning as participation, and learning as knowledge creation. She reflects on trends in blended learning, and this was aided by an extensive literature review that addresses blended learning in higher education, and the bibliometric analysis she conducted. Further, she employed a qualitative methodology and analysed the data, using thematic analysis and the bibliometric analysis. This paper, therefore, discusses both the positive and negative effects of blended learning on students. This study is significant in the sense that it improves lecturers' implementation of blended learning, which would translate into developing essential online and face-to-face learning pedagogy, as institutions of higher learning globally have adopted blended learning.

Keywords: Blended learning, learning space, teaching, learning, higher education.

1. Introduction

Technological advancement has largely contributed to the introduction and implementation of blended learning across the globe. Harper et al. (2024) have reported significant changes in higher education institutions across the globe, especially on the academic landscape, due to the COVID-19 pandemic. Accordingly, Harper et al. have highlighted that the most significant change in this regard, has been the abrupt shift from traditional classroom teaching and learning to online learning, as the lockdown restrictions compelled higher education institutions to shut their campuses.

With a shift from face-to-face learning, remote or digital learning became an integral part of higher education (He et al., 2023). Generally, in almost all the countries, this shift was attributed to the COVID-19 pandemic. The effectiveness of the traditional classroom teaching and blended learning is influenced by several factors. According to Ait Daoud et al. (2024), the term ''blended learning'' is used more frequently in today's education cycles. Similarly, Mohamed (2024) states that blended learning has undergone some notable shift in its application over time. Furthermore, Chilton et al. (2023) point out that much has been learned about higher education institutions and how they could best provide blended learning environments, especially during crises like COVID-19, as well as during ''normal'' times. However, the scholars (Chilton et al., 2023) assert that access to technology, and the ability to use it, are crucial for the success of remote learning.

Castro (2019) argues that the aim of designing blended learning is to improve the efficacy of traditional classroom teaching and learning. Ultimately, Mahmood et al. (2024) postulate that blended learning is an innovative and more efficient way of learning, as it transcends the boundaries of space and time, and broadens possibilities. Furthermore, blended learning is seen as an emerging and crucial mode that offers additional activities for the reinforcement of learning. Du et al. (2022), postulate that blended learning is a student-centred model, where teachers play a guiding and supporting role of assisting students to use the existing knowledge reserved to learn, comprehend, and internalise new knowledge. According to Mohamed (2024), the shift noted here acknowledges the significance to foster an active and engaging learning environments.

2. Research aims and objectives

The study aimed to answer the main question:
What are the major trends in implementing blended learning in Higher Education?
The main objectives of the study were:
1. to map out the research focus on blended learning in higher education in the last 10 years.; and
2. to identify global trends in scientific research on blended learning in Higher Education.

3. Method and data collection

The researcher conducted a bibliometric analysis to explore the implementation of blended learning in higher education institutions mainly to identify trends in blended learning. To achieve this, the researcher critically reviewed co-occurring keywords. She retrieved the data from the Scopus database.

The search was restricted to article title, abstract, and keywords, using the Boolean "OR" - "AND". Therefore, the researcher used the search string "blended learning" AND "higher education institutions" OR "universities". This search produced 5 062 documents.

The search was refined to focus on the years 2013 to 2024 and included subject such as social sciences and arts and humanities, and the type of document was limited to article, and the language restricted to English only. This final search yielded 1 594 documents. The researcher analysed the data retrieved from Scopus, using the VOSviewer.

4. Bibliometric analysis and results

4.1. Keyword co-occurrence

The objective was to map out the research focus on blended learning in higher education in the last 10 years. This keyword co-occurrence could explain the research hotspots in the field over a specific time. These keywords would enable the identification of the important themes in blended learning in higher education and observations around the trending concepts in blended learning.

Co-occurrence in this study refers to the frequency with which a particular keyword appears with other keywords. The 67 co-occurring keywords are displayed in Figure 1 below.

Figure 1. Network Visualisation of co-occurring keywords

4.2. Cluster 1: Blended learning as a learning space

The first cluster consisted of 38 items. The researcher needs to point out that her discussion of the co-occurring keywords was also guided by the emphasis of the literature on blended learning regarding these keywords. The co-ooccurring keyword ''collaborative learning'' emphasises the importance of collaboration during teaching and learning. However, the type of collaboration emphasised is immaterial: this could be student-student collaborations, or student-teacher colaboration. Interestingly, Guo (2024) postulates that the significance of collaborative learning is emphasised: hence, the role of this

collaborative learning is considered crucial to knowledge construction. The appearance of the co-occurring keyword ''pedagogy'' reveals the importance of the process of teaching and learning, irrespective of the mode of delivery. Hence, Anderson (2020) argues that the term "pedadgogy" does not refer to the mere deployment of the methods and learning techniques. The scholar (Anderson, 2020) further postulates that effective pedagaogy equips students for life through the development of their personal, intellectaul and social resources. The scholar is of the view that good pedagogic practice encourages student engagement with highly considered forms of ideas, knowledge, ways of thinking and forms of discourse, and practices relevant to every individual's context.

Another important co-occurring keyword was ''flipped classroom''. It is noteworthy that Danker (2015) explains that the flipped classroom enables the redesign of large lectures into active-learning classes, made of small groups. Danker also highlights that active learning in small groups facilitates student engagement, where they could participate, develop higher-order thinking skills, and receive feedback. Interestingly, Danker also found that the flipped classroom approach promotes individualised learning. According to the scholar, the flipped classroom fosters an environment that increases the interaction between teachers and students, and enables student engagement through practice and application.

Another trend is student engagement. In this regard, Yang and Ghislandi (2023) maintain that student engagement is a qualified proxy for quality learning and teaching. This is confirmed by Mohamed (2024), who argues that combining face-to-face learning with a blended learning framework has revealed an increase in student engagement as well as collaboration with instructors and peers. Accordingly, Mohamed argues that blended learning facilitates the creation of an interactive and dynamic learning space: hence, fostering active engagement among students, resulting in enhanced academic achievement.

Wang et al. (2017) sum up the argument made in cluster 1. The scholars argue that education is no longer something that is imposed externally on students, or just forced onto beings: rather it must emanate from students themselves.

4.3. Cluster 2: Academic achievement and problem-based learning

This cluster contained 25 items. The keyword ''academic achievement'' occurred in both clusters 1 and 2. Therefore, the importance of students achievement in blended laerning cannot be over-emphasised. As Mahmood et al. (2024) show, numerous studies have recently explored the impact of the incorporation of blended learning on student academic performance. Furthermore, the study conducted by Mahmood et al. (2024) revealed that a blended learning approach, with some targeted effort, enhances students performance. Moreover, the scholars argue that this was influenced by the enabling opportunities that students had been afforded, such as collaboration facilities through online mediums, and better interaction, which contribute to increased learning.

Problem-based learning, affords students an opportunity to become active constructors of knowledge. Generally, problem-based learning is considered one of the most important elements of high-order thnking, and develops students' critical thinking. Students who are engaged in problem-based learning more often display the skills and the ability to make decisions. The appearance of the keyword ''problem-based learning'' confirms Mahmood et al.'s (2024) asssertion, who supported previous studies that a blended learning approach promotes higher-order thinking better than traditional teaching practices.

4.4. Cluster 3: Student satisfaction

This cluster has three items only: namely ''satisfaction'', ''student'', and "university sector". Student satisfaction with the teaching and learning process is critical, since it might contribute to student attitude to learning, which could impact academic achievement. In their study, He et al. (2023) found that teacher support facilitates student course engagement, and consequently, student satisfaction.

Some of the important factors that contribute to student satisfaction in teaching and learning are feedback and academic performance. The scholars are also of the view that improved feedback mechanism fosters student motivation as they feel acknowledged and more engaged in the learning process. The study conducted by Chilton et al. (2023) revealed that students appreciate remote learning in other context, but that this should be complementing and should not necessarily supersede face-to-face mode of delivery. Ultimately, Chilton et al. warn that HEIs and teachers should be dynamic and flexible in their interactions with students and acknowledge that this is not a one-size-fits-all model.

4.5. Cluster 4: Community of inquiry

"Community of inquiry" was the only co-occurring keyword that was displayed under the last cluster. This study confirms Castro's (2019) findings, wherein most of the trends that were identified from a pedagogical perspective consisted of models, frameworks, as well as practices at individual and group level: for instance, student-centred approaches, active learning, flipped classrooms, peer

collaborative learning, and communities of inquiry. However, most of these trends fall under the second cluster as discussed above.

Progressively, Teane (2024) states that cognitive presence as part of the theory of a community of inquiry refers to the extent to which individuals could construct and confirm meaning through sustained discourse and reflection: this speaks to what is referred as knowlegde construction. Accordingly, Castro (2019) notes that the core elements of communities of inquiry under practices at group level include among other things, social, teaching, and cognitive presence. This confirms an assertion by Yang and Ghislandi (2023), who clarified that the community of inquiry framework argues that teaching presence, cognitive presence, and social presence are necessary for an enriched online learning experience.

5. Discussion

Pei et al. (2024) maintain that for two decades, blended learning has been considered one of the fastest-growing trends in higher education. It is noteworthy that blended learning, if implemented correctly, would promote student-centred learning, through problem-solving learning, engagement, collaboration, and active learning: hence also enhancing student motivation and satisfaction with teaching and learning, and academic achievement. Notably, in blended learning students for instance, construct knowledge, based on their experience and as they interact with peers and content. This confirms Mahmood et al.'s (2024) findings that problem solving, engagement, and active learning are pivotal in the blended learning approach, wherein students are interpreting and exploring information, instead of passively receiving it. Hence, Mahomed (2024) has recommended that educational institutions should utilise blended learning to further improve student participation and engagement in learning.

Above all, blended learning presents itself as a different learning space. Moreover, the pedagogy, teaching, and learning unfold in a manner that would ensure that everything is student-centred. As Wang et al. (2017) contend, in a blended learning environment students are responsible for actively constructing and engaging in different cognitive activities. This means that they are actively engaged in discussing, creating, thinking, reflecting, collaborating, and investigating.

It is important to note that ''curriculum'', "teaching and learning'', and ''perception'' as co-occurring keywords also suggest that lecturers should plan to implement a blended learning delivery mode, based on their knowledge of their students' different learning experiences, as blended learning allows for a personalised learning experience. This finding support the results of a study conducted by Ait Daoud et al. (2024) that suggested that lecturers should consider the different learning styles of their students when designing and delivering blended learning courses. The most important advantages of blended learning is that it allows for student flexibility: students can access course materials anywhere, and at anytime (Mahomed, 2024). One great benefit of technology-mediated learning is that it affords individuals extended opportunities to acquire the skills and the rich knowledge: hence, it creates a more dynamic and inclusive educational environment. Similarly, Onah et al. (2022) note increasing students' autonomy, students' control of the study environment and their studies, and flexibility as some of the advantages of blended learning.

Besides the great advantages that blended learning presents in teaching and learning, like promoting active learning and student-engagement, it also has some disadvantages. Teane's (2024) study revealed that a lack of resources; like the shortage of data projectors, computers, and other gadgets make the use of online mechanisms challenging. Additionally, access to data and the internet was also a challenge (Teane, 2024). Notably, Wang et al. (2017) found that there is a great demand for information technology skills from both teachers and educational administrators. This confirms the findings of a study conducted by Teane (2024) that the acquisition of technological literacy enables teachers and students to engage in online modes of delivery. The findings in this regard are in line with Teane's (2024) findings: the scholar suggests that teachers at higher education institutions must be the first to receive training in online skills. On the other hand, Pei et al. (2024) warn that instructors must use these communication technologies with caution in blended learning. Interestingly, Teane (2024) maintains that according to Fullan's theory of change, lecturers who adopt the blended learning approach become agents of change. However, Onah et al. (2022) warn that higher education institutions should not expect students to be equally effective in a particular new mode of learning. The scholars argue further that support is required to ensure students' adjustment and the development of their practice of self-regulation for learning.

This study has limitations. The researcher limited her search scope becasue she relied heavily on a single database (Scopus). The researcher is of the view that further qualitative data on students's perceptions of blended learning would ensure valuable contributions to scientific research.

6. Conclusion

To answer the research question, the researcher analysed the data obtained using VOSviewer. Hence, she could identify a large set of the existing trends on blended learning delivery, based on the different or multi-disciplinary research evidence. Lecturers could contribute positively towards students' learning experiences and enhance their academic achievement if they implement the appropriate blended learning approaches.

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REFLECTING ON NEW PUBLIC-SCHOOL TEACHERS' PRACTICES IN THE PANDEMIC IN BRAZIL

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Abstract

In 2020, the coronavirus pandemic caused the closure of schools and the suspension of in-person classes. To face the new working conditions, teachers were forced to work remotely, transforming their homes into studios for recording video classes and interacting with their students using their private cell phones and internet. Beginner teachers, who did not have extensive experience in face-to-face teaching and training for distance learning, found themselves in a situation of extreme vulnerability. In this context, a question was raised: how do new teachers conduct teaching in pandemic? To answer the question, a research project was carried out, and this article will present its partial results. To analyze teachers' pedagogical practices, nine Early Childhood and Primary Education novice teachers from public schools in the state of Mato Grosso, produced an audio-video class recording, and this material was examined regarding the rules and types of pedagogic practice based on Bernstein's code theory. The author defends the distinction between pedagogic practice as a cultural transporter, and pedagogic practice in terms of what it leads to. In other words, between pedagogic practice as a social form ("how") and pedagogic practice as a specific content ("what"). The present study sought to analyze the pedagogical practice of beginning teachers and concluded that they tend more towards child-centered practices and cultural production (progressive and transformative) than practices centered on content and cultural reproduction (traditional and conservative).

Keywords: COVID-19 pandemic, beginner teacher, pedagogic practice, visible and invisible pedagogies.

1. Introduction

In 2020, the outbreak of the coronavirus pandemic led to a significant change in the world of work, across the globe. To contain the spread of the virus, many countries, including Brazil, closed schools, and advocated online teaching modalities as a solution. In this new situation, the pandemic has completely changed the need for internet connectivity and technological devices across the entire population, especially among children (Ayllón, Holmarsdottir, & Lado, 2023), including the poorest students living on the outskirts of large cities or in rural areas (Dias & Pinto, 2020).

Assuming full responsibility for adapting to the demands of new teaching conditions, and without any financial, material, technological or pedagogical assistance, teachers were forced to work remotely setting up home studios to record class videos, and interacting with students using their private cell phones and home internet connection. In a poorly adapted workspace, beginner teachers, who did not have extensive experience teaching in public-schools, training for distance learning, nor technological resources or mastery of the use of technology, found themselves in a situation of extreme vulnerability.

In this context, a question was raised: how do beginner teachers conduct teaching during the pandemic? or how do they conduct pedagogic practice? To answer the question, a set of data from the Project "Interrupting inequitable teaching, fostering equitable pedagogies: re-mediating the practices of novice public school teachers" approved in 2020 (PLATAFORMA BRASIL/CAAE/CONEP n. 33715120.2.0000.5690) was analyzed, and partial results will be presented in this article.

2. Theoretical background

Bernstein (1996) states that social relationships between transmitters and acquirers regulate pedagogic practices and generate the shape of the communicative context. He also distinguishes between pedagogic practice as a conductor, a cultural transporter, and pedagogic practice in terms of what it leads to. In other words, between pedagogic practice as a social form ("how") and pedagogic practice as a specific content ("what"). In this way, a pedagogic practice can be understood as "a uniquely human device for both the reproduction and production of culture" (p. 94).

Bernstein further argues that pedagogic practice as a cultural conductor is regulated by hierarchical, sequencing/passing, and criterial rules, which generate modalities of pedagogic practice, visible and invisible. Hierarchical rules were called by Bernstein as regulative rules, and rules of sequencing/pacing and criteria as instructional or discursive rules. If regulative rules and instructional or discursive rules are explicit, he defined as a type of visible pedagogy (conservative or traditional), and if implicit, as a type of invisible pedagogy, that is, progressive or child-centered pedagogy (Bernstein, 1996, p. 94, 103).

According to Domingos, Barradas, Rainha, and Neves (1986), in Bernstein's theory, in an invisible pedagogy, the teacher creates the context that the child will recreate and explore; the mode of transmission encourages the child's manifestation, pedagogical resources tend to be less predetermined in the form of textbooks or teaching routines, and pedagogical discourse emerges in the form of projects, themes, diversity of experiences (Bernstein, 2003). Also, the teacher's control is not explicit, but implicit, and the pedagogical evaluation criteria are multiple and diffuse, therefore, difficult to measure, because the teacher's attention is focused not on the acquirer's product, but as a whole, in its total "does" and "don'ts" (Domingos et al., 1986). When the pedagogy is visible, the regulatory rules are explicit, the relationships between transmitter and acquirer are one of domination/subordination, the emphasis is on the text that the acquirer produces, and the teacher's performance consists of a pedagogic practice that originates a possible correction work (Bernstein, 2003).

In short, invisible pedagogies emphasize acquisition-competence, and visible pedagogies emphasize transmission-performance.

3. Methodology and results

This article presents partial results of a qualitative and exploratory broader study carried out from 2019 to 2022 on the teaching practices of new public-school teachers during the COVID-19 pandemic in Brazil. In this study, beginner teachers, new teachers, or novice teachers refer to teachers in the first three years of the career in public school, considering this period as a probationary internship. Under the terms of the Brazilian Constitution, the selection of public servants takes place through a public competition, and if selected and at the end of the probationary period is approved, they occupy permanent position in the public administration, and have the right to job stability, except in cases of serious misconduct or other circumstances provided by law. Moreover, beginner teachers are university graduates (Pedagogy course), and some of them have previous teaching experience as hired temporary assistant in public or in private schools (Romanowski & Martins, 2013).

To analyze novice public schoolteachers' practices, in this study, audio-video class specifically about a teaching activity (or a form of transmission, according to Bernstein) were provided by nine beginner Early Childhood and Primary Education from public schools in the state of Mato Grosso. The material provided by the participating teachers was examined to identify regulative and discursive rules and visible and invisible pedagogies based on Bernstein's code theory. Importantly, participating teachers did not receive any instruction or intervention from the researchers on how to create them.

Given our attention to the location of this study, Mato Grosso is a large state located in the central-western region of Brazil. It is the third largest state in the country, and predominantly rural. It has 141 municipalities and the predominant economy is cattle raising and agriculture. In this study, the teachers are from seven different municipalities, one is located more than 100 km from the capital Cuiabá, four are more than 200 km away, and one of them almost 1,000 km away.

To briefly describe the study subjects, most of them were over 30 years old (N = 7), although they were beginners in public administration; also, they had little (N = 4) or no experience (N = 4) in public education, specifically with young children. Some were recent graduates (3 to 5 years) (N = 5), while others had completed the teacher education course more than five years ago (N = 4).

Regarding to the class videos, two teachers (CCA; CCV) recorded a video for Early Childhood Education students aged 4 and 5, one teacher (POR) prepared a class video for 2nd year students, two teachers (BMC, MVV) for 3rd year students, three teachers (TSD, PLR, BMR) for 5th graders, and one teacher (CBA) for 6th graders. The video classes recorded covered knowledge areas of Mathematics (origin of numbers, equivalence, polygons, decimal number system), Portuguese Language (production of texts – stories, literacy) and Social Studies (free fairs, indigenous and African dances), and all these contents were selected by the teachers from the National Common Curricular Base.

To illustrate the recorded videos, we will present a summary of each of them. CCA created an animated and colorful video telling the story of the origin of numbers; CBA created a video to explain Equivalence using a picture of a weight scale with three equal spheres on each side; after the explanation, she showed how to carry out an Equivalence in equalities exercise; BMC provided a video showing her telling a story from a storybook; after, she explained each part of a story, instructed how to create it and

asked the children to produce a new one; TSD recorded a video to explain simple (convex and concave) and complex polygons, and to ask students to solve the exercises; BMR recorded a video to teach the composition and decomposition of numbers, and the absolute and relative value of the digit, using a whiteboard fixed to the wall of the house; afterwards she performed an example exercise to show how to do the homework; PLR recorded a simulation of a face-to-face class and the theme was free fair. First, he asked questions about the topic of the class, then he gave information about a school feeding law, sang a song, asked the students to walk around the classroom to see the pictures about fairs from different regions of the country displayed on the mural; then, he invited students to talk about the figures, and asked them to produce a text on the topic; POR recorded a video to explain the exercises on pages 6, 7 and 8 of the textbook about the vowels (a, e, i, o, u); MVV recorded a video to explain how to perform exercises on indigenous or African dances, using the Jambord tool; CCV recorded a video to explain to parents and children the objectives of each exercise and how to perform them.

All the videos analyzed in this study were homemade and amateur audiovisual productions, made by the teachers themselves using programs and tutorials available on the internet. Some videos contain animations and a background soundtrack, but in all of them, there were images projected on slides. The teachers were the only speakers in all recordings, and the narrations vary between in *on* and *off*. The videos were recorded at the teachers' homes or at the school where they work; the lighting is natural or residential electrical, and the framing is fixed, without camera movements.

Each video was analyzed regarding the communicative context of transmission (whether the pedagogic discourse emerges from projects, themes, experiences or is pre-determined in the form of textbooks), control (whether the relationship between teacher and students is one of domination/subordination or whether children are encouraged to express themselves) and the evaluation criteria (whether the emphasis is on the acquirer's product or on the production process, and whether the criteria are measurable and easy to correct or are multiple, diffuse and difficult to measure).

To illustrate what was mentioned above, we will present some examples. Firstly, we will describe some examples of the **communicative context** of a visible pedagogy and an invisible pedagogy.

Visible Pedagogy

Example 1: *"Today we will have that guidance for families and children... that we have every month, that we deliver our planning... our theme for the month of November will be "Taking care of our Pantanal". And then, in our theme, we have our activities. What will be our activity here, our first activity? Our first activity consists of helping the child to reason, getting them to complete the numerical sequence [...] In activity number 2, we must fill in the missing vowels. What vowels are missing here?"* [CCV]

Example 2: *"This is the first activity. Here we have the map of Brazil, each color corresponds to a region, and previously in the video that the "pro" sent to you, each dance is typical of a region in Brazil. However, we have five dances here. What are you going to do? For example, Catira, click on Catira. Did you click? Then you can drag it, do you remember which region it is from? Look, Catira is from the central-west region, this is the region that is in red. So, you are going to take the Catira there. So, right? And then you will remember where Carimbó is, click on Carimbó and drag it to its region. And you will do this with Frevo, Samba and Pau de Fita. If you did not remember, go back to the video you have on your WhatsApp that the "pro" already sent and look at the video again so you can clear your doubt. All good? Once this activity is complete, click on the next arrow. Here you will write interrogative and declarative sentences. So, there are at least two sentences."* [TVV]

Invisible Pedagogy

Example 1: *"Do you remember that yesterday, children, in our geography class, we worked on rural areas? We saw the characteristics, right? How these rural spaces are constituted, and the people who live there, in these spaces. What they do. We saw all of this yesterday in geography class, okay? And we also saw that most products that are sold in the city come from rural areas, from rural areas, where producers plant their products and sell them to the cities. And there is something interesting that I do not think you know yet. Did you know that there is a law, a federal law, exactly, it is a federal law, which is the law of the National School Lunch Program, which you are part of because you are the beneficiaries. Don't you have the lunch you eat at school? what snack is served? So, in this law it says that thirty percent of school meals, children, must come from family farming. Exactly. Thirty percent, children, of what we consume at our school must be acquired from family farming. Considering the importance of this topic, today we are going to talk about the fair in the classroom."* [PLR]

Example 2: *"I came here today to tell you a super interesting story. Has anyone ever stopped to wonder where the numbers came from? Hmmm... this is a question you have had with us for a long time, right? And today, we are going to find out about this together, okay?"* [CCA]

Next, we will describe some examples of the **control** of a visible pedagogy and an invisible pedagogy.

Visible Pedagogy

Example 1: *"I do not want you to cross the line. It is to write exactly as it is here, within this line, okay? If not, you will have to delete it and do it again later. So, let us do it very calmly, you have four hours of class with me to make it well done and beautiful, okay?"* [POR]

Example 2: *"Hello. Good afternoon, class. In this first Mathematics class, we will work on the content of the Decimal Number System. Content that is not new for the class, you have already known this decimal number system since the third year, or second year, right, when you started from units to tens. So, today, we are going to clarify a little more, a little more about this system. Why what is the objective of studying the decimal system? It is so that you can learn to read better, classify, write, and order numbers. Why? We must know how to place a unit, a ten, a hundred and a thousand, because we use these numbers in everything in our lives, from studying Mathematics, to an economic factor, to a calculation that I need to build, or to manufacture something, then it involves numbers. So, we must know how to classify, order, and also write, which is the number in full. Let us go. Starting."* [BMR]

Invisible Pedagogy

Example 1: *"The next day, they would open the bag and check if there were still the same number of animals outside and, if so, they would know that none of the animals were missing. And if there was not, yikes, it was a real problem. If it had not been, some animal would have disappeared. And so, they started to have this control, and every day they improved... perfected themselves... as time went by, they reached what we know as numbers today. And look, how much time has passed, right? And to this day, numbers are extremely important to us. Imagine! How would we live if we did not have numerals, right? So, for you to see how important the number is in our lives, and how long it has existed. Did you see how interesting it was? And that was today's story. I hope you enjoyed."* [CCA]

Example 2: *"Good morning. Today, what is our first activity? The reading. But today will be different. I will read it for you, then I will explain it better so you can create a new story, ok? [...] Hello students, shall we continue? So, after reading the title Tatu Balão, now it is your turn! You will create a new story where you will be, who? The writer and the illustrator, ok?"* [BMC]

Finally, we will describe some examples of **evaluation criteria** for a visible pedagogy and an invisible pedagogy.

Visible Pedagogy

Example 1: *"Now, I am going to leave you, sixth year B, a probing exercise, so I can check what you understood from this explanation. So, look there. Observe the image below. We have an equality where the terms on one side are: an orange, plus a number 6, plus a number 5, which is equal to the number 3, plus the number 2, plus an orange, plus another orange. So, this is our equality. So, you will look at this image that is posted in this exercise, and you will think about how you can, you know, organize, and solve this exercise, to find the value of each orange, okay? So that is what Profe wants to know. What is the value of each orange? And then, by solving this exercise, you will mark the correct answer. [...] So, given this tip from the teacher and the explanation, I want you to now solve this exercise in your notebook. And as soon as you solve this exercise, the Teacher wants you to take a photo of the solution in your notebook, and send it to the teacher's group. That the teacher will check who is thinking straight, who is able to solve it, who is still in doubt, okay? It is okay if you do not know how to solve it. This is just a first step, it is just our introduction, and Profe will work together with you, okay? You do not need to be afraid if you cannot solve this exercise, okay?"* [CBA]

Example 2: *"So, on the next slide we will have activities on the subject. Good luck! This slide, guys, is the first exercise you will have to solve, okay? Here it asks that you will have to analyze the figures below and answer whether they are convex or not, okay? So, very carefully, you can review the previous slides, and I am absolutely sure that you will be able to solve this exercise number 1, okay? So, a lot of attention, dedication, everything will work out. [...] Ah, in exercise number 2, guys, there are five questions for you to answer. There are subjective questions and objective questions, all related, all related to the subject that was studied in class number one. So, I completely believe that you will be able to respond calmly, ok? A lot of attention, determination, that everything will work out. Big hug, success."* [TSD]

Invisible Pedagogy

Example 1: *"Every story happens around the main character, okay? I thought about the characters, then. I must think about the environment where this story will take place. It could be in a forest, it could be in a city, or in a field. You will choose an environment where this story will take place. [...] And do not forget to put your name at the end. The name of the writer and the illustrator, ok? Good activity, see you later!"* [BMC]

Example 2: *"Now, you have already circulated around the room, you have observed, you have seen, you have talked, you have debated, now there is a really cool activity for you to do. You will now produce a text. That's it! A text production, where you will report, in this text production, your experience with the fair, right? What are your customs, your habits, why do you go to the fair, what day do you go to the fair, right? Who do you go to the fair with, what do you like to buy at the fair and the importance of a fair within the municipality."* [PLR]

The present study sought to analyze the pedagogic practice of beginner teachers, looking for the tendencies between a practice as a cultural transporter and a practice as a specific content, and the analysis of the teachers' forms of transmission showed that POR, MVV and CCV tend to a context of communication, control, and evaluation criteria, which are highly explicit, and in this way, his pedagogical practice tends towards a visible pedagogy, while CCA, BMC, PLR present a tendency towards communication contexts, control, and evaluation criteria strongly implicit, and therefore, an invisible pedagogy. BMR and TSD presented an implicit communication context, but explicit control and evaluation criteria, thus defining a tendency towards a visible pedagogy. And CBA presented an implicit communication and control context, and explicit evaluation criteria, revealing a tendency towards an invisible pedagogy. Thus, our study finds that new public schoolteachers tend, although there are some variations, toward pedagogical practices that emphasize social form and acquisition competence (invisible pedagogy) rather than content and transmission performance (visible pedagogy).

In summary, they tend to a child-centered and cultural production practices (progressive and transformative) more than content-centered and cultural re-production practices (traditional and conservative). This study did not examine the full choreography of interactions in the classroom context due to limited research conditions, but the results unveiled the relevance of the findings. Research carried out during the pandemic revealed that the new teachers' instructional obstacle is not technological, but the internal logic of their practice, which is the fundamental grammar of a pedagogic practice (Bernstein).

4. Conclusion

Our study highlights that some new teachers understand what a teaching activity is, however, others do not distinguish between a teaching activity and an activity for fixing or evaluating learning. Some teachers organize creative and appropriate instructional practice, while others present confusing instructional discourse that is difficult for children to understand, demonstrating a gap in teachers' knowledge of the subject matter to be taught. Some teachers organize an instructional discourse based on a theme, and follow a step-by-step didactic sequence, interconnecting the parts, while others organize an instructional discourse around a theme, but the parts are disconnected and the components have different purposes (numerical sequence, vowels, motor coordination, etc.). Some teachers, even in a non-interaction context, seek children's participation, but others, although are not aggressive or authoritarian, maintain a subtle relationship of dominance/subordination, providing instructions, orders, and limits to the child's behavior. Some teachers plan a creative and interesting sequencing/passing, but at the end of the transmission the assessment of learning is made using criteria focused on the product, right or wrong, or the exact answer. In conclusion, it is important to recognize that this investigation offered new ways of thinking for new teachers who still promote cultural reproduction in public education, based on an unfair pedagogy, disregarding that their students are children of the poorest families in society, dependent on (re)action of teachers to transform this social injustice.

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LEVEL OF PHYSICAL ACTIVITY AMONG UNIVERSITY STUDENTS

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Abstract

Introduction: The contribution focuses on analyzing the level of health-related behavior and identifying risk factors for musculoskeletal health among university students with specific professional orientations in the context of physical activity. The research aimed to determine the level of physical activity (PA), sleep disturbances associated with pain, and motivation for exercise among university students. Methods: The study involved 192 physiotherapy students. The level of physical activity was assessed using the International Physical Activity Questionnaire (IPAQ). To determine the prevalence of pain among students, we used the Oswestry Disability Index (ODI), focusing on lumbar spine pain, supplemented with demographic questions. Results: In the IPAQ questionnaire, students achieved the following overall physical activity scores: 5 students (2.6%) exhibited low levels of overall physical activity; 30 students (15.62%) exhibited moderate PA, and 157 students (81.78%) were moderately active to highly active. The average time spent sitting among the surveyed students was 306.81 minutes/day. Higher values of high-intensity physical activity were exhibited by male students compared to females, and they also spent less time sitting. Research results demonstrated that the largest proportion of overall PA was achieved through activities related to clinical practice during studies (ø 3071 METs/week). The average value of overall physical activity among students who reported no sleep disturbances due to pain (n: 148) was 7671.21 MET, while among students who reported occasional sleep disturbances due to pain (n: 44), the average value of overall physical activity was 6628.81 MET. Strong motivation for PA influenced by studying physiotherapy was reported by 29 (15.10%) students, moderate influence by 83 (43.23%). 33 (17.19%) students were engaged in PA before starting physiotherapy studies, and 9 students (4.69%) stated that their motivation for PA was not influenced by their studies at all. Conclusion: Students who regularly engage in sports activities tend to perform more diverse types of physical activity. Studies focused on movement and physical behavior reflect young people's attitudes toward physical activity. The expected benefit is gaining lifelong professional competencies among university students that will positively influence their health-related behaviors with the intention of preserving musculoskeletal health.

Keywords: Education, university students, lifestyle, motivation, physical activity.

1. Introduction

University students represent a special population with a diverse range of health issues that affect their lifestyle preferences as well as their ability to learn (Grasdalsmoen, Eriksen, Lønning, & Sivertsen, 2020; Freudenberg & Ruglis, 2007). Supporting the health of university students is one of the key imperatives of modern society. One cost-effective approach to preventing the onset of diseases in young individuals is engaging in physical activity (PA) (Dimitri, Joshi, & Jones, 2020; Gordon, McDowell, & Hallgren, 2018). Many studies have focused on the global decline in physical activity and the concurrent increase in sedentary behavior, obesity rates, learning difficulties in children, and the rise in mental health disorders (Anderson & Shivakumar, 2013; Lowry, Lee, & Fulton, 2013; Ghrouz, Noohu, & Dilshad, 2019). The prevalence of physical inactivity in the young population is alarmingly high, reaching levels of 80% (Sallis, Bull, & Guthold, 2016). Therefore, it is interesting that the development of cognitive functions in young people is associated with their level of physical activity behavior (Crone & Dahl, 2012; Fagaras, Radu, & Vanvu, 2015). Students in healthcare disciplines, whose studies are closely linked to the diagnosis and therapy of movement disorders, benefit from applying study methods to their personal lives. They are more flexible in intervening in elements of a healthy lifestyle, and in combination with their acquired medical knowledge, they have a higher motivation for self-realization.

Currently, there are no studies that have examined the impact of a student's study program on their level of physical activity.

University students constitute a group of young individuals transitioning into adulthood, a period associated with assuming responsibility for their behavior. The freedom inherent in student life, coupled with the academic demands it naturally entails, can be challenging for a certain subset of young individuals to manage, ultimately manifesting in feelings of anxiety, depression, sleep disorders, and impacting their academic performance (Watkins, Hunt, & Eisenberg, 2012). Several studies have confirmed a direct correlation between levels of physical activity and sleep quality among university students (Gubelmann, Heinzer, & Haba-Rubio, 2018; Arbinaga, Fernández-Cuenca, & Fernández-Ozcorta, 2019). In our study, we focused on the physical activity of physiotherapy students, their motivation for sports activities, and the impact of sleep quality on their level of physical activity.

2. Methods

We assessed the level of physical activity among a sample of 192 physiotherapy students using the International Physical Activity Questionnaire (IPAQ). Sleep quality was evaluated through the Oswestry Disability Index (ODI) questionnaire. Additionally, a self-constructed questionnaire was employed to inquire about the influence of the students' field of study on sports-related physical activity. Data analysis was conducted using descriptive and analytical statistics, including the Student's t-test.

3. Results

Analysis of the IPAQ questionnaire revealed that the largest proportion of total physical activity (PA) among students occurs during activities related to their studies and sports activities. On average, students spend 306 minutes per day sitting. Throughout the week, females engage in more physical activity at moderate and vigorous levels compared to males, but not at high levels of PA (see Table 1). Five (2.6%) students exhibited low levels of overall physical activity, 30 (15.62%) students demonstrated moderate levels of PA, and 157 (81.78%) students achieved high levels of PA.

Table 1. Overall evaluation of the IPAQ questionnaire (MET/week).

Category		n	average	SD	P ($\alpha \leq 0.05$)
School		192	3071.68	± 3282.79	
Transport		192	1113.59	± 1113.76	
Household. garden		192	1319.29	± 1783.04	
Sport		192	1925.54	± 1801.12	
MET total		192	7430.09	± 4795.82	
Sitting (min/day)	total	192	306.81	± 390.76	
	boys	47	297.31	± 145.10	$p \geq 0.05$
	girls	145	309.89	± 442.45	
Light PA (MET)	total	192	2322.03	± 1878.28	
	boys	47	2126.32	± 1558.17	$p \geq 0.05$
	girls	145	2385.46	± 1971.62	
Moderate PA (MET)	total	192	2144.06	± 1997.18	
	boys	47	1968.96	± 1739.19	$p \geq 0.05$
	girls	145	2200.82	± 2076.32	
Vigorous PA (MET)	total	192	2966.24	± 3011.04	
	boys	47	4320.86	± 3107.80	0.000324
	girls	145	2527.16	± 2854.32	

We examined how pain affects the quality of sleep among students (see Table 2). Out of the total sample, 77.8% of students (n:148) reported that their sleep is not disturbed by pain, while 22.92% of students (n:44) reported that their sleep is occasionally disturbed by pain. The average value of total physical activity among students who reported that their sleep is not affected by pain was 7671.21 MET/week. Students who reported that their sleep is occasionally disturbed by pain achieved an average of 6628.81 MET/week of total PA. Among individuals who reported that their sleep is not influenced by pain, we also found higher average values of physical activity at high (3123.50 MET) and moderate

(2431.14 MET) intensities. Individuals who reported that their sleep is occasionally disturbed by pain exhibited slightly higher average values of moderate-intensity physical activity (2236.52 MET) compared to their peers from the other group (2116.57 MET). The greatest differences between groups were observed in all statistical data regarding high-intensity physical activity.

Table 2. Physical activity according to sleep quality (MET/week).

	n (%)	Light PA	Moderate PA	Vigorous PA	Total
Sleep undisturbed by pain	148 (77.8%)	2431.14	2116.57	3123.50	7671.21
Sleep occasionally disturbed by pain	44 (22.92%)	1955.02	2236.52	2437.26	6628.81

We observed the approach to engaging in sports-related physical activity based on determining its level and quality (see Table 3).

Table 3. Level of physical activity.

	n (%)	Sitting (min/day)	Light PA (MET)	Moderate PA (MET)	Vigorous PA (MET)	Total (MET)
Regular professional level	7 (3.65%)	153.26	2944.07	2971.14	8635.71	14550.93
Regular non-professional level	89 (46.35%)	303.00	2303.83	2139.97	3295.15	7811.55
Irregular non-professional level	84 (43.75%)	328.31	2303.83	2162.38	2328.27	6794.49
Without physical activity	12 (6.25%)	336.22	1407.50	1035.00	600.42	3042.92

The majority of students engage in both regular and irregular sports activities. Among these two groups, there are minimal differences in the average values of physical activity. The most significant differences are observed in the average values of total physical activity and high-intensity physical activity.

We investigated the impact of studying physiotherapy on students' relationship with physical activity based on additional questions. From the results, it is evident that out of 192 surveyed students, 29 (15.10%) responded that their study of physiotherapy significantly influenced their relationship with physical activity and motivated them to engage in higher levels of PA. 83 (43.23%) students reported a moderate impact of studying physiotherapy on changing their PA. 38 (19.79%) students answered "slightly", 33 (17.19%) students responded that studying physiotherapy did not influence them and that they were already engaged in physical activity at the same level before, and 9 (4.69%) students stated that their motivation for PA was not influenced by their studies at all.

4. Discussion

The aim of this study was to analyze the impact of academic specialization on the level of physical activity among students. Choosing a healthcare discipline focused on treating movement disorders presupposes a positive relationship with a healthy lifestyle. Nearly 82% of students in our group exhibited a high level of physical activity, and more than 58% of students confirmed the influence of their study program on their attitude towards regular exercise. There are studies that confirm a positive relationship between academic achievement and level of physical activity (Rasberry, Lee, & Robin, 2011), but scientific publications lack studies specifically focusing on monitoring the direct impact of study programs on changes in physical behavior.

5. Conclusion

Education shapes young individuals not only professionally but also ideologically and physically. Regular engagement in sports activities at a young age is fundamental for building a healthy lifestyle. For further insights into this issue, studies based on the mutual comparison of physical behavior among students from multiple academic disciplines are necessary.

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TEACHING AND LEARNING PRACTICES IN HIGHER EDUCATION INSTITUTIONS: WHERE HAS THE THEORY GONE?

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Abstract

Higher Education Institutions (HEIs) are responsible for imparting knowledge to the next generation of change-makers. While knowledge can be gleaned almost instantaneously from the Internet or an AI alternative, many students continue to choose HEIs to solidify and confirm their acquisition of specific skills and competencies. In the recent years, many HEIs have adapted their teaching and learning practices to embrace or at least accept technology in the classroom. With the experience of the COVID-19 pandemic, more technology was hastily implemented and came without directions or, more appropriately, without pedagogical theory. While theories for using technology exist, the focus was on getting courses running rather than matching the theory or tool to the context. As HEIs have returned to campus, there is time for reflection on the choices that were made and the practices that should continue moving forward. This study focuses on the importance of linking theory to instructional practices in HEIs. We expand on teaching theories, learning theories, practical theories, dynamic theories, and even transformational theories. Our study is based on the development of a metro map of teaching and learning, that we created using the data of 4 surveys held at a Business School in Fribourg, Switzerland during the pandemic. This metro map was then used in a scholarly discussion at the SFDN conference (Swiss Faculty Development Network) in 2023, where we got first feedback of 12 faculty-members of HEI's. This survey will be reconducted with all users of faculty training of the HES-SO (University of Applied Sciences and Arts Western Switzerland). Until now, we found that many traditional theories can be named and may be implemented but need to be better aligned with actual practice. In the rush called *emergency remote learning*, faculty members were more interested in tools to use and tasks to do online; theory took a backseat to the daily needs of animating online classes. Back on campus, we continue using tools and creating tasks that lack the theoretical underpinnings. In this paper, we attempt to convince faculty members of the importance of theory for their teaching, student learning, and inclusion of technology moving forward. We offer an interactive map of theories where faculty members of all disciplines and schools can find their route toward lifelong teaching and learning. We can create the classrooms of the future with a foundation of theory, walls of traditional knowledge, and ever-expansive ceilings of possibilities.

Keywords: *Teaching, learning, Higher Education Institutions (HEIs), theory, practices.*

1. Introduction

For decades, educational experts have tried to introduce traditional pedagogical theories on untrained or unaware faculty in non-traditional contexts by oversimplifying or overcomplicating the teaching process, sometimes forcing them into this deeper understanding of education. Theory was seen as a necessary evil or a box to tick in preparing to be a teacher. During the pandemic, many pedagogical decisions taken were not based on any theoretical underpinning; instead, they were hastily set up in an emergency environment with a 'let's do our best' attitude. How many teachers looked up theories on teaching online? How many adapted their onsite courses to an online setting based on a sound theoretical framework? Few, if any. Teachers spent their preparation time on finding technology that worked, uploading videos and other learning resources, and getting the camera to function. The theory was nowhere in sight. Now, back on campus, we need to take the time to reflect on the choices we made and try to make sense out of a non-sensical period. Some faculty are working backward, that is, trying to fit a theory into their choices. For some experts, post-pandemic, it is time to come back to the roots and simplify teaching without losing its essential character (Hiebert & Stiegler, 2023). By creating an

interactive map with a choice of those theories, that were especially useful during the pandemic (Probst & Zizka, 2022), we try to choose appropriate theories and demonstrate their usefulness at all teaching stages and for as many teaching contexts as possible. Klauer (1985) claimed, "an all-encompassing theory of teaching can be conceived only as a hierarchy of interrelated theories." (p. 5); thus, in this paper, we try to show here the links between the theories.

Using this map suggests there is a general understanding of and comfortability with pedagogical theory. However, currently, there has yet to be a consensus on what a teaching theory is and if it even exists (Praetorius et al., 2023). No theory applies to all courses; not one theory that trumps all others; no hierarchy of theory to follow. Hence, choosing and using theory is a complicated and daunting task. Further, teaching theory is even more complex as faculty have to integrate learning theories into their teaching while building on theories of learning (Praetorius et al., 2023). For Hiebert and Stigler (2023), nonetheless, "it is possible to build theories of teaching – practical theories – that are useful for teachers" (p. 24), which they refer to as sustained learning opportunities or SLOs. However, "the same teaching moves that work in one classroom might not work in another classroom" (Hiebert & Stiegler, 2023, p. 40); thus, faculty may be positively rewarded in one instance and incredibly disappointed in another when basing their teaching on the same theory. Thus, faculty need a safe haven for trial and error when accessing and applying theories.

2. Methodology

This research project was initially based on a figure we developed in 2022 and that was published as a book chapter entitled "Bridging the Gap: From Instruction to Co-construction in Higher Education" (Probst & Zizka, 2022). From our previous research of 4 surveys done during the pandemic and analysis of about 1,700 comments, we established a metro map of practical steps or 'stops' for teacher training. As a follow-up, we then tested the metro map with 12 participants in a presentation at the Swiss Faculty Development Network (SFDN) conference in 2023. During this interactive session, we could gauge if and how participants linked theory to practice. We conducted a live online poll of four questions during the conference session, the results can be seen in the next section. This year, we extended our questions to those who registered for teacher training at HES-SO, in total 1742 persons (=n), but as the survey is still ongoing, we will share the full results in a later study. Hence, this paper focuses on our initial results.

3. Results

The results of the SFDN-conference show that with an average of 13 years of practice in teaching (6.4% of participants answered this questions), most of the respondents prove a certain routine in teaching practice and also have a certain knowledge of the pedagogical theories. Thus, they were able to mention all these theories, when asked which ones they know.

Figure 1. Pedagogical theories.

As seen in the results of the first question, 12 pedagogical theories were cited with *behaviorism* (7 times) and *constructivism* (4 times) being named most often. *Constructive alignment* as well as *connectivism* were the other theories that were mentioned several times. As the participants are faculty developers, we expected them to be quite knowledgeable about pedagogical theories.

Our second question focused on the utility of these theories for their courses: "If you want to base your course on pedagogical theories, which one is the most useful for you?"

Figure 2. Useful pedagogical theories.
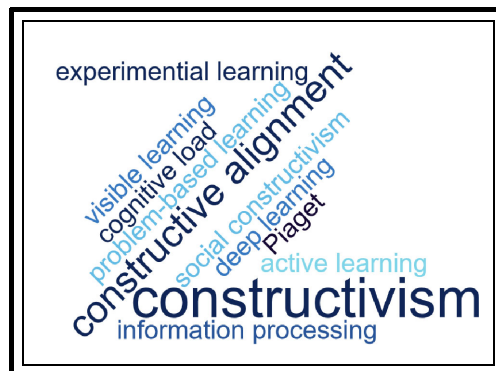
We can see here, that theories are perceived differently when asked about their usefulness, as *behaviorism* disappeared in the second answers, while the focus remains on learning theories.

As mentioned earlier, we developed an overview of important aspects or elements of teaching and learning theories, based on a series of surveys conducted during the pandemic with faculty members and students of a School of Management in Switzerland. The needs and challenges expressed in the open questions gave rise to this picture, when the online setting "obliged many faculty members to rethink their course methodology" (Probst & Zizka, 2022, p. 5) and translate their individual teaching ideas into online courses.

During the workshop, we then shared our metro map and asked participants to pinpoint the one element they felt was the most crucial for teaching (See Figure 3).

Figure 3. Crucial element for teaching.
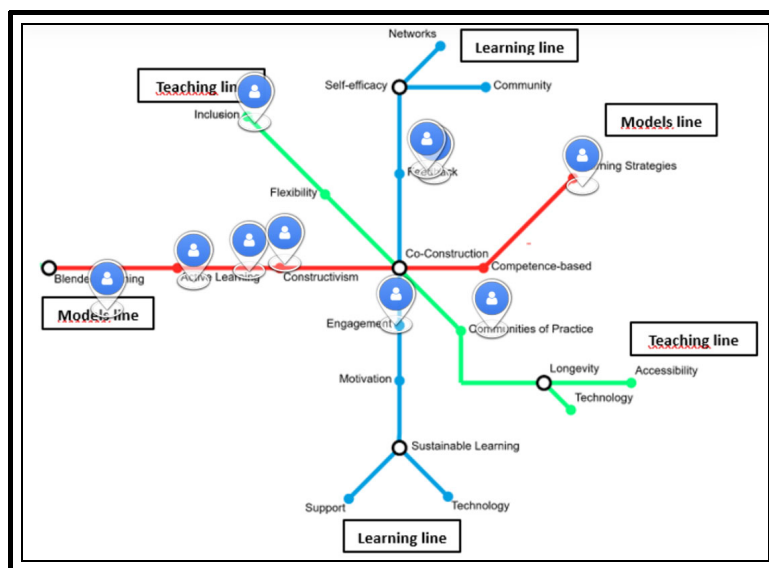
As seen in Figure 3, participants chose more 'stops' on the model's line, perhaps as it aligned with the topic of our workshop. However, inclusion, feedback, and engagement were also chosen. When one considers the crucial elements of teaching, these are pertinent factors as well. To delve further, participants were asked to choose the ONE stop that is the most important to them as educators. This was our question: In your teaching practice, which stop of this metro map is the most important for you? Figure 4 summarizes their responses.

Figure 4. Important stop on metro map.
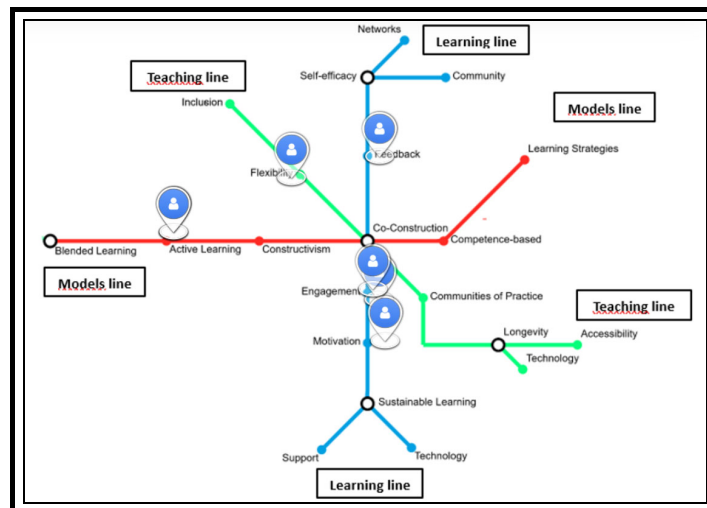
Compared to the models line that was predominantly chosen in the previous question, the responses focus here almost exclusively on the *learning line*. Even the two choices on the other lines, flexibility, and active learning, are also linked to learning. Thus, we can consider that all participants felt the most important aspect of teaching is LEARNING.

In these answers, we confirm there is some knowledge of theories and practice; however, we posit that the learning theories are more important for this public when it comes to their personal choice. "Teaching is guided by a personal theory of learning. The more complete this personal theory of learning is the more the teacher is able to help learners acquire new knowledge, skills, and attitudes." (Bachmann, 2019, p. 7). Thus, it is essential for any faculty member, to be aware of their personal understanding of learning, to be able to translate knowledge into practice.

4. Discussion

We live in a society of knowledge, yet the simultaneity of knowing everything and understanding nothing is a great paradox of our time (Weiss, 2022). We know theories exist, yet we may not know how to apply them. We may want to improve our teaching but are overwhelmed by day-to-day pressures that prevent us from making sound pedagogical decisions grounded in theory.

Despite all of the discussion around theory or personal preferences of theories, for Hiebert and Stiegler (2023), a good theory is one "that teachers actually can use" (p. 46). Faculty members who can easily identify the practical potential of the theoretical ideas will undoubtedly be better teachers since their teaching can be reflected from more angles and thus allow for a better understanding of what has to be changed to improve students' learning. We must not forget that the role of teaching theories is "to identify the characteristics of high-quality teaching" (Praetorius et al., 2023, p. 1). Unfortunately, researchers, teachers, and teacher trainers pick the one theory that fits their concept (Cruess, 2006). If we want to strive for a reflected choice, we better teach more of the instrumental theory, focusing on concepts that can best be translated into our students' learning.

5. Conclusions/Next Steps

Based on our results, we are questioning the perception of theory and how to re-incorporate it into teaching practices. We need to rethink the roles of educators and to "keep pace with the needs of 21st century learners, especially in the realm of workforce preparedness and entrepreneurship" (Becker et al., 2017, p. 38) but also with all upcoming new technologies, especially IA which is resetting all challenges, when it comes to production of learning resources and to assessment. What is needed is a common effort among professionals (Zizka & Probst, 2020). That may come in framing, i.e., instead of focusing on theories, we should focus on reflection or theorized practice to show the concrete link between theory and practice and their usefulness for teaching and learning. We could form communities of practice that would work together to create a fresh, innovative method for learning, applying, and living theory in our teaching. Clearly, theory must be learned and, to ensure learning, applied to specific contexts. We go further, however, by positing the need to 'live' the theory, to work with the theory, and to adapt our teaching to the theory. It is about "Learning, unlearning, relearning – lifelong learning is a must today"

(Bachmann, 2019, p. 2) – but not only for students also for their teachers. This symbiosis between theory and practice, traditional and new ways of teaching must find a fruitful combination. However, simply introducing theory into teacher training is not enough. We need to inspire teachers to seek out theories and test them in their classrooms. The metro map is one starting point to open the dialogue. Moving forward is crucial to continue this line of research to develop our metro map further and offer comprehensive options to teachers.

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SIMULATION MODELING OF A PRODUCTION SYSTEM

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Abstract

Modeling of production and communication systems is one of the modern trends in technical research, finding great practical application. Studying the features and application of simulation modeling by students in engineering specialties allows them to become familiar with real production tasks and the possibilities for their solution. This paper describes a research task considered in the training of students in the field of industrial production systems. A system made up of two production machines served by one robot is presented. Estimated performance values can be obtained and analyzed based on the results of simulation modeling of the system's performance under certain production conditions. For this purpose, the GPSS programming environment is used. Students are introduced to the programming language, basic GPSS operators, examine an example model or create a simulation model of the system under consideration. The obtained results in simulation modeling provide an opportunity for analysis and search for optimal solutions under set criteria for system efficiency. Solving such tasks would support the engineering training of students and their practical implementation.

Keywords: Industrial robot, robotic technology module, simulation modeling, GPSS.

1. Introduction

Simulation modeling allows solving many types of problems. For the purpose of teaching students of various master's courses in the field of industrial engineering, a production system consisting of two production machines that are served by one robot is considered. This is a commonly used robotic system in practice – a type of robotic technological module (RTM) that can work as a stand-alone unit or as part of a single system. This equipment can be considered as a mass service system, and the modeling done based on Queuing Theory (QT). The schematic diagram of such a production system is presented in figure 1.

Figure 1. Schematic of a production system.
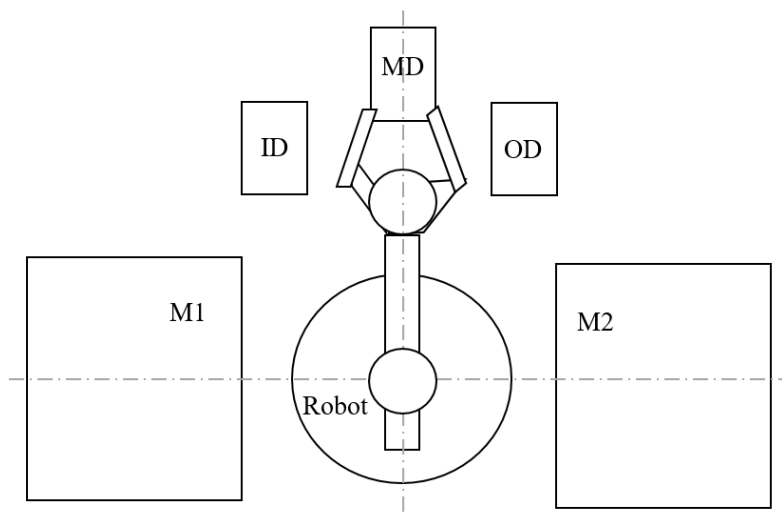
The location of the machines in the assembly diagram of the robotic module can be different, determined by the design features and overall dimensions of the machines, as well as by the features of the occupied work space. In this example scheme, the two machines (M1 and M2) are symmetrically located around the robot (Robot), and it is possible to sequentially perform operations from a single technological process (conditionally divided between them) or both to implement the entire technological process in parallel. The difference between the two types of work organization is in the service cycle of the machines and the need for an intermediate device (MD) in the sequential operation of machines with different operating times.

2. Methodology

2.1. Determining the range of service time variation

In sequential operation, the workpiece arrives at the system input (ID). Then, if the robot is free, it takes it and places it in the working area of the first machine. After finishing the processing, the robot leaves it in the intermediate device. With the second machine free, the robot takes a part from the intermediate device and places it in the work area of the second machine. After finishing the processing, the robot places it in the output device (OD), which completes one cycle of operation of the production system with sequential action. The production cycle of a parallel-acting industrial system begins with the arrival of the part at the system input (ID). If the milling robot is free, it picks up and places the workpiece in the working area of the first machine M1, after which it starts processing it. The robot is free to service the second machine M2 by taking a part from the input device and placing it in the work area of the second machine. Each of the machines, having finished processing a part, gives a signal for service from the robot. The machines are serviced in the order in which requests are received or according to a set priority (Kostadinov, 2017).

For the purpose of the exercise, each of the students considers a technological process with certain operating times realized by the two machines. Using the GPSS simulation environment (Schreiber, 1980), a simulation model of the considered production system must be created, through which its main characteristics can be predicted, such as performance and load of the equipment used under certain operating conditions. This allows students to become familiar with solving practical tasks on the optimization of industrial production tasks. In order to determine and analyze the performance of the system under consideration, it is necessary to set appropriate machine service times. These times must correspond to the permissible relative intensity ρ for the system under consideration: $0.1 < \rho < 0.5$ (Kostadinov, 2017):

$$\rho = \lambda/\mu = t_R/t_M , \tag{1}$$

where $\lambda = 1/t_M$, λ is intensity of service requests, t_M is the average working time of machines, $\mu = 1/t_R$, μ is intensity of service, t_R is the average working time of the robot.

Dependency (1) is used to determine the service time change limits, as:

$$t_R = \rho * t_M \tag{2}$$

Given machine times and an allowable range for variation of ρ, the appropriate range for machine service time variation can be determined. For close machine times, it is appropriate to work with their average value.

$$t_{Rmin} = \rho_{min} t_M = 0,1 * t_M$$
$$t_{Rmax} = \rho_{max} t_M = 0,5 * t_M$$

Using values of service times in the specified range and set machine times, through simulation modeling based on QT, it is possible to obtain estimated values for the main characteristics of the considered system, to be used in the selection of a suitable robot and its technical parameters. Consideration of these questions has a certain practical significance for the education of students in the field of modern industrial systems.

2.2. Simulation modeling in a GPSS environment

Once the service time variation range is determined, one can proceed to program creation in the GPSS environment (Norenkov, 1994). It is necessary to acquaint the students with the features of the simulation software and the operators used to create a model of the considered real system. Some of these operators are (GPSS world reference manual, 2001):

GENERATE (Exponential (q, w, d)) – generation of transactions, time intervals between the occurrence of transactions distributed by the value of the function Exponential; the first transaction appears with a delay of q units of model time, all w transactions will be created, the priority of the transactions is equal to d.

SEIZE t – occupying the device t from the transactions arriving at its input; if a device is busy, the transaction is held in the queue for it;

RELEASE s – release of the device s from the serviced transaction;
QUEUE f – queue organization operator, the length of the queue f is increased by one;
DEPART j – queue organization operator, the length of queue j is reduced by one;
ADVANCE i, p – holds the transaction for a time determined by the contents of fields i and p;
TABULATE h7 – in the corresponding interval (7) of the histogram named h, a unit is added;
TERMINATE g - removes the transaction from the system, the content of its counter is decremented by g units, modeling ends if the content of the counter becomes equal to or less than zero.
An example model from the GPSS World software package [4] presented in figure 2.

Figure 2. Example program in the GPSS environment.

```
Listing
; GPSS World Sample File - ROBOTFMS.GPS
********************************************************************
* Experimental Manufacturing Cell
* Two CNC machines and one Robot
* One arrival area and one finished parts area
********************************************************************
RMULT 78863
Transit TABLE M1,100,100,20               ;Record lead time
********************************************************************
        GENERATE (Exponential(1,0,150))   ;A job arrives
        QUEUE    One                      ;Arrival queue
        SEIZE    Robot                    ;Get the robot
        DEPART   One                      ;Depart the queue
        ADVANCE  8,1                      ;Robot grips the job
        ADVANCE  3                        ;Robot moves to machine 1
        ADVANCE  6,1                      ;Robot place the job
        RELEASE  Robot                    ;Free the robot
        QUEUE    Two                      ;Wait in next queue
        SEIZE    Machine1                 ;Get first machine
        DEPART   Two                      ;Depart the queue
        ADVANCE  (Exponential(1,0,100))   ;Process time
        RELEASE  Machine1                 ;Free machine 1
        QUEUE    Three                    ;Join queue for machine 2
        SEIZE    Robot                    ;Get the robot
        DEPART   Three                    ;Depart the queue
        ADVANCE  8,1                      ;Robot grips part
        ADVANCE  3                        ;Robot moves to machine 2
        ADVANCE  8,1                      ;Robot places the part
        RELEASE  Robot                    ;Free the robot
        QUEUE    Four                     ;Join queue machine 2
        SEIZE    Machine2                 ;Get machine 2
        DEPART   Four                     ;Depart the queue
        ADVANCE  (Exponential(1,0,80))    ;Process 2
        RELEASE  Machine2                 ;Free machine 2
        QUEUE    Five                     ;Queue for exit station
        SEIZE    Robot                    ;Get the robot
        DEPART   Five                     ;Depart the queue
        ADVANCE  8,1                      ;Robot grips the part
        ADVANCE  3                        ;Robot moves to exit
        ADVANCE  6,1                      ;Robot places the part
        RELEASE  Robot                    ;Free the robot
        TABULATE Transit                  ;Transit time
        TERMINATE 1                       ;Job is completed
********************************************************************
```

After running a certain number of simulations, the resulting data can be tracked in the GPSS generated report presented in figure 3. The data should be analyzed with a view to determining the credibility of the proposed simulation model and searching for opportunities to reach the set technical parameters of the system.

Figure 3. GPSS generated report.

```
        GPSS World Simulation Report - Untitled Model 1.2.1
               Friday, March 08, 2024 20:20:07
     START TIME        END TIME  BLOCKS  FACILITIES  STORAGES
        0.000        16744.929      34        3          0


          NAME                      VALUE
        FIVE                     10014.000
        FOUR                     10012.000
        MACHINE1                 10010.000
        MACHINE2                 10013.000
        ONE                      10007.000
        ROBOT                    10008.000
        THREE                    10011.000
        TRANSIT                  10006.000
        TWO                      10009.000

    LABEL           LOC   BLOCK TYPE    ENTRY COUNT  CURRENT COUNT  RETRY
                     1    GENERATE         109           0           0
                     2    QUEUE            109           0           0
                     3    SEIZE            109           0           0
                     4    DEPART           109           0           0
                     5    ADVANCE          109           0           0
                     6    ADVANCE          109           0           0
                     7    ADVANCE          109           0           0
                     8    RELEASE          109           0           0
                     9    QUEUE            109           6           0
                    10    SEIZE            103           0           0
                    11    DEPART           103           0           0
                    12    ADVANCE          103           1           0
                    13    RELEASE          102           0           0
                    14    QUEUE            102           0           0
                    15    SEIZE            102           0           0
                    16    DEPART           102           0           0
                    17    ADVANCE          102           0           0
                    18    ADVANCE          102           0           0
                    19    ADVANCE          102           0           0
                    20    RELEASE          102           0           0
                    21    QUEUE            102           0           0
                    22    SEIZE            102           0           0
                    23    DEPART           102           0           0
                    24    ADVANCE          102           1           0
                    25    RELEASE          101           0           0
                    26    QUEUE            101           0           0
                    27    SEIZE            101           1           0
                    28    DEPART           100           0           0
                    29    ADVANCE          100           0           0
                    30    ADVANCE          100           0           0
                    31    ADVANCE          100           0           0
                    32    RELEASE          100           0           0
                    33    TABULATE         100           0           0
                    34    TERMINATE        100           0           0

FACILITY  ENTRIES  UTIL.   AVE. TIME  AVAIL.  OWNER  PEND  INTER  RETRY  DELAY
  ROBOT      312    0.327    17.552     1      101     0     0      0      0
  MACHINE1   103    0.581    94.491     1      103     0     0      0      6
  MACHINE2   102    0.443    72.688     1      102     0     0      0      0

QUEUE  MAX  CONT.  ENTRY  ENTRY(0)  AVE.CONT.  AVE.TIME  AVE.(-0)  RETRY
  ONE    2    0     109      75       0.022      3.377    10.825     0
  TWO    9    6     109      41       0.849    130.432   209.075     0
  THREE  2    0     102      67       0.028      4.648    13.545     0
  FOUR   5    0     102      53       0.377     61.811   128.668     0
  FIVE   2    1     101      67       0.023      3.832    11.384     0

TABLE              MEAN      STD.DEV.       RANGE     RETRY  FREQUENCY  CUM.%
  TRANSIT        384.804    207.036                    0
                                        _    -    100.000          2     2.00
                                  100.000    -    200.000         17    19.00
                                  200.000    -    300.000         20    39.00
                                  300.000    -    400.000         18    57.00
                                  400.000    -    500.000         19    76.00
                                  500.000    -    600.000         10    86.00
                                  600.000    -    700.000          6    92.00
```

```
700.000   -    800.000         4    96.00
800.000   -    900.000         0    96.00
900.000   -   1000.000         3    99.00
1000.000  -   1100.000         1   100.00
```

3. Results

For the purpose of practical work for simulation modeling of the robotic system presented in Figure 1, students may create their own program or use the one proposed in Figure 2. Machine operation and service times are set and a certain number of simulations are run and the results are summarized. For example, at specific time's 14 – 31 s, 10 simulations were made under the same general conditions (set volume of production 100 parts) and different time for the service robot to work, the results presented in the table were obtained. 1.

Maximum productivity is reached at service time $t_R = 17.552$ s, respectively $Q_{PSh} = 9.355$ units/hour. The general dependence is confirmed that as the cycle time increases, the productivity of the considered production system decreases, which confirms the credibility of the adopted model. Several simulations (1, 4, 7) are striking, where different results are obtained. Given certain ratios of work and service times, such results are possible. The presence of such cases in real production conditions requires an appropriate analysis of the factors leading to the relevant deviations and making correct decisions regarding the organization of work in the production system. During an exercise, it is appropriate to consider incoming proposals from the students regarding possible solutions to reach set values of the efficiency criteria of the system under consideration, to be verified by simulation. This would lead to the expansion of their practical experience, and the discussion of the performed activities - to the improvement of their teamwork skills.

Table 1. Results of conducted simulations.

№	t_R, s	T_{PS}, s	Q_{PS}, un/s	Q_{PSh}, un/h
1	14,622	610,715	0,0016	5,895
2	16,582	401,942	0,0025	8,957
3	17,552	384,804	0,0026	9,355
4	18,548	528,398	0,0019	6,813
5	19,576	525,166	0,0019	6,855
6	20,566	447,981	0,0022	8,036
7	22,596	645,927	0,0015	5,573
8	24,633	455,973	0,0022	7,895
9	27,677	572,252	0,0017	6,291
10	31,573	779,558	0,0013	4,618

4. Conclusion

The use of simulation modeling in the study of systems of machines or technical devices allows analyzing and predicting their various parameters under certain operating conditions. Knowledge of modern general-purpose simulation software (GPSS) and practical work with it allows expanding the professional competence of young specialists facilitates decision-making in real production tasks and leads to deepening of students' practical skills when performing engineering activities in practice.

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THE CONTRIBUTION OF THE PICTURE BOOK AS AN EDUCATIONAL TOOL TO PREVENT CHILD ABUSE

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Abstract

This study seeks to investigate, analyze and explore the contribution of the picture book as an educational tool to the prevention of child sexual abuse. A distinctive aspect of our empirical research lies in the scarcity of children's books addressing this delicate subject within the Portuguese market. A primary objective of our project is to rectify this deficiency by comprehending the potential of illustrations in effectively communicating and raising awareness about child abuse in society. Initiating the project involved an analysis and collection of data concerning child sexual abuse at both national and international levels. Interviews with support and prevention organizations provided valuable insights into the challenges associated with identifying the problem and sharing information. Our analyses incorporated statistical data, firsthand accounts, and studies on abuse, encompassing methods employed by abusers for manipulation. Building upon this foundation, an exploration of existing children's books dealing with child sexual abuse and other emotionally charged subjects followed. The subsequent project phases concentrated on deciphering the symbolic value of images and the power of illustrations to convey informative and preventative messages. This was achieved through a thorough examination of various illustrated books, their styles, techniques, and interpretative approaches. The practical phase unfolded in five distinct stages: 1) collaborative writing of the textual narrative "Where do secrets live?" with a specialized psychologist, 2) development of the storyboard, 3) creation of illustrations, 4) book design, and 5) prototype development. The narrative crafted for the practical project addresses the common strategy employed by abusers— emotional manipulation through secrecy. The storyline distinguishes between good and bad secrets, illustrating the emotional toll of harboring negative secrets. A central character, the Monster of Secrets, embodies the abusers and their manipulative strategies. The character's visual evolution in scale and complexity throughout the story effectively conveys the lurking danger in each person's shadow. The other book's characters represent diverse children living in varied family structures to underscore that abuse transcends socio-economic conditions. Each child's unique experience with abuse is depicted, allowing readers to empathize and better identify abusive situations. Through visual expression and metaphors guided by specialists and utilizing the codex format's potential, "Where do secrets live?" aims to address different types of abuse, associated emotions, and ultimately inform, prevent, and encourage reporting.

Keywords: Child Abuse, illustration, picture book, prevention.

1. Introduction

The project, entitled "The Contribution of the Picture Book as an Educational Tool", was developed in order to obtain a master's degree in the fields of Illustration and Animation. The goal was to analyze and identify the potential of illustration in the communication and prevention of child sexual abuse. To achieve it, a picture book was created to act as an educational tool for the prevention of child sexual abuse.

This is a sensitive issue that is very present in society, although it may seem invisible. The Council of Europe's statistics (2012) show that one in five European children are victims of sexual abuse and it appears that at national level, according to the 2020 Annual Internal Security Report (RASI), 74% of offenders are family members or close ones. This is a number that is far too high and needs to be openly debated.

It is difficult for a child to protect itself from abuse when it is manipulated by the aggressor, with which it may even have a bond of trust. The victim doesn't know that something is wrong, because they don't know what is happening, as they haven't yet developed the cognitive and social skills to identify abuse. This makes children potentially vulnerable to abusers.

It is necessary to talk about child sexual abuse with the young audience, without having to deal with curricular content related to sex education that will only be dealt with later in school education. For this to be possible, it is essential to have access to educational material dedicated to children. There is a need to create support material, such as a picture book, that parents can use to address the issue and create a space for dialogue. Therefore, it is an object with great communication potential for children, as the combination of text and image can communicate any theme through various forms of reading.

2. Overview of child sexual abuse

Many parents think that this type of situation only happens in certain contexts and believe that children will share if something happens to them. The data, however, shows that this thinking is incorrect and that the path to sharing can be much more complex than society realizes: statistics from the Council of Europe (CoE) one in five program show that 70% to 85% of abusers in cases of child sexual abuse are people close to the family who have an established relationship of trust. In Portugal, in the 2020 Annual Internal Security Report (RASI), based on the number of cases reported, the figures show that 74.7% of abusers were people close to the family and 52.4% were family members. The figures show that abusers are close people who are generally trusted by parents. Experts believe that the number of reports is much lower than the actual number of cases and that most cases are not shared.

Many victims live in silence for most of their lives and may never share the abuse. The lack of information and dialogue on the subject in society means that many parents and victims are unable to access the information and support they need.

Conservative educational standards in which there is little opportunity for communication benefit abusers, giving them control over the situation. Families with more open educational standards, in which there is more room for freedom of dialog and sharing and without the abuse of hierarchies, reduce the possibility of manipulation by the abuser. Ângelo Fernandes describes in his book, *What we talk about when we talk about sexual violence against children* (2022), that it is important to emphasize that abuse does not only involve physical contact, and that there are various types of abuse in which the victim may not be touched, but is also exposed.

A young child is unable to identify the abuse because he or she has not yet developed cognitive ability, nor has he or she gathered the necessary information to be able to rationalize what has happened to him or her. They can't externalize the story of the abuse and may be hostage to the abuser's manipulation. Managing the emotions of guilt and shame are factors that silence many victims, as well as the fear of the possible consequences of sharing, which means that some victims may not know who to share it with.

Child abuse occurs when children are subjected to sexual activity that they don't understand. They are developmentally incompatible with it and can't give consent to it and/or it violates the laws or rules of society. As Robert explains, abuse leaves deep scars on its victims, "no child can endure an experience of repeated sexual abuse without being deeply disturbed." (Robert, 2003, p. 30)

In 1989, the article *What sexual offenders tell us about prevention strategies* written by Jon Conte, Steven Wolf and Tim Smith was published in the UK. The study shows the most common strategies of child sex offenders by interviewing some of them. The choice of the victim is based on the vulnerability and the pattern of communication with its parents. A more vulnerable child with a limited family communication pattern proves to be more easily manipulated as they will look elsewhere for the lack of empathy and affection.

Abusers establish relationships of trust with the child's parents to ensure a safe position without suspicion. They offer to be with the child, trying to isolate them and start introducing touches and "affection" that later evolve into gradual sexualization, trying to normalize them. Only when they feel they have total control over the victim, they move on to acts of sexual abuse in which they seek to satisfy their own pleasure without any consent from the victim. They manipulate them into believing that they are to blame and even threaten them. The threat usually involves harming the victim themselves or people close to them, such as their parents. Another form of manipulation is to make the victim believe that if they expose the abuse, they will be punished by their own parents and that they would never accept it. The abuser has absolute control over the victim.

3. Prevention methods and picture books

Some independent associations have developed prevention programs for schools and kindergartens. Their prevention programs are applied in various schools and kindergartens throughout the country. The programs are adapted to the age group of children. Picture books are part of these programs as a method of prevention. Children's literature stands as part of these programs as a method of communication and transmission to children. Some picture books such as *Don't touch me, you fool!* (Figure 1) by Andrea Taubman and Thais Linhares (2017), *Some Secrets Should Never Be Kept* by Jayneen Sanders and Craig Smith (2013) and *Your body is yours* (Fig. 2) by Lúcia Serrano (2023) address important themes such as consent, physical boundaries, and situations of hidden abuse.

Figure 1. "Don't touch me, you fool!" from Andrea Taubman

Figure 2. "Your Body is yours!" from Lícua Serrano

Picture books play an important role in childhood. Not only do they serve to tell stories, but they also provide learning and space for reflection.

According to Florindo (2009), "Children's books, in general terms, can be informative, poetic, narrative, abecedary or just pictures." (Florindo, 2009, p. 15). Among them is the picture book, which communicates in various ways and can be used for various purposes. The picture book not only tells a textual and visual narrative, it also allows the author and illustrator to transmit messages, teach important lessons, reflect on social issues, address our space as individuals and as a community. As Abramovich explains, "When reading a story, the child also develops a whole critical potential. From there they can think, doubt, wonder, question..." (Abramovich, 1995, p. 143). Rodrigues identifies the potential of the illustrated album in the development of children. "In the book, the illustration functions as a stimulating element in the development of the child's emotional and cognitive capacity." (Rodrigues, 2009, p. 5). The picture book can contribute in various ways to a child's development.

4. The creation of a prevention tool – The picture book "Where do secrets live?"

The practical process consists of creating a picture book that addresses the issue of child sexual abuse, but in a neutral way without going into the context of sex education. To do this, we identified one of the most common strategies of abusers: secrets. It is through secrets that they are able to manipulate their victims into keeping them quiet. Abusers threaten their victims, saying that if they share the abuse with anyone, they could hurt someone close to them.

As secrets are part of life and growing up, it is important to distinguish healthy secrets from dangerous ones. The textual and visual narrative focuses on the difference between good and bad secrets, as well as the presence of bad secrets and their impact on the daily lives of their victims. The book is designed as an educational tool and is divided into 5 parts:

4.1. Identifying the adults you trust

Before the textual and visual narrative begins, the young reader is asked to draw their two adults they fully trust, one of which should be from within the reader's family environment and the other from outside it. This way, the parents can see with which adult the child feels more secure.

4.2. The story *Where do the Secrets Live*

The narrative follows the presence of bad secrets in the lives of various characters. The secrets not only follow the characters, but also begin to grow and make their lives more difficult. They gain more and more size and weight in the daily lives of the characters, who try to find various ways of dealing with their monster of secrets. Eventually, they find the right way to free themselves from their burdens and become happy children again. Although the main character is the monster of secrets (Fig. 3), its shape is similar to

a human shape, metaphorically representing the aggressors. It is a shadow represented by several layers of scratches and lines. The layers, together with the variation in material, symbolize the various secrets that are accumulated and therefore build up the character.

Figure 3. The monster of secrets   *Figure 4. Picture Book "Where do the secrets live?"*

4.3. The difference between good and bad secrets, as well as good and bad touches

In the end, the idea was to create a space for reflection, in order to help the reader understand the difference between good and bad secrets, as well as good and bad touches. There is a double-page describing these distinctions of concepts that the child should understand.

4.4. Text for adults

From the interviews with the organizations, it became clear that the adults reaction plays an important role when it comes to victims sharing their abuse. For this reason, we decided to include a text dedicated to adults in order to alert them to its importance and explain that they should pay attention to their reaction when children are sharing cases of abuse. For this purpose, it was important to have the intervention of a professional. Psychologist Marta Oliveira developed the text for adults, including a guide about the topics discussed.

4.5. Support contacts

As the book seeks to be a support tool for communicating child sexual abuse and creating a space for sharing, reflection and communication, contact details for support associations have been included.

After a careful analysis of various picture books, the development of the practical process began with the construction of the textual narrative. During the writing process, some key words began to emerge in rhyme. It is not uncommon to find rhymes in picture books, as they are appreciated by children and facilitate memorization, contributing to learning. After finishing the textual narrative, we started dividing the text into pages, in order to create a reading rhythm.

At this point the book's storyboard is developed. It's a planification and sketching of the visual narrative and its application on each page. The illustrator develops a first sketch for each page, creating a reading rhythm from a visual point of view. The illustrations are the main element of the picture book's visual communication, as they play the most important role. Although the illustrations are present in all parts of the book, it is in the story that they stand out for their visual and fluid reading.

The main character in the story is represented by a shadow of a human shape. It's graphic representation contains layers of various textures, as well as an increase in the character´s scale in each illustration. The intention is to transmit the accumulation of secrets and their psychological weight in the lives of the victims.

After finalizing the illustrations, the next step was creating the layout of the book and its editorial design, including the pagination. Finally, a mock-up of the book was printed to test the book with its audience (Fig. 4), in order to analyze if any adjustments or changes needed to be made. At the moment, the book is in the process of being tested.

5. Conclusion

Throughout the research and practical development of the project, we tried to identify how the picture book can be used as a teaching tool for the prevention of child abuse and contribute to communicating this message to different audiences. The illustration becomes an effective tool that, together with the written narrative, enables a new form of communication that is captivating for children.

This project resulted in a unique picture book, developed in order to contribute to the fight against child sexual abuse, with the potential to effectively reach a wider audience, including children and adults.

Child sexual abuse is considered to be a silent and invisible problem, but it is present within society. Silence only benefit the abusers. In this way, this project seeks to contribute to the fight against child sexual abuse, giving visibility to the problem and a voice to children.

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THE CURRENT STATE OF FINANCIAL LITERACY AMONG GRADUATING STUDENTS IN CONNECTION WITH THE EFFECTS OF CRISES

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Abstract

Recently, society has been seriously affected by global crises. These facts also affected students in the final years of high schools and universities. The paper presents the state of knowledge in the field of financial literacy in the research sample with a specific focus on personal bankruptcy and the amount of pension. The survey took place in Slovakia in 2022-2023 and presents statistically relevant results. The conclusions confirm serious deficiencies in the scope of knowledge of financial literacy and in the decision-making process associated with critical thinking. The reason for researching and writing the article is to identify a possible path for education in the area of financial literacy and critical thinking for students entering the labor market and making serious decisions about their future quality of life. One of the suggested features is the development of an application for education in the field of pensions and similar bankruptcy. It should consider competences in the decision-making process in the area of financial literacy.

Keywords: Financial literacy, education, critical thinking, quality of life, IT resources.

1. Introduction

Curricular reform is underway in Slovakia, which is intended to improve the quality of results in the field of education, especially by developing the competencies of graduates of educational cycles. This reform is taking place simultaneously with a change in the quality of education at universities. That is, graduates of secondary education and higher education are focused on improving personal competences according to the needs of the labor market, and I am focused on increasing the quality of life. Under the influence of societal events all over the world, Slovak society underwent serious changes that had an impact on the quality of life. The economic crisis in the form of the energy crisis, the health crisis during the global pandemic and the consequences of political decisions had an impact on the entire society. The article is dedicated to describing the state of financial literacy in which high school and university graduates who enter the labor market find themselves. It mainly focuses on examining two important aspects, namely decision-making in the area of pension security and understanding personal bankruptcy.

2. Theoretical starting points and the current state of the investigated issue

Since 1989, the Slovak education reform has been underway in Slovakia. The need was a transformation from a model of a totalitarian way of education and training focused on the development of competences and skills of individuals who were easily manipulated and controlled even by an ideologically colored interpretation of scientific facts and realities.

The transformation had several goals and stages. We are currently in the stage of curriculum reform, the concept of which has been in the making since 2008. The main point of the reform was the introduction and creation of educational areas and the creation of interdisciplinary so-called cross-sectional relations and models of education. Curricular reform should therefore represent, or be aimed at the transformation of education in order to introduce effective methods of personal development of pupils and students. However, analyzes of school reforms implemented during the last three decades in various countries of the world point to a strong connection between state ideology and curricular innovations (Rýdl, 2003; Průcha, 2004; Le Métais 1999; OECD, 2011). These goals of the reform are the

basic pillar for improving the quality of education. The quality of education and training is considered an indicator and key determinant of the maturity of economic systems and society as a whole. On the one hand, this brings many positive impulses for the development of education, education, schools and educational sciences. On the other hand, however, it also brings such tendencies that do not respect the traditionally understood value of education by narrowing it down only to a person's qualifications as a prerequisite for their employment on the labor market. According to the analyses, the reform is never an isolated modification of the curriculum, but a philosophical and ideological change that must be accepted by all actors involved in its implementation (Hošková, Lukáčová, 2022).

After the analysis, after testing in Slovakia on the basis of the analyses, the Ministry of Education, Science, Research and Sport of the Slovak Republic set as a priority the creation and introduction of a new program of the State Education Program, while the creation and introduction of this program was also included in the framework of the Recovery and Resilience Plan of the Slovak Republic, which the government SR directs and activates reforms for the coming years (https://www.planobnovy.sk/kompletny-plan-obnovy/ kvalitne-vzdelavanie/). The State Pedagogical Institute started working on the creation of a new framework for the state educational program in 2021.

The method is the implementation in the creation and also in the current educational programs is Financial Literacy. According to UNESCO (2023), literacy is a human right, but financial literacy can also serve as a tool for personal empowerment and a means for social and human development. Literacy is at the core of basic education for all, and its understanding and mastery is essential to eradicating poverty, reducing child mortality and slowing population growth.

The results of the PISA study in OECD countries ranked Slovakia in 38th place out of 83 countries, where we fell below the average of the OECD results and we fell the most in mathematical literacy by 22 points compared to 2018. It follows that the situation regarding the declining financial, mathematical and scientific literacy and this also has an impact on decision-making in the area of financial literacy. (https://www2.nucem.sk/sk/merania/medzinarodne-merania/pisa/roky/2023-2024).

The transformation of higher education taking place in Slovakia has significant changes in the area of improving the quality of internal systems at the universities themselves. Interdisciplinarity and the updating of the quality system became the goal for the menu with an accent on educational areas according to the needs of the labor market and the development of personal competences. (Osvaldová et al., 2024) (Závadská Z., 2020).

Within the framework of solving the problem of financial literacy, the use of modern IT tools is shown as one of the possibilities of testing the state of literacy and as a source for obtaining information for the subsequent education of the respondent, e.g. application. Correct setting of the application and appropriate popularization creates prerequisites for a suitable form of education of respondents and thus creation of prerequisites for correct decision-making in the field of financial literacy. (Katrenčík et al. 2023)(Zatrochová, 2023).

3. Design. Objectives. Methods. Discussion

The research is aimed at determining the financial literacy of young people entering the labor market in the context of the state of their financial literacy, focusing on two factors: preparation for retirement and personal bankruptcy.

The rationale for choosing the research specification is based on the current situation that is experienced in 2023-2024 as a result of the development of society and its economy based on global shocks by the standards of society, the COVID crisis and the energy crisis.

The survey was conducted in the years 2022-2023 in the final years of secondary schools and universities in Slovakia. The number of respondents was 250 and a representative sample was selected from all over Slovakia.

We tested knowledge in the field of financial literacy on a standardized questionnaire that contained 15 professional questions, 2 questions from the field of education and one question about gender.

When processing the questions, the questions with the highest error rate included: G11: What is the essence of "personal bankruptcy"? G13: Can you get the funds to file for personal bankruptcy from these sources? G3: What part of the monthly household income do you save on average? G4: If it were necessary, for what purpose would you decide to secure a credit card from the bank?

We are interested in questions from the field of personal bankruptcy and its course G11 and G13. In the field of future capacity, securing a lot of money for a future pension is an important question for us G3.

When testing H0, we examined 3 areas.

1. Relationship to correct decision-making in the researched areas in relation to gender. H1: Gender has an influence on the degree of awareness in the given issue. When evaluating H0 using a single factor ANOVA for three groups (man, woman, did not state), it was not confirmed, therefore the conclusion is: gender is not a decisive factor.

2. The relationship between the correctness of the respondents' answers and their perception of the state of their financial literacy. H1: H1: In the monitored groups (a, b, c) the degree of awareness is different. Average values are not equal. There is at least one pair where: m i ≠ m j , i.j = 1,2,3. When evaluating H0 using ANOVA single factor at the significance level of 0.05, the conclusion is: The different level of awareness was not confirmed. The real knowledge of the respondents does not correspond to their own ideas about knowledge in the given issue. An important factor that distorts the given results is the abundance in individual classes a,b,c. Differences in groups are statistically insignificant.

3. The third observed characteristic, which we assume can have a statistically significant effect on the level of information of the respondents in the given issue, is education. Respondents stated secondary school (SŠ) education in 68 cases, university (VŠ) in 182 cases. Only one respondent stated a high school education, so we excluded this class from testing.

H0: Education does not affect the results achieved in the area of financial literacy.
H1: Education has an impact on the results achieved in the field of financial literacy.

To verify the hypotheses, we used the t-test of two mean values at the significance level of 0.05. We present the test results in Table 1.

Table 1. Evaluation of the relationship between education and the ability to make correct decisions in the field of financial literacy.

t-Test: Two-Sample Assuming Equal Variances		
	SŠ	*VŠ*
Mean	66,96429	64,1196
Variance	210,034	125,0932
Observations	68	182
Pooled Variance	147,4461	
Hypothesized Mean Difference	0	
df	57	
t Stat	0,799992	
P(T<=t) one-tail	0,213518	
t Critical one-tail	1,672029	H0
P(T<=t) two-tail	0,427037	
t Critical two-tail	2,002465	

Source: Custom processing.

4. Conclusions

From the aforementioned examination of the results, we found out the state of financial literacy of the respondents. The serious claims were that the respondents themselves do not realize that they do not have the correct information in the field of financial literacy, which we investigated by verifying the correctness of their claims.

Respondents lack basic knowledge of bankruptcy. From the statistics presented in the Bankruptcy Register, we see a significant negative change after the pandemic. In the years 2017-2020, new cases of bankruptcies, that is, personal bankruptcy, fluctuate around the amount of 130. In 2021, it is already 186, in 2022 it is 216, in 2023 it is already 332, and in the first 4 months of 2024 it is 114. (https://ru. justice.sk/ru-verejnost-web/pages/statistiky/vyhlaseneKonkurzy.xhtml. cited 05.05.2024).

Thus, the situation after the Covid pandemic has significantly worsened and there is a tendency that it will continue to worsen. One of the possibilities for describing the causes is also ignorance in the field of dealing with finances and making the right decisions to deal with them.

The gender factor of respondents does not affect the correctness of decisions, which we verified statistically.

In the same way, high school or university education does not affect the correctness of the respondents' decisions in the area of financial literacy.

Therefore, it is an interesting question for us whether the curricular reform and the reform of the change in the provision of education at universities has a potential impact on the financial literacy of the respondents and their subsequent correct decision-making in the area of personal bankruptcy and securing a pension.

The proposed education using artificial intelligence, which would be available as an application on a mobile phone or tablet, has the potential to describe (identify) the state of knowledge in the field of financial literacy. A properly configured application could accompany in model situations and educate (educate) in a short but explanatory way and possibly recommend seeking professional help with the help of a financial advisor.

From this point of view, it is possible to propose just such a method of education in the field of financial literacy, which is accessible, modern and understandable for graduates of high schools and universities entering the labor market and making decisions in the field of finances for their future pension and quality of life.

Acknowledgments

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A PROBLEM-BASED LEARNING APPROACH TO INTRODUCE THE ENZYME INHIBITORS BLIND SCREENING TO UNDERGRADUATE BIOCHEMISTRY STUDENTS

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Abstract

Learning styles based on inquiry, discovery, and problem-based approaches can promote students' problem-solving skills, critical thinking, and self-confidence development. Our Educational Innovation Group TR4BIOCHEM (PIE22-067) is interested in implementing new inquiry-based biochemistry laboratory experiments focused on the last course-chemistry and biochemistry undergraduate students. The high throughput blind screening of enzyme inhibitors, one of the most widely used strategies in pharmacology for the discovery of new drugs, is the subject of a new problem-based learning (PBL) activity developed at the University of Malaga in the last few years. Within the subject "Pharmacological Biochemistry", 4th year-biochemistry undergraduate students must face a situation that resembles the real scenario encountered by a professional working in medicinal chemistry. Working in groups of 4-5 students, and guided by a challenging driving question, students get involved in a meaningful learning process which leads them to propose solutions and carry out the practical identification of acetylcholinesterase inhibitors through enzymatic analysis. The hands-on *in vitro* studies allow students to put into practice in the laboratory much of the knowledge that they have acquired throughout their studies and face, for the first time in some cases, some practical issues such as the reagents selection and protocols optimization. The implementation of this PBL has been very satisfactory in terms of academic performance. As for the students' perception, they appreciate the opportunity to apply concepts in a real-world context, considering that these experiences can better prepare them for their future professional scenarios.

Keywords: *Problem-based learning, drug discovery, blind screening, laboratory experiments, undergraduate.*

1. Introduction

Traditionally based in a "cookbook" style of expository instruction, laboratory practices in science laboratories at the university level, often ignore the principles of the scientific method. Sometimes considered of minor relevance in a teaching-learning process that is mainly based in the use of theoretical lectures in which students are at risk of playing a passive role, their objectives are often limited to the development of certain technical skills. Being aware that the laboratory teaching at our university demands a change to make students become protagonists of their own learning process, our Educational Innovation Group TR4BIOCHEM (PIE22-067) has been working for several years in the implementation of new inquiry-based laboratory projects (García Ponce et al., 2019 and 2021, García Caballero et al., 2022).

Under the umbrella of the educational innovation projects funded by the University of Malaga, our group is interested in transforming the laboratory teaching of last course-chemistry and biochemistry undergraduate students into cross-disciplinary inquiry-based laboratory projects that could make students formulate questions, discuss protocols, collect and analyze data, and finally, draw conclusions (Ronennbeck et al., 2016). This could make them play a more active role in their learning, not limited to the acquisition of new technical competences, but also to improve their critical thinking skills. In the following sections of this chapter, we present one of these approaches, aimed to illustrate some principles of drug discovery to the last course undergraduate biochemistry students.

2. Topic of the study: The early drug discovery based on the *in vitro* blind screening of enzyme inhibitors

The development of a new drug is a costly and complex process that can take 12–15 years. Preclinical stages of the drug discovery process include target identification and validation, assay development, high throughput screening (HTS) of a chemical library, hit identification, lead optimization, and finally, the selection of a candidate molecule for further clinical development (Hughes et al., 2011).

The blind screening of enzyme inhibitors is one of the most widely used strategies in pharmacology for the discovery of new drugs. Many marketed drugs today function through inhibition of enzymes mediating disease phenotypes. In "Pharmacological Biochemistry", a subject offered to 4th year-biochemistry undergraduate students at the University of Malaga, students get familiar with the main types of drugs and their mechanism of action. With a number of students ranging 30-40 per year, its syllabus also includes a chapter devoted to the basic principles of drug discovery, based on the identification of new inhibitors of a target enzyme. This chapter includes those considerations to be considered when designing a high throughput enzymatic assay focused to the *in vitro* identification of new inhibitors, as well as the use of *in silico* modeling tools for the characterization and improvement of the drug interaction with its molecular target. Our approach to teaching this subject has evolved over the years, adding a series of activities aimed at helping the students to put into practice what they have learned in theory classes and better assimilate these concepts. Among others, these activities include the *in silico* drug-molecular target studies, or the design of a robust enzymatic assay for HTS applications.

Some critical issues that need to be addressed when developing an enzymatic assay for HTS purposes are, among others, pharmacological relevance of the assay (the assay is capable of identifying compounds with the desired potency and mechanism of action), source of enzyme (use of a relevant isoenzyme, assayed in physiological conditions), reliability and reproducibility (positive and negative controls of inhibition), cost (the use of microtiter plates minimizes the costs of the assay and allows automatization), effect of the solvent used to store the chemical libraries, concentration(s) at which compounds will be tested, or threshold to be reached for a compound to be considered a hit (Copeland 2005, Hughes et al., 2011). All these issues are discussed by the teacher in the theoretical class. However, these concepts are internalized to different extents by the students, depending on whether or not they have been reinforced with some additional active learning experiences focused to put them into practice, as will be explained in the following sections.

As for the target enzyme, we have worked with acetylcholinesterase, since inhibitors of this enzyme are currently used for the treatment of Alzheimer patients, and they can be easily identified *in vitro* by means of a quite inexpensive colorimetric method (Figure 1) (Ellman et al., 1961). Other target enzymes that we have used in this experience are mammalian dihydrofolate reductase and bacterial β- lactamase (for the discovery of new antitumor drugs or antibiotics, respectively)

Figure 1. Ellman's method, used for the in vitro detection of acetylcholinesterase inhibitors.
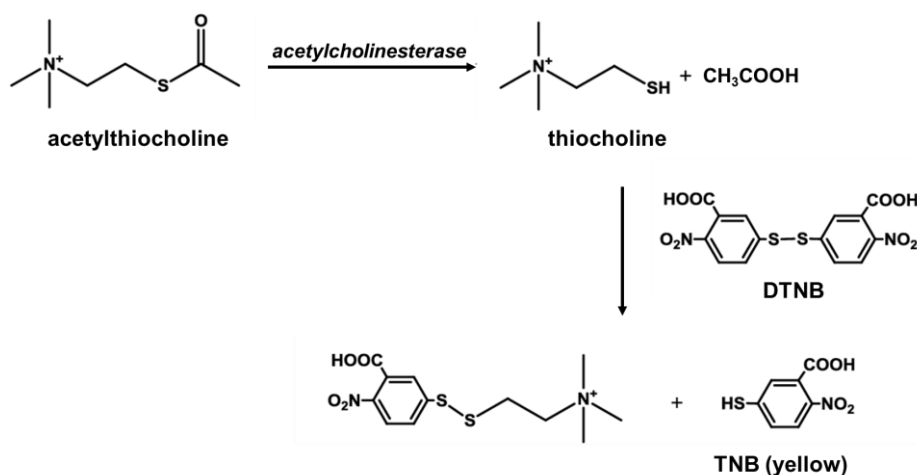
3. Developing a new PBL activity aimed to illustrate the early stages of drug discovery

As a practical tool to teach this topic, we have implemented a new PBL activity, intended to be a hands-on introduction to the early stages of the drug discovery process. Under the instructor's guidance,

students, working in groups, are involved in a meaningful learning process focused on proposing solutions and carrying them out in a practical way, both *in vitro* and *in silico*.

The sequence of activities of this PBL is:

1. After a theoretical introduction in the classroom by the teacher on the bases of the drug discovery process and the strategies for a blind screening of enzyme inhibitors, students are asked to form groups of 4-5 people. Groups will work as independent pharmaceutical laboratories that receive a letter stating the objective "To find new acetylcholinesterase inhibitors as drug candidates for the treatment of Alzheimer's disease".

2. After searching for information in the bibliographic databases, students propose solutions to the driving question and design protocols. The experimental development includes a bibliographic search on the Alzheimer's disease and current therapies, the use of acetylcholinesterase inhibitors for the treatment of patients, and those enzymatic assays that could be used for the identification of new inhibitors of this enzyme. This search brings students to select the above mentioned Ellman's procedure (Figure 1). Concerning the enzyme employed in the *in vitro* HTS, cost and commercial availability considerations make *T. californica* acetylcholinesterase the best choice. Thereafter, groups summarize their findings in a report, explaining what reagents and instrumentation are needed to carry out the *in vitro* screening for inhibitors of this enzyme.

3. During the laboratory activities phase, students design the experimental protocol, make calculations of how the reagents are prepared, optimize the experimental protocols in the laboratory and finally perform the screening test. As a result of this process, they identify an inhibitor of the enzymatic activity of the acetylcholinesterase among a group of unlabeled compounds provided by the instructor, facing a situation that resembles a real scenario found in the area of medicinal chemistry.

4. Once the *in vitro* part of this PBL is performed, groups accomplish the *in silico* studies. After an introductory lecture in the classroom, introducing the drug design rationale using computational techniques and the main available informatic tools, groups carry out *in silico* docking studies and explore the drug-protein interactions using PyRosetta, a package containing the Python-bindings of the Rosetta v3.0 source code, in Jupyter notebooks. The digital format of Jupyter Notebooks allows students to practice with interactive coding exercises, make molecular visualization movies and embed images to study drug-protein interactions.

5. At the end of the PBL, students prepare both a final report and an oral presentation about the different stages of the project and the results obtained.

4. Students' achievement of the learning goals

Students' knowledge about several issues regarding drug discovery was evaluated in the final exam of the subject by using a rubric in which some key points that students should mention were identified. These concepts had been taught by the teacher in his/her introductory lecture class, delivered to all groups of students and were related to the following topics:

1. Therapeutic relevance of the target enzyme
2. Need of a HTS assay
3. Use of multiwell plates
4. Need of fixing an inhibition threshold
5. Hit criteria ($< 1\%$)
6. Need of a positive control (known inhibitor)
7. Compounds are assayed at a fixed concentration (typically 1-10 µM)
8. Enzyme characteristics (isolated from natural sources, recombinant…)
9. Initial velocity is measured (continuous recording or fixed time measurement)
10. Enzyme concentration
11. Use of physiological conditions in the assay
12. Check the effect of the vehicle (solvent in the compounds solutions)
13. Substrate concentration (near Km)
14. Reagents addition order. Preincubate with the inhibitor
15. From Hit to Lead (check positive in a secondary screening assay)
16. ADME/Tox /Clinical assays
17. *In vivo* assays are needed to confirm positives.

As mentioned, although initially the teaching of this topic was limited to a theoretical exposition by the teacher and an unrelated *in silico* exercise of drug-protein modelling, lately it has been transformed into a more complete sequence of related activities.
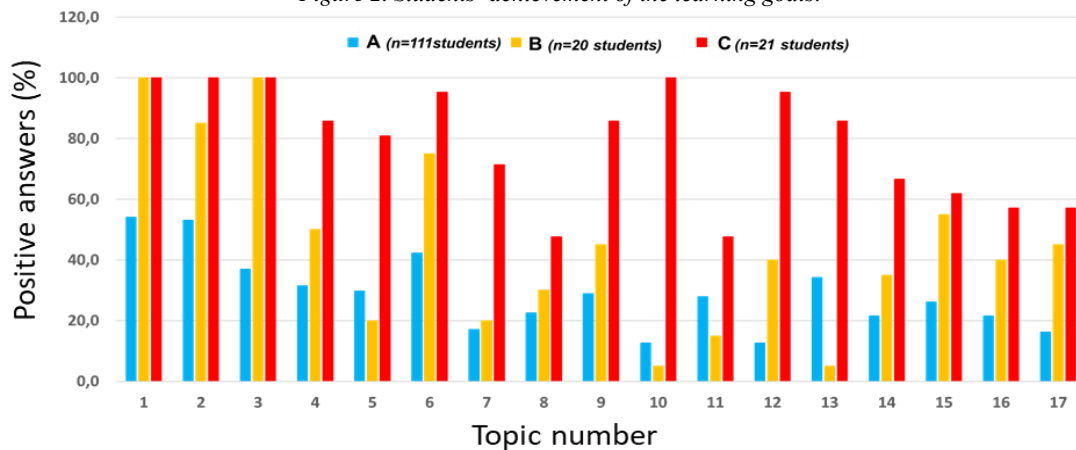
Figure 2 show the achievement of the learning goals by students belonging to three different groups of students that learn this subject using different approaches:

Group A. The principles of blind screening were just explained by the teacher (expositive lecture) (n=111 students).

Group B. Besides the expositive lecture by the teacher, blind screening was included in a PBL activity that excluded the laboratory work (students had to design the in vitro assay, but did not put it into practice in the laboratory) (n=20 students).

Group C. Besides the expositive lecture by the teacher, blind screening was included in a PBL activity that resembles the full process, including protocol optimization and drug selection in the laboratory (as described in section 3 of this chapter) (n= 21 students).

Figure 2. Students' achievement of the learning goals.

As can be observed in this figure, our results indicate that, in general, PBL approaches (groups B and C) improves the student's achievement of the learning goals, when compared to students that only received a theoretical class. In addition, those students who completed the entire PBL (group C) assimilated practical aspects better (topics 4-14).

5. Students' perception of the teaching methodology

In order to compare the students' perception of the PBL methodology, groups B and C students were asked through of a post-course mixed questionnaire, using 1 to 5 Likert-type scale questions. Results are presented in Table 1.

Table 1. Perception of the teaching methodology by those students who carried out the PBL (groups B and C).

Statement	B		C		p value (t test)
	mean	sd	mean	sd	B versus C
The learning methodology (PBL) learning) used in this activity is innovative with respect to that used in other subjects of the degree.	2,90	1,45	4,76	0,44	1,45E-05
I think the work dynamic has been efficient and satisfactory.	2,85	0,81	4,33	0,86	1,393E-06
I did not like working autonomously, without the teacher being directly responsible for my learning.	3,20	1,01	1,57	0,75	1,154E-06
Sometimes I have been confused about how I should approach the resolution of the problem posed.	4,50	0,69	2,86	0,91	1,159E-07
With this methodology (PBL) I felt especially involved in my learning.	3,20	0,89	4,62	0,50	7,86E-07
With this methodology (PBL) I did not learn more than through the traditional way of studying.	3,40	1,14	1,14	0,36	1,948E-08
I think I/we managed to work well in order to solve the proposed case.	3,20	1,06	4,19	0,87	0,0023703
This work methodology (PBL) did not require more work and preparation on my part than in others of the same or other subjects.	1,60	1,10	2,52	1,36	0,021614
The solution of the PBL case took me too much time, sometimes incompatible with the workload I had to devote to other subjects and assignments.	4,50	1,24	2,14	0,85	3,836E-08
In my opinion, the weight of the PBL activity in the evaluation of the course grade was too low for the time I spent on the task.	4,20	0,95	1,86	0,85	4,778E-10
In this PBL I was confronted with situations similar to those I may encounter in my future professional development.	3,75	1,12	4,76	0,44	0,0008906
With this PBL I learned how to plan my own laboratory experiments.	2,90	1,21	4,81	0,40	7,576E-07
Global perception of this experience	2,70	0,80	4,60	0,58	3,848E-10

Results presented in Table 1 show that the students' perception was significantly more positive for those students who carried out the complete PBL, including the laboratory practical work (group C), with a global satisfaction grade of 4.6 versus 2.7 (group B) with this experience.

Those students who had been able to fulfill the identification of an inhibitor of acetylcholinesterase by using the enzymatic analysis method designed by themselves (group C), found the experience much more gratifying. In this regard, they perceived the learning methodology as innovative and the work dynamic efficient. In addition, they considered that although this activity had taken them more time than others of the same or other subjects, this extra-effort had been worthwhile, allowing them to face and solve situations that they could find in their future professional development. This positive perception was not shared to the same extent by those students who completed a PBL in which the laboratory sessions had been removed (group B).

All these results suggest that this PBL is composed by a series of steps that fit together to give meaning to the whole. Additionally, it makes the students get involved in the activity, assuming the roles derived from the gamification of the activity. For this reason, the completion of the PBL with a hands-on laboratory work that could resemble a real-world scenario, could be essential for the students to enjoy and recognize the advantages of this educational experience.

6. Conclusion

Drug discovery at early stages provides an excellent scenario to simulate real-world problems that could make science undergraduate students take more active roles in their learning process. Although inquiry-based approaches are more demanding in terms of effort and time, they are very positively perceived by students, who become more actively involved in their learning process and find this type of research experience very rewarding. Making the experience to resemble as much as possible the real-world situation contributes to engage students in their learning process. In this sense, gamification may help students to gain confidence in their capability to apply their knowledge to solve specific problems, by having replicated situations that they will most probably face in their next professional careers.

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ENHANCING DEEP COMPREHENSION IN HIGH SCHOOL STUDENTS THROUGH THE USE OF GRAPHIC ORGANISERS

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Abstract

Reading comprehension is acknowledged by the European Commission as a citizenship right (Recommendation 2006/962/EC) and one of the goals of the 2030 Agenda; however, OECD PISA data show that scores on reading tasks have been steadily declining over the past 15 years, and in 2022 the average reading performance dropped by 10 points, that means half a school year (PISA, 2023). The present project aims to investigate the relationship between the use of cognitive strategies that support students in reading and information processing and deep comprehension of a text, with the aim of guiding the student towards achieving meaningful learning (Ausubel, 1968). Results in a reading comprehension test from a sample of 45 11th-13th graders don't show any difference between a control group with no given material nor instruction and two experimental groups provided with a guided or expert-made map. However, answers from a qualitative self report show a higher cognitive engagement when using a map, and students reported they perceived the use of a conceptual map as beneficial. According to the literature, we hypothesise that graphically visualising concepts may be beneficial when the task is complex, but may harmer learning and comprehension when the task is perceived as easy, since it can add cognitive demand, increasing the students' cognitive load.

Keywords: Reading comprehension, meaningful learning, visualisation, conceptual map, graphic organisers.

1. Introduction

Reading comprehension is acknowledged by the European Commission as a citizenship right (Recommendation 2006/962/EC) and one of the goals of the 2030 Agenda; however, OECD PISA data show that scores on reading tasks have been steadily declining over the past 15 years, and in 2022 the average reading performance dropped by 10 points, that means half a school year (PISA, 2023).

The aim of the presented project is to stimulate reflection with a view to the development of meaningful learning and metacognitive skills - learning to learn - of students. The purpose of education is to train strategic readers (Gentile, 2017), who are able to deeply understand the meaning by achieving a stable representation of what they read (Gentile, 2017), practising strategies autonomously, reflecting on their reading, making connections with their prior knowledge, using images and illustrations (Ruiz, 2015), to make connections with their own lives and give meaning to what they learn. In fact, deep comprehension is a fundamental condition of learning (Vezzani, 2023), understood as the result of mental representations generated from the systematic organisation of information (Seel, 2003; Clement & Rea-Ramirez 2008; Schnotz, 2014) through the identification of key concepts and the integration of these with prior knowledge. It requires cognitive patience (Wolf, 2018) and it is possible to hypothesise that it can be facilitated by tools for the development of cognitive strategies that enable students to process, visualise and relate information, so as to create mental models of the learned topics (Seel, 2003), such as graphic organisers and conceptual maps, i.e., «graphical tools for organizing and representing knowledge» (Novak, Cañas, 2008).

2. Research

The present project aims to investigate the relationship between the use of cognitive strategies that support students in reading and information processing and deep comprehension of a text, with the aim of guiding the student towards achieving meaningful learning (Ausubel, 1968). According to literature, it is

possible to hypothesise that comprehension can be facilitated by tools for the development of cognitive strategies that enable students to process, visualise and relate information, so as to create mental models of the learned topics (Seel, 2003; Schnotz, 2014). To investigate this hypothesis, we carried out exploratory research developed around the following research question:

RQ: *Is it possible to enhance students' comprehension using specific cognitive strategies, such as graphic organiser or conceptual maps?*

2.1. Sample

The sample consisted of 45 students from 11th-13th grades of an Italian high school.

The students were divided into three groups: a control group (no material group, NM; n=15), to which no instructions nor support material were given, and two experimental group, one provided with a conceptual map made by an expert (expert map group, EM; n=15) and one provided with a blank conceptual map to fill following specific guiding questions (guided map group, GM; n=15).

2.2. Materials

For each group, a file was prepared with instructions, passages, comprehension questions, text, and a qualitative questionnaire concerning the use of reading comprehension strategies. The two experimental groups were given concept maps: the EM group (expert map) was given a complete concept map, while the GM group (guided map) was given an empty concept map, to be completed after reading the text by following the guiding questions on the arrows.

Three passages on philosophical topics were selected for research, specifically passages on philosophers studied throughout the year. For class three, a passage on Plato's political theory was chosen, taken from M. Vegetti's Introduction to the Republic. For class four, a text on the development of the modern state in Hobbes' theory was chosen, taken from Bobbio's monographic volume. For class five, a text on radical evil in Kant was chosen, taken from K. Jaspers. The passages were followed by 11 questions, 10 multiple-choice and one open-ended asking the student to write a summary of 10-15 lines. We chose to use multiple-choice questions to test comprehension of the text to ensure that the comparison between the various groups was as rigorous as possible but, in order to have more feedback on true comprehension and to neutralise any bias arising from closed answers, it was decided to have the students also write a summary.

Finally, a qualitative questionnaire was prepared on the use of any reading comprehension strategies, the difficulty of the task and the effectiveness of the use of the maps provided. The students in the two experimental groups were asked whether or not they found the map useful and to explain why; the students in the control group were asked to list which strategies they had used (if any). Finally, all three groups were asked to express the difficulty of the passage and questions by rating them on a 4-point Likert scale, where 1=not at all, 2=a little, 3=quite a lot, 4=very much.

2.3. Procedure

The study took place over the course of one school day. The students were asked to read the passage and answer the comprehension questions and the final evaluation questionnaire in a time frame of one and a half hours. The activity was introduced by giving the students instructions that were also written on the sheets as follows:

"Read the text carefully. After you have finished reading the passage, answer the comprehension questions. The questions are multiple choice, i.e., there are answer alternatives from which you have to choose only one. After answering the questions, write a summary of 10-15 lines. Finally, fill in the final questionnaire, but only after you have completed the text comprehension part. If there are words you do not know, circle the word.

Be careful: once the test has started, you will not be able to receive any help." The two test groups were instructed to help themselves to the map provided (EM) or to *"Read the text carefully, keeping the question paper in view. Underline phrases or expressions that may provide clarification, answers or definitions. Fill in the map by following the indications on the connecting arrows"* (GM).

3. Results

3.1. Quantitative data

The students' tests were scored by awarding one point for each correct multiple-choice answer; for the score of the summaries, one point was awarded for each conceptual core cited by the student, which had been previously identified in the texts. This score was then reported in tenths.

The data were reported in a table and processed on Jamovi. The sample does not comply with a normal distribution (Shapiro-Wilk p < 0.001), so the Kruskal-Wallis non-parametric one way of variance

test was run to analyse the difference between the groups, the results of which are shown in table 1. In-between groups comparisons of scoring are also shown (table 2).

Table 1. Results of the Kruskal- Wallis variance test of the scores in the reading comprehension tasks.

Kruskal-Wallis

	χ^2	df	p
Essay - scores	2.513	2	0.285
questions - scores	0.423	2	0.810

Table 2. Pairwise comparison of the scores in the reading comprehension tasks.

Pairwise comparisons - Essay - scores

		W	p
no material	expert map	2.385	0.210
no material	guided map	1.385	0.590
expert map	guided map	-0.235	0.985

Pairwise comparisons - questions - scores

		W	p
no material	expert map	-0.6626	0.886
no material	guided map	-0.9010	0.800
expert map	guided map	-0.0909	0.998

3.2. Qualitative data

Graphic 1. Answers to the question: Was the map useful?
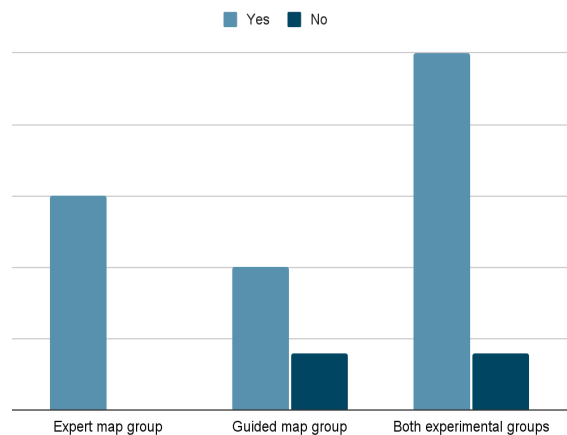
Table 3. Answers to the question: Was the map useful? With explanations of reasons.

Was the use of the map beneficial?	Reasons:
Yes	• Summary function • Anticipatory function • General frame of the text • Visualisation and organisation of concepts and logic connections • Correction of mental models
No	• The text was easy • Added cognitive load

Graph 1 shows the answers of the students in the two experimental groups (29, because one student did not answer) to the question concerning the usefulness of concept maps and Table 3 shows the reasons given by the students in this regard. Finally, as regards the response to the Likert scale concerning the difficulty of the passage and the questions, almost all the students stated that both were not very difficult (2). Among the used strategies, the control group listed rereading, connecting previous knowledge, highlighting key concepts, dividing paragraphs and creating a conceptual map.

4. Discussion

The research hypothesis stated that there could be a significant difference between the scoring depending on the material used. However, the Kruskal Wallis test reports a p value >0.05 and a chi-square of 0.4 for questions and 2.5 for essay, i.e., smaller than the critical value, and therefore the null hypothesis cannot be rejected, i.e. we cannot state that there is a significant difference in the results between the three groups. This result is also easily explained in light of the results from the qualitative questionnaire. As a matter of fact, almost all of the students stated that the text to be read was indeed easy, making the use of additional strategies superfluous if not actually counterproductive because, we can assume, easy tasks increase the cognitive load rather than reduce it. Furthermore, students who were not provided with material for the graphic organisation of topics still used strategies for working and organising the text, such as underlining main concepts, dividing them into paragraphs and schematizing concepts. Many students who were not given instructions created their own concept maps.

One aspect that remains interesting, however, concerns the answers to the questions on the usefulness of the map found by the students. The answers are interesting mainly for two reasons: firstly, the substantial difference between the usefulness found in the pre-made maps and in the guided maps, and secondly, the difference in use with respect to the school year attended. Although therefore the test results do not show a clear difference between the control group and the two experimental groups, the students nevertheless benefited from the map, which in the case of the already completed map was found useful in all cases, and in the case of the guided map was found useful in 71% of cases, a positive percentage overall but one that shows a difference with the previous one. In fact, completing the guided map turned out to be an additional task for some students, rather than a facilitative exercise for understanding the text; Furthermore, in 11th grade only one student found the map useful, in 12th grade some found it useful and others did not, in 13th grade all found it useful and this allows us to hypothesize that the usefulness of the guided map is also linked to the degree of experience of the students who use it, both with respect to the use of strategies for the graphic organisation of contents and with respect to the familiarity of the contents in question. In fact, while 11th graders began this year to deal with philosophy topics, 13th graders have already been dealing with it for three years.

With respect to the use of the maps, guided or already compiled, the students expressed that they found a benefit for the following reasons: The use of the conceptual maps played the role of graphic anticipator, allowing the students to know in advance the contents they would be confronted with in the text; it provided them with a way of visualising key concepts quickly and in an organised manner, also highlighting the logical connections between them; it acted as a self-test and finally it helped them to «refine and in some cases correct the mental scheme» that the students constructed autonomously following the reading of the text.

The use of conceptual maps, therefore, although it did not lead to significant differences in scoring - also because the students in the control group performed excellently by obtaining very high scores - was perceived by the students as facilitating the comprehension of the contents, the identification of the main junctions of the text read and in the recognition of the logical connections between them, in order to better understand the text and better elaborate a discourse on it.

Overall, therefore, what seems to emerge from the results of this preliminary exploratory study is that visually organising the content to be learned facilitates its comprehension, although this seems to be true predominantly in the case where the source content is actually difficult, otherwise the creation of concept maps or graphic organizers is perceived as an additional task and as increasing the cognitive load.

5. Conclusion

The question we asked ourselves in developing this research concerned the possibility of using concept maps - or more generally strategies that allow the visualisation and integration of concepts and the logical connections between them - to facilitate comprehension and learning. The quantitative results did not allow us to reject the null hypothesis, i.e., to confirm what we hypothesised, but the qualitative results

did highlight some interesting aspects concerning the usefulness of using strategies for the graphic and visual organisation of contents such as concept maps, as discussed in the previous section.

The results on the one hand allowed us to align ourselves with the scientific literature on the subject (Mayer, 2014; Sweller, 2011; Renkl, & Scheiter, 2017) on the other hand to elaborate parameters from which to develop future research. The one presented here is in fact a preliminary exploratory study, which allowed us to identify critical points on which it is appropriate to work in order to verify the starting hypothesis. First of all, seeing the variation in the responses on the usefulness of the guided map among the various classes, it is conceivable that experience in using certain strategies may be an important variable in determining the effectiveness of map use and it is therefore appropriate to specifically instruct students before having them confronted with maps that might otherwise be perceived as difficult and confusing. Furthermore, the ease of text perceived unanimously by students invites us to test the hypothesis that graphic organisers and similar strategies are useful depending on the difficulty of the task at hand. A further limitation of the study, found through the answers to the qualitative questionnaire, concerns the timing of the presentation of the tasks: in the present study, the students were given a single packet containing all the tests, without specifying whether or not they could go back over the text and the tasks: many of the students in the control group reported that they read the text several times, going back over it even after reading the questions: In order to test whether or not consulting or creating a map following the reading of the text can play a facilitating role, it is worth considering separating the reading of the text and the performance of the test with the comprehension questions, letting the students answer only with what they have learnt and not with the text under examination.

On the basis of the results obtained and the criticalities that emerged, it is therefore possible to develop a more in-depth protocol, which also provides for a longitudinal check on the students' learning, also in relation to a path of explanation on the use of certain strategies for organising and visualising content, strategies that were in any case on the whole appreciated by all the students who participated. This path, which is planned to be implemented starting from the next school year, will make it possible to verify the hypothesis underlying this research in a more thorough and rigorous manner.

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PHONETICS AND AUDIO-VISUAL HELP TO IMPROVE AND STRENGTHEN THE PRONUNCIATION OF THE ENGLISH LANGUAGE

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Abstract

College English language learners mislearn the pronunciation of some basic words, and the fossilization of these mispronounced words includes the unlearning process to relearn the new correct pronunciation, an avenue for solution is technology. The Internet is regarded as a pedagogical device to develop language teaching and the learning process. This study will use the help of seven internet tools and phonetics as an audio-visual help to improve and strengthen pronunciation. The aim is that students detect incorrectly pronounced words, get students to know seven internet tools, get them to know the differences in pronunciation between American and British English, get them to know and use the methodology of the spaced effect, strengthen memory, retain correct pronunciation, and defeat fossilization, that students learn to learn the correct pronunciation by themselves. This study is quantitative and qualitative, with pre-and post-tests aimed at measuring 42 college learners' pronunciation before and after training which aims to de-fossilized wrongly pronounced sound elements with the help of a doble methodology; Spacing Effect, a memory strategy of reviewing the material multiple times at different intervals to retain the correct pronunciation, and Action Research, aimed at problem-solving that seeks to engender positive change and a participatory process that requires the equal and collaborative involvement. The results show an improvement in learners' pronunciation, a cyclical correction, a more careful awareness of pronunciation, and a recognition between American and British English.

Keywords: Phonetics, language internet tool, spacing effect, action research, English language pronunciation.

1. Introduction

Most of the students majoring in English Language Teaching Departments have difficulties pronouncing the words correctly. Learners mispronounce some basic words and they keep producing the mispronounced patterns (Cakir, 2012; Sadaqui, 2015).

It is a long process to deal with fossilized words during the language teaching process (Cakir, 2012).

There are a lot of difficulties that affect pronunciation acquisition and the limited opportunities to practice that learners have, an avenue for solution is technology (Fouz-González, 2015).

The Internet is regarded as a pedagogical device to develop language teaching and the learning process (Hismanoglu & Hismanoglu, 2011).

This study will use the help of seven internet tools and phonetics as an audio-visual help to improve and strengthen pronunciation.

College English language learners mislearn the pronunciation of some basic words, and the fossilization of these mispronounced words includes the unlearning process to relearn the new correct pronunciation.

The problem to be solved with this research is to determine: How to improve and strengthen the pronunciation of college learners from the Language Department of the UMSNH, overcoming fossilization?

The present work describes a quantitative study of the English pronunciation of 42 College English language learners from the Language Department at the Universidad Michoacana de San Nicolás de Hidalgo. Our aim in the study was that English language learners:

1. Detect incorrect pronounced words.

2. Get students to know the internet tools Linguee, Google Translate, YouGlish, Reverso Conjugation, Reverso Context, Cambridge's Phonemic Chart and Antimoon Phonetic Alphabet to have an audio-visual support of the correct pronunciation in English.

3. Get them to Know the differences in pronunciation between American English and British English.

4. Get them to Know and use the methodology of the spaced effect.

5. Strengthen memory, retain correct pronunciation, and defeat fossilization.

6. That they learn to learn how to learn the correct pronunciation by themselves.

The research question of this work was:

How to improve and strengthen the pronunciation of the English language in the apprentices of the Language Department of the UMSNH?

2. Theoretical foundation

How technology can assist learners in their productive practice is closely linked to the techniques employed for perceptual enhancement. It is only after learners perceive divergences between their output and that of the model that they make further attempts to improve production (Fouz-González, 2015).

The use of technology can increase student engagement, students' confidence in their abilities as independent learners and their motivation, as well as the opportunity of listening to native speakers of the language they are learning with different accents as well as learning the word in context, where users can find the definition of the word, the audio of the pronunciation, the phonemic with symbols from the International Phonetic Alphabet (IPA) symbols. This can be a good way to provide learners with short tips to help them focus on these words and remember them longer. Internet tools can be accessed on a variety of devices (computers, smartphones, tablets, etc.) (Fouz-González, 2017).

Table 1. Pronunciation and fossilization meanings.

Pronunciation errors	Errors are systematic, **likely to occur repeatedly, and not recognized by the learner**. Hence, only the teacher or researcher can locate them (Ababneh, 2018).
Pronunciation fossilization	Fossilized pronunciation errors consist of **making a faulty** in one of the three elements: **accuracy, intelligibility or fluency** (Demirezen, 2010).
Fossilization	Fossilization is known as the **long-term persistence** of the non-target-like structures in the interlanguage of non-native-speakers (Rudneva, Valeeva, Nigmatzyanova, Guslyakova, & Pavlova, 2019). **Repeated errors** are often the demonstrations of competence fossilization and also represent the incorrect structures that are been considered as corrected errors but they keep emerging (Sadaqui, 2015).
Phonological fossilization	Repetition of phonological errors which result from the incorrect acquisition of pronunciation of L2. When such phonological errors are **repeatedly made and eventually stay stable in the incorrect manner**, phonological fossilization occurs (Sadaqui, 2015).

Fount: Audio Articulation Method and educational phonetics as rehabilitators of fossilized pronunciation error (Demirezen, 2005; Bartolí Rigol, 2005).

Rudneva, Valeeva, Nigmatzyanova, Guslyakova, and Pavlova (2019) categorized grammatical, lexical, and pronunciation fossilized errors, detecting that the most frequent fossilized errors in advanced learners are pronunciational ones. Mispronounced words were treated throughout 8 weeks. The study focussed on the validity of self-assessment as an approach to address fossilized errors.

Mompean and Fouz-González (2016) used Twitter as a language teaching/learning tool, it had a positive effect on the pronunciation of some words commonly mispronounced by English foreign language students. Instructions had a beneficial effect on the students' pronunciation of the target words and participants were actively engaged during the study.

3. Method

It is a quantitative and qualitative study; the sample was 42 College English language learners from the Language Department at the Universidad Michoacana de San Nicolás de Hidalgo.

As part of the procedures and instruments, there were a Pre and Post Test, Task 1 Perception is a multiple-choice identification Google form of 13 questions with pictures. It focuses on 1) vowels,

2) consonants, 3) word stress, 4) intonation (sentence-final), and 5) sentence stress, through grouping sounds, sound patterns, rhyming pairs, distinguishing between sounds (Reyes Morente, 2019; Grupo Vaughan, 2021; RealLife English, 2021). Task 2 Production is a reading aloud, recorded, to provide natural language in a much broader context than is found in sentence items.

Two methodologies were employed; Spacing Effect Methodology, which consists of reviewing the material multiple times and at different intervals which will help to retain the new information for much longer. There were 8 interventions or reviews as Figure 1 shows. Action research addresses four main themes: participant empowerment, collaboration through participation, knowledge acquisition, and social change. Action research is essentially applied research, it is a spiral of action research cycles consisting of four main phases: planning, acting, observing, and reflecting.

Figure 1. The Forgetting curve.
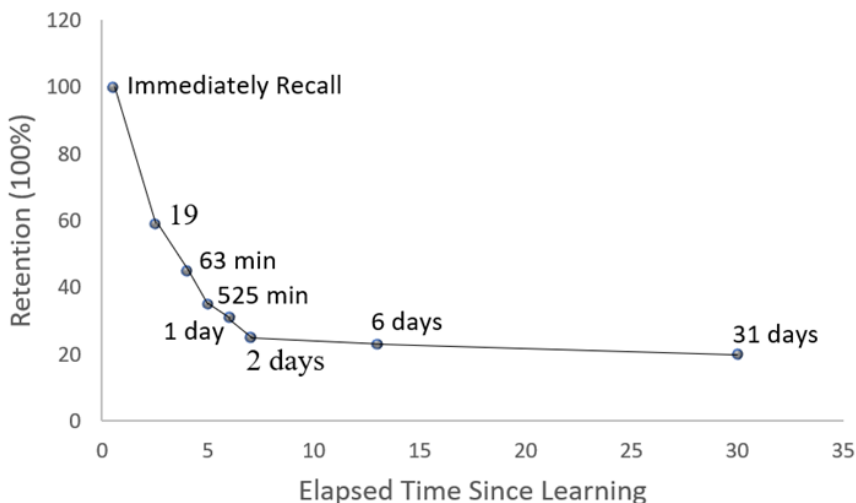
Fount: Based on Weimer-Stuckman, G. (2009). Second Language Vocabulary Acquisition: Spacing Frequency of Rehearsals. University of Victoria.

Three software were used: Speech Analyzer, Meet, Excel.

4. Results

Table 2.

Questions	Pre-test	Post-test	Improvement
1	14%	90%	76%
2	69%	71%	2%
3	31%	31%	0%
4	19%	69%	50%
5	83%	88%	5%
6	10%	81%	71%
7	71%	93%	21%
8	78%	88%	10%
9	7%	26%	19%
10	29%	48%	19%
11	52%	79%	26%
12	62%	57%	-5%
13	67%	69%	2%
Improvement	46%	69%	23%

Fount: Own elaboration.

Figure 2. Pronunciation improvement test.
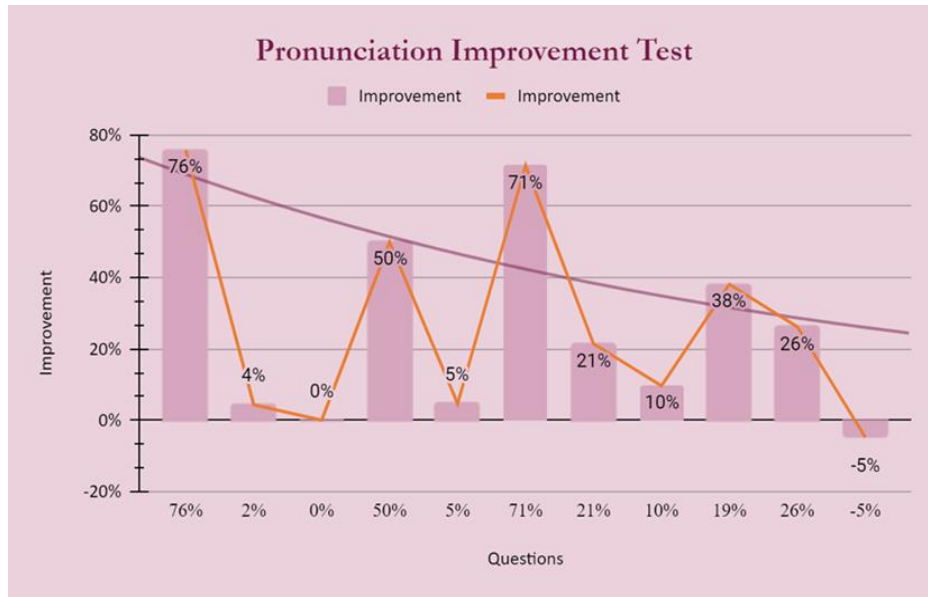
Fount: Own elaboration.

Figure 3. Participant's preferences on internet tools.
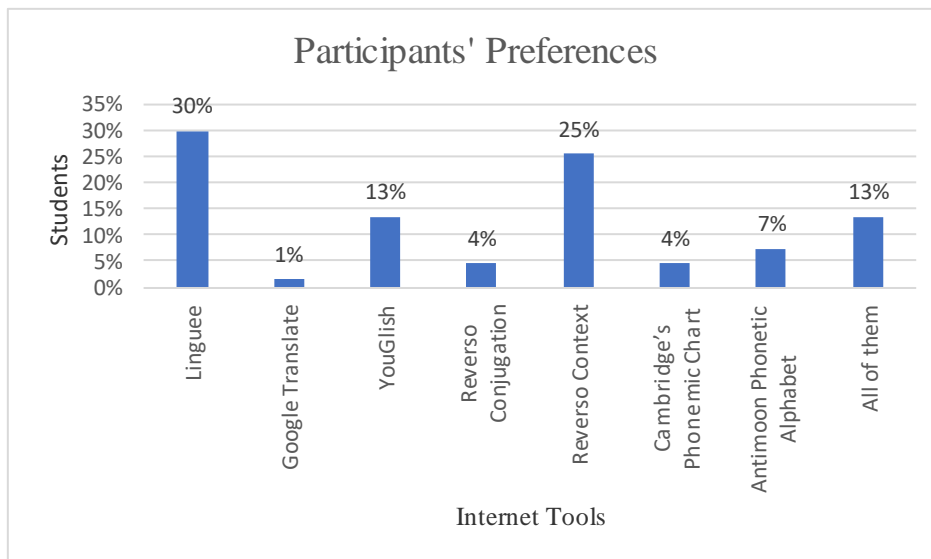
5. Conclusions

The results show an improvement in learners' pronunciation, a cyclical correction, and a more careful awareness of pronunciation due to the help of phonetics and the audio of these seven internet tools. Limitations were found in the research like limited number of participants, Online sessions, and distance approach. Limited to just one semester.

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SKILLS DEVELOPMENT AT THE SCHOOL SUBJECT OF MODERN GREEK LANGUAGE THROUGH DEBATE

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Abstract

This present research treats the importance of debate as a technique of skills development and more specifically communicative and metacognitive skills with students of A class of senior high school at the school subject of modern Greek language. After a brief conceptual clarification of the main motions of the research and a summary based on bibliography of similar researches, the research questions that are expressed concern, from the student's side, about how much debate contributes to communicative and metacognitive skills development by students through their participation in it, and, from teachers' side, the enlargement of their opinion about the importance of debate in the cultivation of the skills mentioned above. This research has been carried out in the school environment of an urban area high school. The sample consists of three philologists who will teach their class twice, one based on their own lesson plan and the other on the researcher's plan, and also of the students who have accepted to participate in this procedure, 59 on the first count and 50 on the second. The research questions are examined via half-structured interviews of teachers, lists of questions that were distributed and answered by students and the observation made by the recording and the transcription of the interviews. The research questions of the investigation prove the positive opinion of the teachers for the debate technique and the experimental method they used to cultivate the communicative and the metacognitive skills during their lessons. In addition, through students' participation, it is obvious that via the debate the cultivation of the skills above is facilitated taking into consideration the classes in which they participated themselves, while even international studies support these conclusions. At the same time, this research contains the comparison between the teaching methods used studying all the issues mentioned above.

Keywords: Debate, communication skills, metacognitive skills, modern Greek language.

1. Introduction

This present research is going to investigate, on the one hand, the opinions of teachers regarding the contribution of debate to the cultivation of the above skills and, on the other hand, how much debate contributes to communicative and metacognitive skills development by students through their participation in it. This is a very important issue regarding the upgrading of the educational process but also the skills development which, indisputably, are an inextricable part of our lives, they are present in every manifestation of our daily life, establishing our personality. Modern education, therefore, needs to be connected to authentic learning and assessment environments, in order for students to get the multidimensional benefits offered from it. Below we will briefly present the two central motions we are studying: skills (communicative and metacognitive) and debate.

2. Theoretical framework

2.1. Skills

As "skill" the definition that has prevailed in "the ability to apply knowledge and use know-how to fulfill tasks and solve problems" (Cedefop, 2014; Tsolakidou, 2021, p. 153). In this paper we will be concerned communicative and metacognitive skills.

More specifically, communicative skills are one of the most basic human traits. "A person with communicative skills can communicate with those around him, send and receive messages, manage social situations, solve problems and transmit information" (Verouli, 2022, p. 37). This paper examines listening

skills consisting of eye contact, interest and acceptance of the speaker, active listening to the other's opinion and even free expression, teamwork and cooperation.

Regarding metacognitive skills, we can define the term "metacognition", which according to Kasimati (2020) is defined as the ability of the individual to adjust his mental activity to achieve a better understanding. We will therefore refer to skills related to argumentation and counter argumentation, critical ability, documentation, receptivity to opposing arguments, personal interpretation of arguments and decision-making to solve problems in the group.

In the end, we should also refer to the learning framework within 21st century skills because, as we know, the "21st Century Skills" have permeated all aspects of everyday life in a rapidly changing world. This is a unified, collective vision for learning, describing the skills, knowledge and expertise that people need to be successful in work and life. For this research, we took into consideration the KSAVE model (Binkley et al., 2012), the Competence-based learning from Deusto university (Sanchez & Ruiz, 2008) and the OOSA model (Smyrnaiou, 2021).

2.2. Debate

Debate is a dimension of oral speech and is considered a "confrontation" of arguments and persuasion. It is a collaborative and experiential form of learning that focuses on the participants' argumentation on a topic –and as with any topic, there are at least two conflicting points of view approaching it. Those two opposing sides try to defend their idea or opinion (Iman, 2017). Using debate as a learning activity requires careful research. It is considered a useful learning activity for teaching critical thinking and improving communication skills. It is an effective pedagogic mode because of the level of responsibility for learning, understanding and active participation required of all students who discuss.

The teacher has many responsibilities before, during and after the debate. Before the debate, the teacher explains the process to the students and reinforces the fact that it will be used as a learning experience and not as a test. The teacher also determines the rules and the format to be used for the debate and facilitates the choice of the topic of the debate. Another role of the teacher is to set the emotional climate and educational environment for the debate (Garrett et al., 1996). Finally, "the degree of teacher intervention, after the first applications, will gradually be limited and the active involvement of the students will be promoted in all stages of the implementation of the debate, from its organization to its completion" (Dimitriadis & Fakazi, 2009: 321).

Having taken into consideration the forms of debate, the analysis of its characteristics (roles that participate), the ways of persuasion in argumentation and the role of the teacher in it, the researcher created a teaching plan that was used in the three following lessons carried out by the teachers, while themselves, in the first teachings, they created their own plan and applied it each in their class.

3. Objectives

The purpose of the research is to investigate how debates can be a technique for developing skills in A class of senior high school students, showing their importance in the context of the school community. Thus, it will focus on demonstrating the debate as a means of multifaceted development, since not only skills are cultivated through it, but also the way of correct argumentation and persuasion that can be used in all aspects of life. So, to limit the research field to a specific research problem, the research questions we are asked to answer in this paper are the following:

· What are the opinions of the teachers regarding the use of debate and the communicative and metacognitive skills that the students acquire in the Modern Greek language course?

· To what extent does the debate contribute communicative and metacognitive skills development by the students through their participation in it?

4. Methodology

For this research, the mixed research method was chosen, which combines qualitative and quantitative data. Qualitative research data were collected using the techniques of semi-structured interview, interview protocol, observation (non-participant) and field notes, while quantitative data were collected using questionnaires.

The research sample consisted of three philologists and the students of their classes, 59 on the first count and 50 on the second. The counts are the 2 teachings made in each of the three classes to observe skills that change in a different context of debate application. After each count, questionnaires were shared to the students and an interview was taken by each philologist at the end of the research. In addition, the research, due to the fact that it was carried out at the school where the master's internship

took place, with teachers and students we had already worked with, is characterized by convenience sampling.

Finally, the process of analyzing the qualitative data (interview and observation) was done by thematic analysis and its validity was ensured by the triangulation of the data while its presentation was also carried out by content analysis. On the other hand, descriptive statistics (frequency tables) were used to analyze the quantitative data, as well as the x^2 analysis to examine whether there is a statistically significant difference between the concepts we are studying: debate, communicative and metacognitive skills. Data entry was done on the SPSS22 platform.

5. Conclusions

Starting from the first research question, firstly, the necessity of integrating the debate technique into teaching, the desire for students to acquire communicative skills, the exercise in argumentation and the pleasure they will get emerged from the teachers' aspirations in the first teaching that students carried out through the overall process. Also, what we call "Trapeza Thematon" (from which either independent subjects or sections of subjects that correspond to fifty percent (50%) of the written test for the subjects examined in writing in A class final exam of each type of High School are drawn at random. The remaining 50% of the written test is the responsibility of every teacher) emerges as a limiting factor for the implementation of the debate. In addition, through the first teaching in the Modern Greek Language, listening skills, free expression, cooperation, taking initiatives and speaking in public were found in the communicative skills and in the metacognitive skills the argumentation and critical skills associated with the debate.

Furthermore, the debate upgrades the educational process as its use contributes to student-centered teaching, the active role of students and experiential learning while the relationship between students and teachers develops. Furthermore, the role of the teacher evolves into that of coordinator and guide. Finally, it contributes to the smooth adaptation to school and adult life, in the social and professional arena (agreement with Hall, 2011; Kennedy, 2007).

Conclusions obtained from the comparison of the two teachings are classified into 3 categories: general, communicative and metacognitive skills. In general, the research teachers indicated that in the second instruction, the students responded better in terms of organization and timing, cooperation and participation. In communicative skills, there was a positive sign in terms of comfort in front of an audience, more comfortable eye contact, greater interest, teamwork as well as empathy. On the contrary, the feeling of stress due to time was negatively observed. Finally, in metacognitive skills, there was more organization in finding and developing arguments and counterarguments in the second teaching and better rebuttal, while in both teachings personal meaning of the arguments was made but in the first it was greater due to proximity to the subject.

Problems encountered during implementation consisted of rivalry and dogmatism, immaturity due to inexperience, team composition and dialogue. Then, there was reference to the communicative skills developed by the students during the lessons which consisted of listening skills (maintaining eye contact, interest, accepting the interlocutor) (agreement with Darby, 2007) speaking in front of an audience (agreement with Nurakhir et al., 2020; Hall, 2011), empathy (agreement with Kennedy, 2007), teamwork and time stress. In metacognitive skills we have the critical ability (agreement with Nurakhir et al., 2020; Kennedy, 2007), argumentation, for students to filter and judge the arguments while the difference in written and oral speech also emerges (agreement with Darby, 2007). Furthermore, counterargumentology (agreement with Handayani, 2016), organization in finding and developing arguments and counterarguments (agreement with Hall, 2011; Handayani, 2016) as well as the personal meaning of the topic are included.

Last conclusions concern, firstly, the comparison of the debate with the traditional teaching from which the change in the role of the student as it becomes more active, more direct participation, more active involvement and the change of feelings of the students and, consequently, gives a better feeling in in the class. In addition, the teachers' expectations for the debate include the change of the students' attitude in the Modern Greek language course, the improvement of the students' speech (and vocabulary), the avoidance of monotonous teaching and the fact that the repetition and a greater frequency of application will bring results to the debate.

Conclusions for the second research question that arise are divided, like the questionnaires, into the general ones for debate, communicative and metacognitive skills. In general, from the first to the second teaching, students understood better the steps and roles they were asked to take as participants in a debate (agreement with Nurakhir et al., 2020), but the knowledge of the above variables discouraged them from participating.

In communicative skills, the relationships between the participants were more developed within the debate (agreement with Turnposky, 2004, i.e. in Tawil, 2016), the group's common goal that satisfied members' needs and interest in an argument they did not support (agreement with Tawil, 2016). The resolution of any conflict of opinion within the group, the resolution of conflict of opinion between

opponents and the limitation of time were less developed. In addition, addressing an argument did not match the students' interests from an emotional point of view and eye contact (agreement with Shaw, 2012, cited in Nurakhir et al., 2020).

Finally, in metacognitive skills, variables related to understanding the positions of opposing team members (agreement with Nurakhir et al., 2020), time management for building arguments and team spirit under time pressure developed more. Additional variables that were developed consisted of responding to an argument they did not expect to hear, supporting an argument they did not agree with, the degree of facilitation of eliciting arguments with questions that clarified points that were not understood and the criteria for evaluation by audience-judges and feedback (agreement with Nurakhir et al., 2020). Knowledge of argument structure, decision-making about problem-solving (agreement with Nurakhir et al., 2020) and personal meaning-making were less developed.

Acknowledgments

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PRIMARY SCHOOL TEACHERS' TRAINING NEEDS TO MEET THE CHALLENGES OF 21ST CENTURY SCIENCE EDUCATION

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Abstract

In the age of the Anthropocene, ordinary citizens have to make choices and decisions on complex and controversial socio-scientific issues that can have dramatic consequences on both their individual lives and the community's public life. That is why today, more than in the past, science education matters, and in OECD countries, it is compulsory for all students from kindergarten to age 15 or higher. According to the Pisa 2025 Science Framework, a 15-year-old school leaver aspiring to think and act as a responsible citizen should have developed specific scientific competencies that require the mastery of content, procedural and epistemic knowledge in order to be performed. Such an ideal of science education – which implies a certain image of science (epistemological variable), a specific educational task of the school (pedagogical variable), and a peculiar conception of scientific learning (didactic variable) – raises two distinct but related problems, which will be addressed concerning the Italian situation. The first problem concerns how to conceive of teachers' didactic competence in relation to the type of variables mentioned above. The position defended in this contribution is that the epistemological and pedagogical variables are mutually independent but not the didactic variable. Insofar as the choice of what is worth teaching and having students learn is concerned, the latter is constrained by the first two. Embracing this stance entails recognizing that teachers' didactic competence depends as much on their disciplinary expertise as on specific epistemological and pedagogical awareness. The second problem concerns the types of learning at stake. Since the competencies identified by Pisa 2025 are complex long-term learnings hindered by deep-rooted misconceptions about what science is and how it works, it is necessary to define the goals of science teaching from the perspective of a vertical curriculum and to identify the specific training needs of teachers of different school orders accordingly. Taking physical education as a case study to explore these issues, a theoretical reflection and operational suggestions are provided for updating in-service and pre-service teacher training, focusing on primary school teachers.

Keywords: Science education, teacher training, epistemology, physics teaching, vertical curriculum.

1. Science education in the 21st century

In the age of the Anthropocene, ordinary citizens have to make choices and decisions on complex and controversial socio-scientific issues that can have dramatic consequences on both their individual lives and the community's public life. That is why science education matters today more than in the past. In many countries, it is a goal of the school curriculum from kindergarten until the completion of compulsory education, which usually ends at the age of 15-16. According to the Pisa (Programme for international student assessment) 2025 Science Framework, a 15-year-old school leaver "prepared for life" in modern society should be able to a) explain phenomena scientifically, b) construct and evaluate designs for scientific enquiry and interpret scientific data and evidence critically, c) research, evaluate, and use scientific information for decision making and action. For such domain-specific competencies to be performed, students must master and integrate three kinds of scientific knowledge – content, procedural, and epistemic knowledge – and feel engaged and confident in science as a collective human endeavor.

Concerning Italy, this entails that during ten years of compulsory education, students should learn not only selected content from the main fields of science but also how such knowledge is produced and why we consider it reliable (Duschl & Osborne, 2002; Sandoval, 2005). However, in 2015, the last year in which science was a major domain, the mean score of Italian 15-year-olds on the overall science scale was 481 points against the OECD average of 493 (OECD, 2015), with a mean performance on the procedural and epistemic knowledge subscale lower than that on the content knowledge subscale (479 vs.

483). In subsequent assessments, Italian students' scores remain below the OECD average: 468 vs 489 in 2018 and 477 vs 485 in 2022. While the causes of these negative results may be multiple, in this paper, an attempt is made to highlight those somewhat related to the ideal of science education fostered by Pisa in order to identify teachers' training needs, which differ according to their academic background (generalist vs. specialist) and/or the school level they teach in. Therefore, the research questions to be addressed are as follows:

RQ1. What kinds of competencies and awareness do teachers need to develop to promote the ideal of science education outlined by Pisa 2025?
RQ2. How can in-service and pre-service teacher training be updated to meet these formative needs?

The hypothesis is that teachers' didactic competence depends on their disciplinary expertise and specific epistemological and pedagogical awareness. Indeed, designing a science curriculum implies choosing what is worth teaching and how to do it (didactic variable) regarding a set of learning objectives that must be selected according to both a certain idea of the nature of scientific knowledge and knowing (epistemological variable) and the educational purpose that the school should strive for (pedagogical variable). Embracing this stance means recognizing that teachers' didactic decisions are neutral, neither concerning a certain image of science nor a certain idea of school (Martini, 2011; Tombolato, 2020). If this hypothesis is accepted, then it is possible to put the problem in these terms: net of other factors, teachers' didactic choices will be all the more effective in promoting the three competencies identified by Pisa, the more their personal view of science (epistemological variable) and the purpose they assign to their teaching (pedagogical variable) will be consistent with the image of science and the purpose of science education underlying the PISA framework.

The rest of the work is organized as follows. In section 2, the main features characterizing the image of science to which Pisa refers (PIoS) are identified by analyzing the types of scientific knowledge required to perform the three competencies. The objectives of science education will also be clarified based on the select competencies and the document's rationale for such a choice. Next, an attempt will be made to highlight the different training needs of primary and secondary school teachers. Finally, some suggestions are offered to update teacher training, focusing on primary school teachers.

2. The ideal of science education in Pisa 2025

According to the Pisa 2025 framework, which refines and extends previous competencies (PISA 2015), learning procedural and epistemic knowledge and disciplinary content is necessary for developing and implementing scientifically responsible behaviors in a STEM-oriented society. Procedural knowledge is defined as knowing the standard procedures and practices implemented by scientists to obtain reliable statements about the natural and human-made world and to evaluate evidence that can be used to support claims in a disciplinary domain. It includes, for example, knowledge about measurement and experimental procedures, modeling techniques, and processes of peer vetting within the scientific community. In general terms, epistemic knowledge concerns understanding the relationship between the aims (describe, explain, predict) and the means (e.g., models, data, evidence) of science as a collective and collaborative enterprise. It involves an awareness of why scientists' procedures, practices, and forms of reasoning must be considered reliable and within what limits.

At the core of this perspective, which differs from that of many school curricula dominated by content knowledge (Pisa, 2025, p. 10), is the shift from products to practices characterizing recent trends in science education (e.g., Duschl & Osborne, 2002; Kelly, 2008; Chinn & Rinehart, 2016) that take on board the views of scholars (e.g., Giere, 1988; Kitchener, 1993) interested in what scientists do to make reality intelligible and how they justify their findings. Within curriculum studies, a spokesman and, to some extent, the forerunner of this position is Joseph J. Schwab (1964), who maintains that what characterizes a discipline is not only the set of its concepts and theories but also its "syntax", i.e., the peculiar disciplinary modes of investigation, discovery, and verification that determine the different ways in which disciplinary knowledge claims are "true". Thus, the ideal of scientific education promoted by Pisa is based on an image of science conceived not only as an organized system of knowledge (ready-made science) but also as the collective effort of a community to solve problems by applying shared rules and criteria and by using disagreement (on methods, facts, interpretations, objectives) and rational discussion as tools to promote the advancement of knowledge (science in the making). This epistemologically sophisticated view of science can inform different didactic decisions according to the educational purposes assigned to its teaching. Pisa's choice to privilege education for citizenship is realized in the selection of competencies that do not concern the production but rather the informed and critical consumption of knowledge. Indeed, becoming acquainted with procedural and epistemic

knowledge helps students develop a trustworthy attitude toward scientific research by understanding the norms and values to which community members express their commitment.

In summary, the choice to emphasize the epistemological aspects of science (procedural and epistemic knowledge) and not only the disciplinary aspects (content knowledge) is aimed at improving students' understanding of "science in the making" to enable them to evaluate information better and make responsible decisions, in order to avoid irrational and dangerous behavior stemming from naive beliefs. However, based on the data mentioned above, it is plausible to assume that the ideal of science education promoted by Pisa has been poorly implemented in Italy (but also in other countries), where teachers, while recognizing, to a greater extent than in the past, the importance of promoting the formative and cultural value of science, do not seem to be able to design teaching activities consistent with this goal, which requires shifting the focus from knowledge as a product (content knowledge) to knowledge as a process (procedural and epistemic knowledge). A major cause, though not the only one, is that university curricula do not foster the integration of the "two cultures," i.e., scientific knowledge and epistemology informed by pedagogical aims, the latter sometimes labeled by educational researchers as the "nature of science" (e.g., Abd-El-Khalick & Lederman, 2000). By taking physics education as a case study, I will explore this hypothesis first concerning upper and lower secondary school teachers (a more precise differentiation is not possible for this article) and then to primary school teachers, trying to bring out based on their respective strengths and weaknesses, the different training needs.

3. The training needs of primary and secondary school teachers

In Italy, university physics curricula offer repeated exposure to concrete problems deemed paradigmatic by the scientific communities (Kuhn, 1997), thus providing students with an opportunity to learn the syntax of the discipline (Schwab, 1964). As the philosopher of science Ronald Giere (1988) explains, through the study of standard textbooks and laboratory experiences, university students tacitly acquire new techniques and methods of knowledge production legitimized by the relevant scientific community. So, they learn alongside the practice of modeling the conditions of applicability of models to the target phenomena, and they get used to controlling different types of variables (independent, dependent, and control variables) during experiments to avoid confounded findings. In short, through extensive practice, physics novices acquire the way physics represents the world and, with it, the constraints to which it is subject. However, unless explicitly brought to students' attention through epistemological discussions (e.g., Bächtold et al., 2021), such knowledge embedded in practices and conveyed through exemplars (Kuhn, 1997) usually remains tacit, only becoming visible through competent actions. This is what happens to many future secondary teachers since university physics curricula do not offer any course entirely focused on the "nature of science" (Dibattista & Morgese, 2012, pp. 151-153), which at most is mentioned in the "Didactics of Physics" course, but only a "History of physics" course.

While this "epistemological naivety" is not necessarily a problem for scientists (Rosenblueth & Wiener, 1945), it negatively affects teachers' didactic choices as they generally fail to include procedural and epistemic goals in their school curriculum planning. As a result, in carrying out the didactic transposition of scientific knowledge into knowledge to be taught (Chevallard, 1985; Schubauer-Leoni, 2008; Martini, 2011), epistemologically naive teachers are more likely to isolate the content of a discipline from its syntax, thus providing students with mostly inert knowledge, i.e., information that they can memorize but not use to interpret reality. Actually, according to Sandoval (2005), there is not necessarily an agreement between practical epistemologies (i.e., epistemological beliefs manifested through practice) and formal epistemologies (i.e., explicit epistemological beliefs), a hypothesis that seems to be confirmed by Michela Mayer's (1996) investigation of commonplaces about scientific practice in secondary school science teachers. Among the most widespread clichés that Mayer (1996, p. 136) identified by analyzing the responses of some groups of teachers to a semi-structured questionnaire on scientific knowledge (Mayer & Vicentini, 1996, pp. 65-68) are worth highlighting: the superiority of nomothetic sciences, conceived as examples of a single universal explanatory model, over ideographic sciences; the naive empiricist idea that laws and theories are derived inductively from observations and experiments; the myth of a universal and ahistorical method, which provides privileged access to truth and demarcates science from pseudoscience.

This trivialization of the relationship between reality and scientific representation, also prevalent in various school texts, strengthens the naive ideas of students, which eventually turn into deep-rooted misconceptions. Based on many years of experience teaching physics (labs and lessons) to primary school students, most have a dogmatic and naive view of how scientific knowledge is produced and justified. Specifically, practices devised and/or employed by Galileo to make the natural world intelligible, such as the asymptotic approach to "pure case," the causal simplification in experiments

(i.e., the strategy of controlling variables), or the design of counterfactual mental experiments (McMullin,1985; Koertge, 1977), seem extremely counterintuitive to prospective primary teachers. Indeed, they often mistake the ideal cases (e.g., movement in the absence of friction, oscillations of a mathematical pendulum) described in textbook problems as real and concrete, fail to identify and control different types of variables (dependent, independent, and control) while doing simple experiments, or struggle to connect observed phenomena with their mathematical or graphical representations. Making such errors, examples of which can also be found in the specialist literature (Matthews, 2001; Schecker, 1992; Oberle et al., 2005; Roth & Tobin, 1997), denotes a lack of knowledge of both disciplinary epistemic practices and the conditions under which such practices can be used to produce reliable knowledge about the natural world.

Within this framework, the training needs of secondary and primary school teachers appear very different. The former must be helped to explicate, problematize, and integrate the learning they have implicitly developed through practice to overcome commonplaces about their discipline and its teaching and intentionally design instructional activities consistent with the ideal of science education promoted by Pisa. The latter, on the other hand, need to be helped to evolve the different types of misconceptions developed during their schooling while gaining a more sophisticated view of physics so that they can truly understand how and to what extent this discipline can contribute to shaping active and responsible citizens. Suggestions to this effect will be formulated in the next section.

4. Epistemology and history of science in the service of teacher training

Due to the generalist degree course they attend, primary school students suffer from the difficulty of having to acquire knowledge and skills in a wide variety of disciplines through a limited set of experiences. Unlike secondary school teachers, they cannot count on implicitly acquiring disciplinary procedures and rules through extended and extensive practice. This suggests acting on two levels - disciplinary and interdisciplinary - to turn what may at first glance appear to be a weakness into a strength and at least partially compensate for the absence of specific courses in history and philosophy of science. On the one hand, I propose to identify synergies between the different areas of knowledge within the curriculum - i.e., the other scientific disciplines, pedagogy, and general education - in order to converge objectives and maximize student learning. On the other hand, I propose to exploit the epistemology and history of the discipline to rethink the transposition of physics in the light of two types of learning goals: those concerning students as learners and those concerning students as prospective teachers. As primary education is the only degree course that directly qualifies students for teaching, they must simultaneously acquire disciplinary and didactic competencies.

Hence, there is a need to work on two fronts. Firstly, students need to understand why physics should be taught from primary school onwards. Thus, they must realize that since the competencies identified by Pisa as essential for the 21st-century citizen are complex long-term learnings (Bateson, 2000; Baldacci, 2012), the objectives of science education must be defined from the perspective of a vertical curriculum. This requires that all school levels involved contribute to their achievement. This kind of awareness can be fostered in students by working in synergy with Pedagogy and General Didactics courses. Secondly, prospective teachers must realize how they can contribute. This implies that they understand how physics produces and legitimizes its knowledge and how and within what limits this knowledge furthers the progress and welfare of humanity so that they can develop a rational trust in research, which they can pass on to their future students. Such a positive and rational attitude can be strengthened if promoted in synergy with other scientific disciplines.

Within this framework, epistemology and discipline history can be used as teaching resources to pursue procedural and epistemic learning objectives effectively. At an operational level, I thus propose to use the following epistemological questions (e.g., Osborne and Duschl, 2002; Sandoval, 2005) to deconstruct the discipline (in this case, physics) and reconstruct it for teaching purposes: a) What exactly do we know through that discipline (e.g., physics)?; b) How do we know what we know?; c) Why do we trust what we know? By analyzing physics and its history in the light of these questions that are consistent with PIoS, some epistemological nodes linked to specific educational goals can be identified, around which it is possible to design teaching activities of different levels of complexity without being bound to specific content. For example, referring to the second question applied to the history of physics, the asymptotic approach to "pure chance" can be identified as an epistemological node. This technique, for whose counterintuitiveness Galileo was also criticized by his mathematical friend Guidobaldo del Monte (Matthews, 2001), can suggest activities that can be designed around different content (e.g., the principle of inertia or the law of falling bodies) and whose level of complexity can be determined in relation to the school level and other learning variables.

In the perspective of a vertical curriculum, these epistemological nodes, which identify procedural and epistemic knowledge consistent with the Pisa ideal of science education, can represent the converging goals of teaching activities that need to be adapted according to students' different needs and abilities.

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EFFECT OF BELIEF ADHERENCE AND ARGUMENTATION ON BELIEF FLEXIBILITY DURING CHILDHOOD, ADOLESCENCE AND YOUNG ADULTHOOD

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Abstract

Argumentation is everywhere in social life, in debates, controversies, and daily discussions, and the most persuasive individuals are not the most "logical" but those who best justify their beliefs. Indeed, beliefs often bias reasoning and lead to systematic errors called cognitive biases. We rely on an alternative, more "ecological" model than the classical dual-process (Analytic-Heuristic) model; the argumentative theory, in which reasoning would have a primary function – argumentative – (Mercier & Sperber, 2011) and an important role when an individual must justify their beliefs; it would appear afterwards to justify an intuitive response (Mercier, 2008). We want to observe if participants justify their beliefs preferentially with argumentation based on Heuristic or Analytic reasoning. Moreover, when they fail to justify their beliefs, subjects may change their minds thanks to counterarguments (what we call "belief flexibility"); so, in children, adolescents, and young adults, does the way of justifying one's beliefs impact changing one's mind? 78 children (mean age: 11.3 years), 83 adolescents (mean age: 16.89 years), and 88 young adults (mean age: 24.65 years) participated in this study in which measures of adherence and flexibility were carried out, as well as the analysis of the production of justifications of the subjects' beliefs. This study shows that children justify their responses more with Heuristic reasoning because they rely more on their beliefs to understand the world than adolescents and young adults. Furthermore, the effect of age on flexibility is more significant for subjects with Heuristic justification; adolescents who argue their beliefs with "less logical" Heuristic reasoning would question their opinion more than others, while those who argue Analytically would have a reasoning style more similar to adults. Overall, adolescents revise their beliefs more after exposure to contradictory arguments; they are more likely to change their minds than adults when their reasoning is no longer "strong" enough, whereas young adults are less likely to question their opinions (even if it's not well justified). In other words, adolescents argue as well as adults but are more likely to question their opinion when necessary, while adults are more "rigid". The END Conference will be an opportunity to present this work, discuss these results in light of reasoning and its development models, argumentative theory, and the implications that these results may have in terms of critical thinking education.

Keywords: *Argumentation, reasoning, beliefs, critical thinking.*

1. Introduction and background

Argumentation is everywhere in social life, and it appears that the most persuasive individuals are not those who have the most "logical" reasoning, but those who best justify their beliefs. Argumentation is one of the ways in which someone can be led to spread or revise a belief, because human beings like to be able to find justifications for their beliefs and actions (Mercier, 2021). [In Psychology, a belief does not necessarily refer to religion or spirituality; a belief refers more broadly to information to which one adheres that is not supported by empirical knowledge].

Reasoning is defined in psychology as a mental activity that enables the processing of information in order to produce or evaluate a conclusion, a knowledge, an argument or a proof (Mill, 1843; Rossi & Van der Henst, 2007; Tricard, 2018). Reasoning can be defined as epistemologically "self-constrained thinking", i.e., thinking that aims to reach justifiable conclusions (Moshman, 2004, 2011).

The classic model for representing information processing, reasoning and beliefs is the so-called dual process model (Kahneman & Frederick, 2002; Kahneman, 2011; Evans, 2003), which states that there are two modes of reasoning: analytical and heuristic. A first heuristic system would be cognitively inexpensive, based on the individual's prior emotions and beliefs, sensitive to the context of the situation, its role would be to produce the most appropriate intuitive automatic response as quickly as possible, without seeking coherence and based on simple associations between the elements available to it. A second system, analytical, slower and more resource-intensive, conscious and controlled, based on the use of logical rules, would aim to produce a conclusion that conforms to the normative rules of formal logic, by analyzing the validity of the premises available to the subject.

In this study we also rely on an alternative, more "ecological" model than the dual-process theory; the argumentative theory, in which reasoning would have a primary function - argumentative - (Mercier & Sperber, 2011). Reasoning would thus have an important role when an individual has to justify his beliefs; according to the argumentative theory, it would come after the fact to justify the intuitive response (Mercier, 2008). A Heuristic or Analytic argument used by a subject to justify his belief would account for the quality of the internal reasoning produced to justify his adherence to this belief. Moreover, these argumentative skills (both in the production and evaluation of arguments) are central to the construction of a critical mind, enabling us to distinguish between knowledge (i.e., a verified and true assertion) and a belief, which must be supported by arguments (Petraglia, 1998; Nussbaum, 2008).

Reasoning serves to produce arguments to convince others, but also to convince oneself (Mercier & Sperber, 2011); when they are no longer able to produce sufficient arguments to justify their beliefs, subjects are likely to change their minds (what we call belief flexibility) thanks to exposure to counter-arguments (i.e., arguments contrary to their basic beliefs) (Trouche et al., 2014). According to this model, the more firmly anchored a belief is in a subject, the more capable he or she would be of justifying it with logical arguments; and therefore, the individuals who would adhere most to the belief would give it more analytical justification. However, when heuristics are based on beliefs and knowledge that are too deeply rooted, they are an "impenetrable module" (Fodor, 1983), and cannot be challenged by the Analytical System, so the reasoner persists in his belief, even if it's an error.

Furthermore, if we justify our belief with heuristic argumentation, we would be more easily able to question it and thus change our mind when faced with arguments contrary to our belief, because our arguments are no longer sufficient to justify our beliefs. On the contrary, subjects who justify their beliefs in a more "logical", analytical way would be less likely to question their position and change their mind.

In a developmental perspective, children would use more heuristic (versus analytic) arguments than adolescents to justify their beliefs, and adolescents themselves more than young adults, because young people are more accustomed to having their positions challenged and called into question.

According to Siegler (1991), children from a very early age are constantly revising their beliefs in order to learn about the world around them. We therefore assume that children are more likely than adolescents to change their opinions after being exposed to arguments that don't support their beliefs (and that their beliefs will therefore be more flexible), and adolescents more so than young adults.

2. Objectives

The aim of this study is to observe how children, adolescents and young adults preferentially justify their beliefs (with heuristic or analytic arguments), and whether exposure to counter-arguments has an effect on subjects' propensity to change their opinion about their beliefs (so-called belief flexibility) depending on how they justify them.

3. Methods

This study was approved by the Tours-Poitiers Research Ethics Committee (CER-TP), Tours, France, under number 20201005. The sample of the study was composed of 235 subjects of both sexes divided into three different age groups:

- Group C (Children): composed of 78 schoolchildren aged from 11 y.o to 13 years and 2 months old with an average age of 11 years 3 months old (s.d: 0.621)
- Group Ad (Adolescents): composed of 69 highschool students aged from 15 y.o to 18 years and 7 months old with an average age of 16 years and 9 months old (s.d: 0.926)
- Group YA (Young Adults): composed of 88 subjects aged from 22 y.o to 28 years and 11 months old with an average age of 24 years and 6 months old (s.d: 2.721)

For this study, subjects were asked to respond to a questionnaire consisting of four popular beliefs: "Humans will be able to live on Mars by 2050", "Old people are too old to learn", "At school, some subjects are more important than others" and "You have to work hard to succeed in life". For each

belief, the subject was first asked to rank his or her opinion of the belief on a Lickert scale, from "Strongly disagree" to "Strongly agree": Measure of belief adherence; and then to produce arguments to justify why they thought so. There were then two possible scenarios; if the subject adhered rather positively to the belief (i.e., had ticked "Rather agree", "Agree" or "Strongly agree"), he or she was presented with four arguments opposing the belief, but if the subject rather disagreed with the belief (i.e., had ticked "Strongly disagree", "Disagree" or "Rather disagree"), he or she was presented with four arguments supporting the belief: Exposure to counter-arguments. To ensure that subjects correctly read and understood the arguments of different strengths presented to them, they were asked to rank them from most to least convincing. Finally, a new measure of belief adherence was performed. Belief Flexibility, i.e., the propensity of individuals to revise their beliefs, was defined as the difference between the two measures of adherence, before and after exposure to opposing arguments.

4. Results

First, we sought to observe whether the effect of age on the type of argumentation preferred to justify these beliefs with a generalized linear model. This analysis first revealed a significant effect of Age Group ($\chi2$ = 14.27; ddl = 233; p<0.001) on Preferred Argumentation. To go a step further, we then performed Post-Hoc tests to specifically observe contrasts between the Children-Adolescents and Adolescents-Young Adults age groups. There was a significant difference in the type of Argumentation preferred between the Children and Adolescent groups (Z = -2.817; p < 005; OR = 0.354), but not between Adolescents and Young Adults. Children justify their beliefs significantly more with Heuristic than Analytic arguments than Adolescents and Young Adults.

We performed a factorial ANOVA to observe the effects of Age Group and Preferred Argumentation on Belief Flexibility. This ANOVA revealed effects of each of the observed variables, but no significant interaction between Age Group and Preferred Argumentation on Belief Flexibility. Post-hoc t-tests were then performed to specifically observe comparisons between the Child-Adolescent and Adolescent-Young Adult age groups. This test revealed a significant difference in Belief Flexibility between the Adolescent and Young Adult groups (t = 2.657; p = 008), but not between Children and Adolescents. The results of this analysis are presented in *Table 1*.

Table 1. Summary of post-hoc tests presenting inter-age group comparisons on Belief Flexibility.

Group Comparison	mean diff	standard error	df	t	p
Children - Adolescents	-0.0554	0.34	229	- 0.163	0.871
Adolescents-Young Adults	0.7985	0.3	229	2.657	**0.008****

*** : p<0.01*

We then carried out post-hoc comparisons to specifically observe the differences in Flexibility for each Age Group and each type of Preferred Argumentation (Arg). The results of these comparisons are presented in *Table 2*.

Table 2. Inter-group comparisons, effects of age group and preferred Argumentation type on Belief Flexibility.

Comparison

Age group	Arg		Age group	Arg	mean diff	standard error	df	t	p-value
Children	H	-	Children	A	0,5554	0,509	229	1,092	0,276
		-	Adolescents	H	-2892	0,38	229	-0,761	0,448
		-	Adolescents	A	0,7339	0,414	229	1,775	0,077
	A	-	Adolescents	H	-0,8446	0,539	229	-1,567	0,118
		-	Adolescents	A	0,1784	0,963	229	0,317	0,752
Adolescents	H	-	Adolescents	A	1,0231	0,45	229	2,272	**0,024***
		-	Young Adults	H	1,2821	0,42	229	3,053	**0,003****
		-	Young Adults	A	1,338	0,398	229	3,362	**< 0,001*****
	A	-	Young Adults	H	0,259	0,45	229	0,575	0,566
		-	Young Adults	A	0,315	0,43	229	0,733	465
YA	H	-	Young Adults	A	0,056	0,398	229	0,141	0,888

**** : p<0.001 ; ** : p< .05 ; * : p<0.01*

5. Discussion and conclusions

In the results of this study, we highlighted the effect of Age Group on Argumentation used to justifying beliefs: indeed, subjects in the Children's group justified them more in a Heuristic mode than Adolescents and Young Adults (Z = -2.817; p = 005; OR = 0.354). However, there was no significant difference in the quality of the Argumentation preferred between Adolescents and YAs when it came to explaining the reasons for their beliefs. In other words, Children justify their beliefs more with Heuristic reasoning because they rely more on their beliefs to understand the world than Adolescents and YAs. On the other hand, there was a significant difference in Belief Flexibility between the Adolescent and Young Adult groups (t = 2.657; p = 008), but not between Children and Adolescents. These results show that the youngest individuals (Children and Adolescents) are more likely to question their beliefs and change their minds than Young Adults. We thus observe that Children argue their beliefs differently from Adolescents and YAs, but that Children and Adolescents are different from YAs in terms of Flexibility towards beliefs. More precisely, the effect of age on flexibility is more significant for subjects with Heuristic justification; adolescents who argue their beliefs with "less logical" Heuristic reasoning ("heuristic adolescents") would question their opinion more than others, while those who argue Analytically ("analytic adolescents") would have a reasoning style more similar to adults.

Adolescents would learn to justify their beliefs Analytically as they grow up (i.e., more "logically" than Children), approaching the arguments and reasoning of Young Adults, but those who still use a Heuristic mode are just as likely as Children to revise them. Among Adolescents, therefore, argumentative reasoning profiles really do differ according to whether they manage to operationalize their thinking Analytically or Heuristically. "Heuristic Adolescents" are more like Children than YAs when it comes to argumentation skills, while "Analytical Adolescents" are more like Young Adults.

Overall, adolescents revise their beliefs more after exposure to contradictory arguments; they are more likely to change their minds than adults when their reasoning is no longer "strong" enough, whereas YAs are less likely to question their opinions (even if it's not well justified). In other words, adolescents argue as well as adults but are more likely to question their opinion when necessary, while adults are more "rigid".

The major need to belong to a group encountered during adolescence (Nelson & Guyer, 2011) could explain why "Heuristic Adolescents" change their minds and revise their beliefs when presented with more convincing counter-arguments. The fact that individuals are convinced by counter-arguments because they can no longer justify them with "good enough" arguments confirms the persuasive purpose of reasoning (Mercier, 2008). Argumentation would be produced to justify adherence to a conclusion or belief first formed, and this is even more salient in "Heuristic" Children and Adolescents.

I would like to outline a more practical aim of this work: particularly in the field of teaching and learning about Critical Thinking. It has been shown that Adolescents in particular are more likely to adhere to false beliefs (Wineburg & McGrew, 2016) and seem to have more difficulties in correctly evaluating contradictory information (arguments and counter-arguments) than others. Moreover, they rarely benefit from learning to counter these difficulties and understand that a belief does not become true because it is well argued but because it is supported by empirical evidence. Indeed, it seems that the ability to produce and correctly evaluate the arguments presented to us (and therefore reasoning skills) are at the heart of the development of critical thinking and therefore effective decision-making (Byrnes, 1998; Klaczynski, 2004; Kuhn & Udell, 2003).

Adolescence then seems to be the perfect time to implement specific learning on argumentation and critical thinking, as this is the age when young people are still "flexible" enough to question their beliefs, and at the same time are increasingly capable of developing analytical argumentative skills.

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AN ANALYSIS OF GENERATIVE ARTIFICIAL INTELLIGENCE TOOLS USAGE TO ADAPT AND ENRICH SOFTWARE DEVELOPMENT COURSES

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Abstract

The adoption of generative artificial intelligence (GAI) tools has experienced rapid growth and widespread usage, significantly impacting various industries, including software development. Recently, various AI tools and services, commonly based on large language models, have demonstrated significant potential in automatic code generation, code completion, and test case generation, but also more complex refactoring, reverse engineering, and code comprehension in explaining and reasoning the code. These tools work standalone or as extensions into integrated development environments (IDEs) to assist software developers and elevate programming productivity, thus revolutionizing and streamlining the entire software development process. Teaching and conducting programming and software development courses in higher education have often posed various challenges, especially in an online environment with students with insufficient programming experience. In recent years, various education programs in computing, computer science, software engineering, and software development have faced many challenges and have taken diverse approaches to solve them, particularly related to academic integrity and plagiarism detection. However, the recent wide availability and omnipresence of GAI tools and services that are easily used by students for various tasks in software development in an uncontrolled environment outside of a classroom brought another considerable disruption that needs to be addressed. Our research presents a preliminary analysis of the possibilities of using GAI tools and services in programming and software development courses at the undergraduate level at the university of applied sciences in Croatia. Our goal was to elucidate how these tools could enhance students' learning related to software development and motivate them to acquire better programming skills based on practical assignments from the AI-assisted learning process in an ethical and legal way. At the same time, we aimed to mitigate potential risks associated with academic honesty, specifically related to plagiarism and the unallowed use of code generation. We base our research on using these GAI tools to solve individual programming tasks and software development assignments in undergraduate courses. We analyze the applicability of these tools for various programming tasks students need to perform in a responsible way and compare their performance and the level of help they offer, as well as the correctness and accuracy of results. Finally, we summarize the findings of our preliminary analysis of examined GAI tools and services that could be used in undergraduate programming and software development courses to enrich student comprehension and help educators.

Keywords: Artificial intelligence tools, software development, programming, course, generative artificial intelligence.

1. Introduction

In recent years, we have witnessed the rapid growth and widespread adoption of generative artificial intelligence (GAI) tools and services, significantly impacting and reshaping various industries that use them to generate text and other textual constructs, such as programming code. Moreover, predominantly built on large language models (LLM), various GAI tools and services have demonstrated significant potential in software development and programming, more specifically in tasks such as code completion, automatic code generation, and test case generation, which aim to improve the performance of software developers and the overall speed of programming process. Furthermore, these modern AI tools are also capable of doing more complex and intricate tasks in software development, such as programming code optimization and refactoring, as well as helping software developers in comprehension by explaining and reasoning the code, regardless of it is newly generated code or legacy code. Although sharing many characteristics and functionalities, the most popular AI tools and services used as programming assistants,

such as ChatGPT, Copilot, Tabnine, and CodeWhisperer, also present differences in the way they function, how users interact with them, and how they provide results and solutions. Most currently, many software developers use these AI tools to assist them in daily programming tasks by automatically completing code, suggesting code snippets, and writing whole methods based on the prompts provided.

Within the domain of higher education, namely in software development and programming undergraduate courses, the integration of artificial intelligence technology offers exceptional prospects as well as presents non-negligible obstacles. Educators are facing more complicated situations, especially ina non-controlled online learning environments, where students, particularly those with less programming experience, may start greatly depending on these tools, sometimes without the educator's approval. The widespread accessibility of AI tools also brought new concerns to academic integrity, causing educational institutions to reassess strategies for efficiently dealing with academic dishonesty problems and plagiarism.

This study explores integrating several popular AI tools within undergraduate programming and software development course curricula at our university of applied sciences. The objective of this preliminary research was to examine how these tools can not only improve the learning process by facilitating the acquisition of practical programming abilities but also tackle ethical considerations associated with their utilization. Through an analysis of the implementation of AI tools in educational environments, we aimed to monitor the capacity of these tools to enhance educational achievements while ensuring their usage aligns with principles of academic integrity. In addition, our research explores the practical uses of AI tools in software development course assignments, examining their usefulness in assisting students with programming tasks and measuring the dependability of the solutions they offer. This preliminary analysis aims to provide insights into the utilization of GAI to improve educational practices, primarily in software development courses, which helps students prepare for the changing requirements of the technology industry and develop a solid ethical foundation for their professional growth.

2. Background

Most recently, a number of research papers and studies presented their findings on the usage of AI tools and services for assistance in programming and software development (Barke et al., 2023; Daun & Brings, 2023; Puryea Ben & Sprint Gina, 2022; Vaithilingam et al., 2022). We took a similar approach and explored the usage of the most popular AI programming assistants: ChatGPT, Copilot, Tabnine, and CodeWhisperer. We examined differences in the way students use prompts to interact with them and monitor the perceived usefulness of the solutions to programming assignments they provided. Due to its widespread application in natural language processing, ChatGPT (OpenAI, 2024), based on the GPT (Generative Pre-trained Transformer) model, is best known as conversational AI. Therefore, its aptitude for comprehending and producing text that sounds human is helpful for writing documentation and explaining programming code that calls for natural language communication. An interesting potential for writing programming code as well as debugging has also been showcased by ChatGPT versions 3 and 4. However, ChatGPT's lack of deeper integration with integrated development environments (IDEs) limits its real-time coding assistance capabilities. Copilot (GitHub, 2024), developed in cooperation with GitHub and OpenAI and recently marketed as "the most widely adopted AI developer tool", was built to integrate with contemporary IDEs, such as Visual Studio Code and JetBrains IntelliJ IDEA, and work as a collaborative (pair) programmer trained on an extensive collection of publicly available code, mainly from GitHub. It automatically provides complete lines or even entire blocks of programming code on demand, conforming to the developer's coding style in seamless integration with the development environment, showcasing capacity to make it highly potent for generating high-quality code in real time. Tabnine (Tabnine, 2024) primarily emphasizes automatic code completion by leveraging machine learning models trained on diverse codebases to anticipate and propose subsequent code completions that also dynamically adjust to the developer's coding style. It is also compatible with several IDEs (e.g., VSCode, IntelliJ, PyCharm, WebStorm, Android Studio, Eclipse), allowing it to be used effectively for different programming purposes. Tabnine's model has the capability to function both locally and in the cloud, which, in some instances, can provide a notable advantage in terms of privacy (and performance) since it eliminates the need to send code externally for generating completions. CodeWhisperer (Amazon Web Services, 2024), a product developed by Amazon Web Services (AWS), bears a resemblance to GitHub Copilot but is specifically engineered to seamlessly connect with the AWS ecosystem and provide code suggestions and evaluation services integrated with AWS's range of development tools. It offers code suggestions and critiques by leveraging a range of code samples from AWS code base and user contributions, focusing strongly on adherence to industry standards. Furthermore, it prioritizes best practices and security recommendations, providing code that not only suits the task but also complies with security requirements, a vital aspect for enterprise apps.

Although some AI tools and services can operate independently, their most significant benefits come from their incorporation into IDEs, enabling them to immediately assist and support software developers in their programming tasks, improving programming productivity and revolutionizing the entire software development process. These AI tools aim to enhance efficiency and democratize programming skills by making complex coding approaches more accessible to a wider range of programmers, including those with less experience, such as students. Integrating these AI assistants into the software development process has the ability to transform conceiving, creating, and managing software completely, which may signify a new era in code production and software development in general.

3. Methodology

Since this is the first preliminary analysis of this type that we conducted at our organization, we decided to start with a group of 46 students in two sections in the second year of the undergraduate study program who were motivated to use selected AI tools (ChatGPT, Copilot, Tabnine, and CodeWhisperer) in the course teaching data structures and algorithms. Moreover, we encouraged students to explore the possibilities of these AI tools within the different IDEs they could use within ethical and legal boundaries, primarily within Visual Studio Code and IntelliJ IDEA, although other editors and IDEs were also allowed.

Each week, the students were presented with specific computational problems that could be solved with the assistance of AI tools and services. These problems were directly related to the topic previously covered theoretically and practically, followed by homework assignments that the students had to solve independently. More specifically, the tasks were related to the most commonly used data structures, including various types of linear data structures such as arrays, linked lists (singly, doubly, circular), stacks, queues, and decks, as well as hierarchical (non-linear) data structures such as various types of trees, maps, sets, heaps, and graphs. To solve computational problems, students had to use the data structures for which they had to create appropriate classes and methods, and implement specific algorithms. Most common computational problems introduced the implementation of the popular searching and sorting algorithms as well as recursion, backtracking, greedy, divide-and-conquer, and other techniques, with respect to time and space complexity (Big-O) and performance. Some of the problems involved the implementation of searching algorithms such as linear search, binary search, exponential search, breadth-first search (BFS), depth-first search (DFS), and other search algorithms. The other problems involved the implementation of sorting algorithms such as selection sort, bubble sort, insertion sort, merge sort, quick sort, and other variants. Some algorithms were run on specific data structures, such as Euclid's algorithm, Dijskstra's algorithm, Prim's algorithm, Kruskal's algorithm, and several others. We asked students to track their usage of AI tools in resolving all these computational problems, more precisely, how they used AI tools, how are they satisfied with their results, what challenges they faced, and what concerns they had. To achieve that, we used the anonymous survey that was each week sent to students to be responded to after successful solution submission.

The combination of close-ended questions was prepared based on prior experiences on evaluations of AI programming assistants (Barke et al., 2023; Denny et al., 2023; Moradi Dakhel et al., 2023; Puryea Ben & Sprint Gina, 2022; Vaithilingam et al., 2022). The sets of questions were prepared for the success of usage of AI tools, and challenges and concerns. The initial question (Q1) was related to the usage of offered AI assistants (ChatGPT, Copilot, Tabnine, and CodeWhisperer) throughout the semester. The group of questions (Q2-Q8) was related to students' perceived success in using AI programming assistants for specific tasks: autocompletion of code and recalling the code (Q2), generation of code with simpler programming logic (Q4), generation of repetitive code (Q4), creating code explanations and/or comments in the code (Q5), improving the efficiency and performance of the code (Q6), providing proof-of-concept and skeleton for the solution (Q7), and learning new language constructs or API/libraries (Q8). The final set of questions (Q9-Q15) was related to challenges students faced while using those AI tools and concerns they experienced, including: difficulty writing prompts and expressing requirements (Q9), relying too much on AI tools code generation (Q10), issues with understanding the code and APIs used (Q11), issues with integrating the code in the solution (Q12), concerns about the correctness and accuracy of the code (Q13), concerns about the performance of the code (Q14), and finally, concerns related to academic dishonesty, intellectual property, and plagiarism (Q15). In the next chapter, we discuss the results and our findings.

4. Results and discussion

The first question was related to the AI programming tool students used, and according to their answers, students mostly used (answers "Always" and "Often" combined) ChatGPT (77%) and Copilot (57%), while Tabnine (18%) and CodeWhisperer (12%) were used much less, as presented in Figure 1.

Figure 1. Usage of AI programming assistants (Q1).
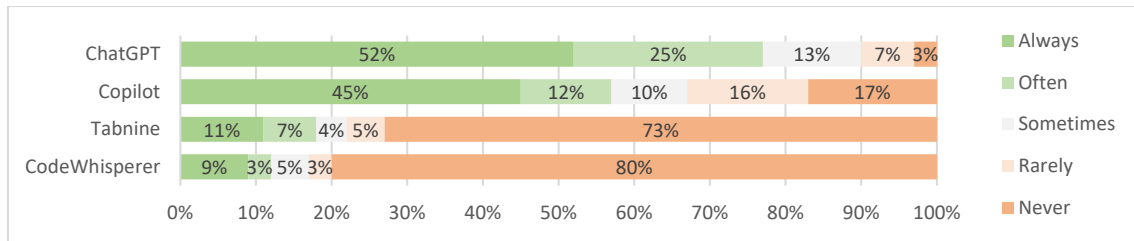
The second group of questions (Q2-Q8) was related to fulfilling students' expectations and success in using AI programming assistants for specific programming tasks and activities. According to the results, students were the most successful (answers "Very good" and "Good" combined) in using AI programming assistants for the following activities:

- Autocompletion and recalling the code (Q2) was most commonly used (85%) to accelerate programming based on the standard API and libraries using IDE's autocompletion feature and recalling code syntax instead of consulting API documentation or online tutorials, or doing online search for code snippet examples (StackOverflow), which is accordance with other studies,
- Generation of code with simpler programming logic (Q3) was the second most used (78%), usually used to deal with external resources (such as reading/writing files or network resources), create independent and often static utility methods, as well as code that supports CRUD operations on typical data structures and commonly used searching and sorting algorithms,
- Generation of repetitive code (Q4) is also widely used (66%), introducing the most common functionalities that are often repeated (also referred to as "boilerplate code,"), although this was a feature already supported in some IDEs even before help from AI assistants,
- Creating code explanations and/or comments in the code (Q5) is also often successfully used (57%), thus providing an additional way of better understanding the code written by AI tools,
- Improving the efficiency and performance of the code (Q6), was used a bit less successfully (53%)
- Providing proof-of-concept and solution skeleton (Q7), was also considered less successful (45%),
- Learning new language constructs or API/libraries (Q8), was, surprisingly, considered the least successful activity (43%).

Figure 2. Perceived success using AI programming assistants for specific programming tasks and activities (Q2-Q8).
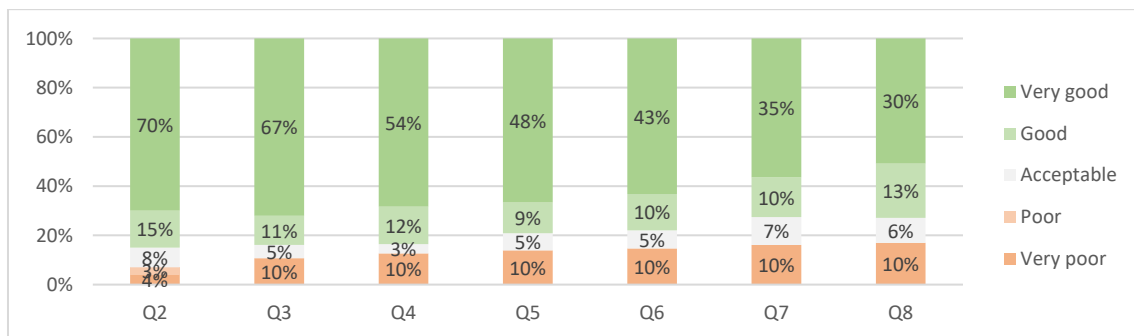
The results of the final set of questions (Q9-Q15) related to challenges students faced when using AI tools and concerns they experienced (Figure 3.), revealed significant issues students are dealing with:

- Difficulty writing prompts and expressing requirements (Q9) is considered problematic (46%),
- Relying too much on AI tools code generation (Q10) without trying to write the code themselves, which is one of the main concerns (75%) once when students got used to it,
- Issues with understanding the code and APIs used (Q11) were less significant (43%)
- Issues with integrating the code in the solution (Q12) were also present (45%)
- Concerns about the correctness and accuracy of the code (Q13) were not very large (37%),
- Concerns about the performance of the code (Q14) were even less expressed (35%)
- Concerns related to academic dishonesty, intellectual property, and plagiarism (Q15) were expressed more (68%), mostly because of a fear of how generated code would be evaluated.

Table 3. Perceived challenges and concerns when using AI tools (Q9-Q15).
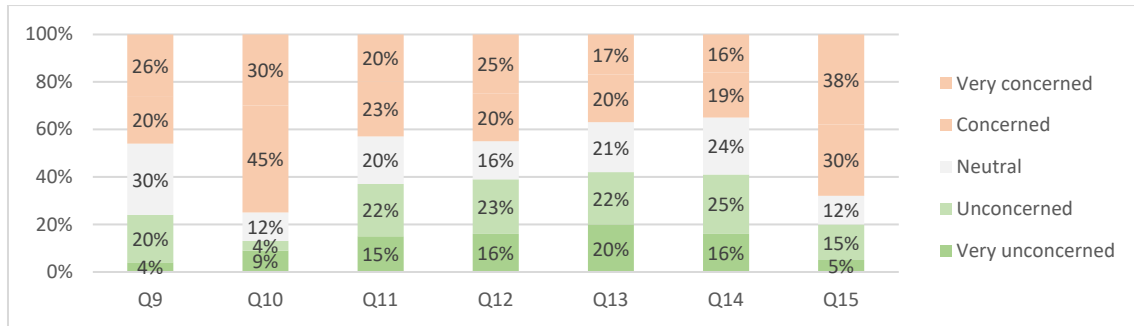
5. Conclusion and future work

In this paper, we explored the practical uses of AI tools in programming and software development undergraduate course assignments, thus examining their usefulness in assisting students with programming tasks. Our preliminary findings provided insights into the utilization of AI programming assistants, primarily ChatGPT and GitHub Copilot, which students mostly used to provide autocompletion and recalling of the code, as well as generation of code with straightforward programming logic and repetitive code. On the contrary, the most significant issues students faced were related to the habit of starting to rely too much on AI tools for code generation. Our findings could be used to improve educational practices in software development courses, thus helping students better prepare for the changing requirements of the technology industry and develop a solid ethical foundation for their professional growth. Since this is preliminary research, we plan to extend it further in the next academic year with more relevant questions, additional AI tools and services for assisting students in programming and software development activities.

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ANALYZING DRUG COMPOSITIONS IN A PROBLEM-BASED LEARNING EXPERIMENT TO STIMULATE UNDERGRADUATE STUDENTS´ AUTONOMY

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Abstract

The oversimplification of higher education experimental practices may provoke a lack of confidence among graduates, who do not feel fully prepared to face the situations that they will find when entering the labour market. Our Educational Innovation Group TR4BIOCHEM (PIE22-067) is interested in the implementation of new Problem-Based Learning-laboratory experiences to bring students closer to real situations that they may encounter in their potential job opportunities in an immediate future. Herein, we present a didactic experience carried out with fourth year-biochemistry undergraduate students, within the subject "Advanced Instrumental Techniques" at the University of Malaga. Students, working in groups of five people, adopted the role of analytical chemistry companies, which had to find a solution for a driving question, set in a letter from a pharmaceutical company, interested in the quantitative analysis of a newly developed drug. In this letter, the problem (the quantitative composition of the drug) was issued and the main required specifications for the analysis (sensitivity, accuracy, price, etc.) established. Groups had to search bibliography in order to select the most suitable analytical technique for the analysis, design and optimization of the experimental protocol, including cost estimation and safety considerations. Following the practical implementation in the laboratory, results were presented in a session that simulated a work meeting where the group members assumed a different role in the company organigram. Students, who perceived having gained skills in designing laboratory experiments, felt strongly involved in this project, considering that this experience could be useful for their future careers.

Keywords: Problem-based learning, biochemistry, analytical chemistry, autonomous work, undergraduate.

1. Introduction

A rapid social transformation has brought to the table the need for a revision of the educational system. Indeed, a clear disconnection between the educational training provided by universities and the demanding skills required by the labour market has been perceived by students, educators and employers. The introduction of degrees in European universities has catalyzed the development of an education system that is increasingly becoming focused on the development of competences. The term competence is complex and implies a combination of skills such as attitude, motivation, knowledge, teamwork, communication, emotional intelligence, among other factors, to achieve an integrated set of knowledge, skills and abilities (Moliner et al., 2019). Competences development requires an active, student-centred learning methodology that limits the role of teachers to that of mere guides in the process (Almulla, 2020). The active participation of learners usually leads to an increased retention of knowledge as well as a greater involvement and motivation in their learning process. Consequently, better academical outcomes are achieved. Many methodologies, such as design-based learning or inquiry-based learning, have been postulated to bring the labour environment closer to students (Kolmos et al., 2021). Problem-based learning (PBL), firstly used in medical sciences education (Barrows and Tamblyn, 1980) is one of the most promising strategies. It focuses the learning process solving a problem in a real-life situation, which facilitates the development of multiple skills required by employers. In addition, it is often implemented

in small groups, which also prepares students for an environment in which they must work in multi-disciplinary groups to solve complex problems (Moliner et al., 2019).

Stemmed from the concern that the laboratory teaching at our university demands a change, our Educational Innovation Group (PIE22-067 TR4BIOCHEM) is interested in the implementation of new inquiry-based laboratory experiences that could make students become protagonists of their own learning process (García Ponce et al., 2019 and 2021; García Caballero et al., 2022). In this chapter we describe a PBL experience within the subject "Advanced Instrumental Techniques", offered to 4th year-biochemistry undergraduate students at the University of Malaga. In this PBL students had to design, analyse and optimise an analytical method to quantify the components of different pharmaceutical preparations as well as present their results to an audience. Encouraging results have been obtained both in terms of students' academic grades and satisfaction.

2. Design

2.1. Context of the study

The target population of this study was fifteen undergraduate students attending the elective course "Advanced Instrumental Techniques" in the final year of the Biochemistry degree at the University of Málaga. These students acknowledged having had a previous poor experience in PBL activities.

2.2. Timeline and data collection tools

The PBL experience was carried out during the first term of the 2023-24 academic year, between mid-October and the end of December 2023 as it is shown in Figure 1.

Figure 1. Timeline, main stages and tasks carried out during the development of the PBL experience at University of Málaga.
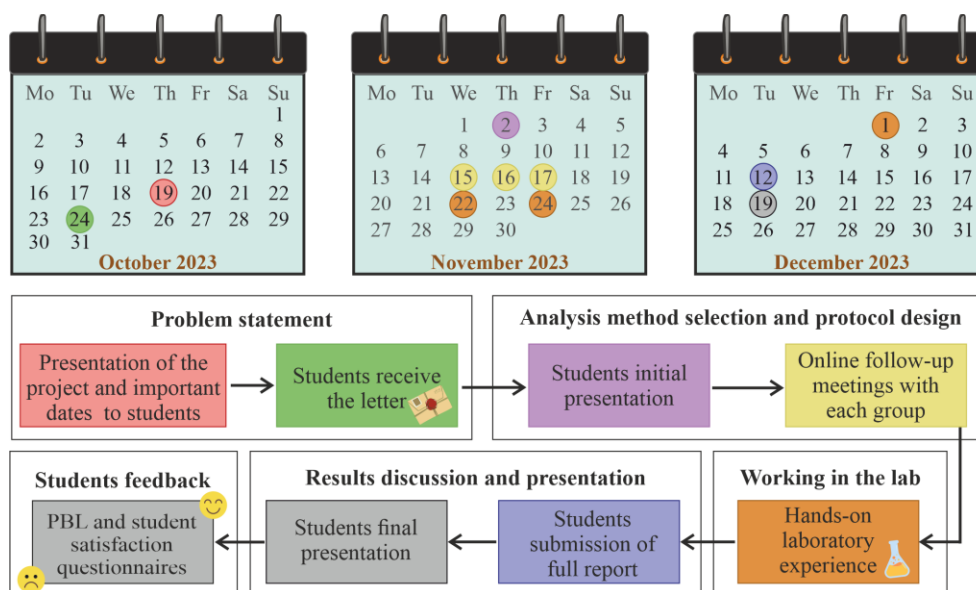
The main steps of the implementation of the PBL strategy are summarized in Figure 1. In the first session, the teachers presented the PBL activity to the students, its stages and chronology. The experience consisted of a role-playing game in which students would work in groups of 5 people. Groups should choose a name and design a logo and an organigram, so that each student should play a different role within the company throughout the whole process. Some days later, they received a letter on behalf of a fictitious pharmaceutical corporation stating the objective "to find a method for the quantitative analysis of two novel pharmaceuticals". In that letter, the main requirements related to the quantitative analytical technique were indicated (fast, economical, reproducible, accurate, sensitive in the ppm concentration range and robust). Then, students carried out a thorough literature review of the different analytical techniques that have been used in similar scenarios to the one requested in the letter. They compared the different analytical techniques, taking into account several parameters such as the method accuracy, robustness, reproducibility and simplicity, the safety considerations, the investment required, or

the adaptability to different types of samples, among others. The following week, groups made a short presentation in which they introduced their company to a putative customer and discussed their findings, proposing a method for the drug quality control. At this point, teachers sent students a list of available materials, reactants and equipment to perform the practical experience in the laboratory, in relation to the analytical method proposed in their presentations.

The next step was to design the experimental protocol, carry out calculations for standards and sample preparation, make a cost estimate and establish the necessary safety considerations. An online meeting between teachers and each group of students was set to clarify any doubts the students might have and to ensure the viability of the students proposed protocols. As a result of this process, each group designed a protocol based in the use of High-Performance Liquid Chromatography (HPLC) coupled with an UV detector to selectively quantify the amount of acetylsalicylic acid (ASA), paracetamol and caffeine present in the different medicines. The protocols proposed by the groups converged in a similar protocol, summarized in Figure 2, which they further and independently performed in the laboratory.

A few weeks later (see Figure 1), the companies submitted a final report in which the summarized the reasons for the selection of a given method, the protocol design and the results they had obtained in the laboratory, calculated from the chromatograms, ending with a final general discussion. All this information was also included in a short presentation to an audience that replicated a work corporate meeting.

Figure 2. Schematic representation of the protocol designed by the students for the quantitative determination of two drug components. As an example, the chromatogram of drug 1 at the wavelength of maximum absorption of each of its components (230 nm for acetylsalicylic acid and 246 nm for paracetamol) is shown.
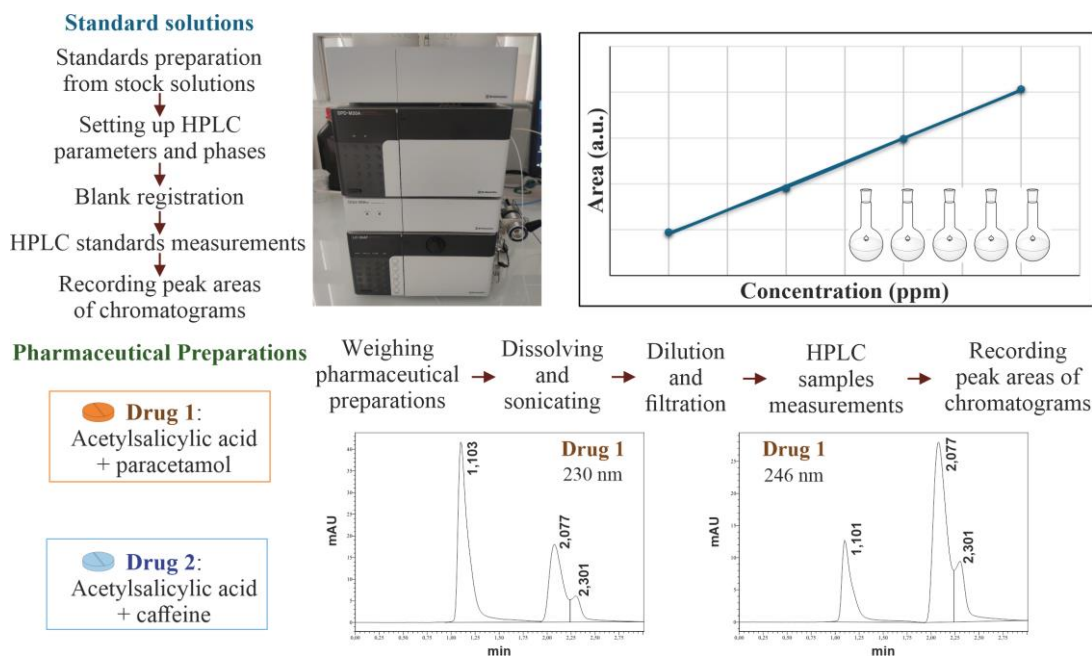
The instruments used to assess the competences acquired by the students were the final report and the initial and the final presentations, all of which were rated using rubrics. Finally, two tests were provided to the students: one to analyse their previous experience and familiarity with PBL and another to evaluate the students' satisfaction with the methodology and the organisation of the exercise in general.

3. Results and discussion

One key parameter to evaluate the impact of this PBL experience was the students' academic grades, since the ultimate objective of any educational experience would be to promote their acquisition of knowledge, skills and competences. This activity aims to develop some practical skills in students who would enter the labour market as biochemistry graduates the following year. It should be mentioned that the mark for this PBL experience was a twenty percent of the final mark for the "Advanced Instrumental Techniques" subject, representing an relevant percentage of the assessment process. The scores obtained in this PBL exercise by the three groups were 9.1, 9.4 and 9.6 out of 10, what implies an average group

score of 9.37 ± 0.25 (mean ± S.D.). These marks are a first indication of the positive impact of this activity on the students learning process.

In any educational project, students' satisfaction is an aspect to be considered. Excessive workloads, as well as the use of teaching methods that students could find boring and/or unremarkable, generally generate feelings of stress, anxiety and apathy, leading to a loss of interest and a disengagement from the subject and its content. Therefore, the analysis of the students' responses to the practice satisfaction test is essential to make improvements and adjustments in future implementations. Students' perception of the teaching methodology used in this PBL experience was evaluated by means of a post-course mixed questionnaire, using some 1 to 5 Likert-type scale questions, complemented with some open-answered questions. Main answers are summarized in Table 1.

Table 1. Student responses to the PBL satisfaction test. Each statement in the test could be rated between 1 (strongly disagree) and 5 (strongly agree).

Statement	Mean	SD
The learning methodology (PBL) used in this activity is innovative with respect to that used in other subjects of the degree	4.33	0.98
I think the dynamics of working in the group has been efficient and satisfactory	3.80	1.08
I did not like working autonomously, without the teacher being directly responsible for my learning	1.93	1.10
Sometimes we have been disoriented about how we should approach the resolution of the problem posed	2.33	1.18
With this methodology (PBL) I felt especially involved in my learning	4.00	1.07
With this methodology (PBL) I did not learn more than through the traditional way of studying	2.20	1.26
I would have preferred to work individually, or at most in pairs, not in a group	2.80	1.42
I think we managed to work well in the group in order to solve the proposed case	3.79	0.97
This working methodology (PBL) did not require more work and preparation on my part than in others of the same or other subjects	3.27	1.44
The solution of the PBL case took me too much time, sometimes incompatible with the workload I had to devote to other subjects and assignments	2.73	1.33
I think that not all members of the group worked with the same intensity and that some took advantage of the effort of others	2.87	1.30
In my opinion, the weight of the PBL activity in the evaluation of the course grade was too low for the time I spent on the task	1.87	1.13
In this PBL I was confronted with situations similar to those I may encounter in my future professional development	3.87	1.36
In this PBL I learned how to plan my own laboratory experiments	3.80	1.37
Global perception of this experience	4.07	0.80

An average global perception rating 4.07 over 5 indicates that the experience was in general terms well received by students. They particularly appreciated the fact that the activity was innovative, effective, satisfying and that they had felt involved and autonomous in their learning process. In addition, students mostly considered useful the experience for having developed some skills that could be useful for their future professional activity. The weight of the activity in the final mark of the subject was considered to be appropriate. Teamwork was an issue on which the students' opinions disagreed. Although most of the students felt that they had managed to work well in a group, the preference for individual work and the feeling of uneven effort among group members emerged from some of their responses. The time that students had invested in this experience, compared to that spent on activities from other subjects was the most criticised question. Indeed, some students found that in some occasions it had been challenging for them to combine it with the workload from other assignments. This question should be considered in possible future implementations.

In the final test, students were also asked about their previous experiences and their perception regarding the PBL educational tool. Around 28% had never heard of PBL and more than 85% expressed they had never used it (Table 2). The experience statements that received the lowest were those related to active learning, autonomous working, and planning and receiving instruction in unconventional formats (Table 2). Students rated the acquisition of integrated knowledge, far from the traditional compartmentalisation of subjects, as the most important issue. In this sense, analytical chemistry, pharmacology and biochemistry concepts are all part of our daily experience.

Table 2. Students' responses in the test on their PBL experience and some perceptions of learning. Each statement in the test could be rated between 1 (low experience or relevance) and 5 (high experience or relevance).

Statement	Experience		Importance	
	Mean	SD	Mean	SD
Solving a problem or question autonomously, without the explicit help of the teacher	3.71	1.27	4.67	0.90
Learning, working in a group, in a collaborative environment	4.07	0.92	4.40	0.91
Being the main protagonist or responsible for my learning	3.57	1.09	3.73	0.96
Receiving a non-conventional lesson in which the teacher acts only as a facilitator of the task	3.79	1.05	3.47	1.19
Using an active learning methodology that could be used for different subjects or disciplines	3.86	0.95	4.67	0.90
Diagnose what I need to know or learn to solve a problem or issue	4.07	1.07	4.60	0.83
Planning my learning process and the actions needed to solve a problem	3.86	1.10	4.73	0.80
Integrating knowledge from different subjects or disciplines	4.14	0.66	4.93	0.26
Making decisions about what to learn and how to learn	4.14	1.10	4.67	0.82
Question	Number of students			
	Yes		No	
Prior to this course, did you know or have you heard of Problem Based Learning (PBL)?	4		10	
Have you ever used this methodology?	12		2	

4. Conclusions

Our research suggests that the PBL approach was well received by the biochemistry undergraduate students, although it required more effort on their part than traditional teaching. Student grades and satisfaction tests support this hypothesis. Students felt involved in the project and acknowledged it as useful as a training for their immediate professional future. Moreover, the multidisciplinary nature of this exercise was in line with the importance attached by the students to the acquisition of a comprehensive knowledge.

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PEDAGOGICAL POWER OF STORY-TELLING IN HIGH EDUCATION TO DEVELOP CRITICAL THINKING

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Abstract

Storytelling is the art of telling stories. It helps to facilitate better communication and connection between humans. In high education this methodological technique helps to keep learners engaged, activate their emotions and make learning more memorable. Besides, stories are easy to remember and facts are to be remembered much better if they are part of the story. Provided that our goal in every communication is to impact the target audience, i.e., change their beliefs, attitudes and behavior, well-structured stories are the most effective vehicle for making impact. From this perspective, using stories as a pedagogical tool in high education provides great opportunities to develop students' critical thinking and reasoning skills which enables them to have better study outcomes. A good story has a transformational effect which helps students to respond positively to teaching. For example, a well-selected and structured case study presented in a narrative format helps students to feel themselves as part of the story and experience characters. Therefore, when students are taught to include the details in their stories that generate additional interest from the audience and provide significant context, they study better and communicate more effectively. Additionally, story-telling works for all types of learners – visual, auditory and kinesthetic. The article will display outcomes of research conducted in high education context in Georgia. More specifically, in teaching areas of business communication, leadership, organizational behavior, academic writing, English language and research methods. The methodological tool of story-telling was employed with the view to facilitate student learning and acquisition, especially, during pandemic times when anxiety and psychological strain were high. Tasks and activities were designed in a way which allowed learners to narrate stories and by doing so get involved in learning. Outcomes demonstrate that students found this method effective for their learning since it helped them to better and accurately remember. In business communication classes it enabled students to influence the target audience - change their current attitudes, behavior and knowledge. Another element of story-telling being a very effective tool for influence is that stories about professional mistakes and what leaders learned from them are a good possibility to learn. In fact, when students identify themselves closely with stories, they imagine how they would have acted in similar cases. Therefore, they are able to have less risk in various situations. What's most important, with a simple personal story they convey values, offer insights and inspire others.

Keywords: *Story-telling, pedagogical tool, transformational, learner, high education.*

1. Introduction

Storytelling is the art of telling stories. It helps to facilitate better communication and connection between humans. In high education this methodological technique helps learners to maintain their attention, make emotions activated and turns the learning experience more memorable and interesting. Besides, stories are easy to remember and facilitate better memorization of facts. Provided that our goal in every communication is to impact the target audience, i.e. change their beliefs, attitudes and behavior, well-structured stories are the most effective means to make impact. From this perspective, using stories as a pedagogical tool in high education provides super opportunities to develop students' critical thinking and reasoning skills which enables them to be more motivated to study, have better study outcomes and focus on their future endeavors.

2. Design

Stories have been a part of society ever since humans started to communicate. They helped people to carefully transfer information and emotion about a concrete topic, piece of news or idea. From the practical point of view, stories help to communicate information so that a clear picture is given from a

specific point of view. Thus, using them as methodological tool across various disciplines in high education creates a wonderful opportunity to have higher quality learning, include all types of learners and enable them to develop a positive and results-oriented mindset.

3. Objectives

The paper will display outcomes of research conducted in high education context in Georgia. More specifically, in teaching areas of business communication, leadership, organizational behavior, academic writing, English language and research methods. The objective is to demonstrate how important story-telling as a methodological too is with the view of enabling students study better, get more confident and create pleasant learning environment around them.

4. Methods

The methodological tool of story-telling was employed with the view to facilitate student learning and acquisition, especially, during pandemic times when anxiety and psychological strain was high. Tasks and activities were designed in a way which allowed learners to narrate stories and by doing so get involved in learning. Outcomes demonstrate that students found this method effective for their learning since it helped them to better and accurately remember. In business communication classes it enabled students to influence the target audience - change their current attitudes, behavior and knowledge. They were given a task or role-play to give stories about professional mistakes and what leaders learned from them. In fact, when students identify themselves closely with stories, they imagine how they would have acted in similar cases. Therefore, they are able to have less risk in various situations. What's most important, with a simple personal story they convey values, offer insights and inspire others. So, using the methodological tool of story-telling provided students with the possibility to openly share their views and by being involved, learn more productively whilst managing their psychological and emotional level.

5. Discussion

In general, story-telling is the basis of why we communicate. It enables us to connect with the audience and pass a piece of information. As such, we all have a story to tell because we have something to inform or persuade. We also have the power to tell the "why" and let individuals realize and understand the point of view. On top of this, story-telling builds trust between you and the target audience and lets you interconnect effectively.

Story-telling is also careful transfer to information and emotion around a specific idea, topic, piece of news or opinion. It helps to paint a very clear picture for the receiver from a specific point of view. Therefore, if properly designed, authentic emotion aroused by it enables to harmonizes the situation between the messenger and the receiver.

Thus, story-telling unites us as humans, evokes empathy, emotion and authenticity, requires a clear idea of audience and purpose, paints different pictures and, therefore, it can be very successfully used pedagogically, especially, in high education, since it involves teaching and research with focus on the study of knowledge. Most importantly, high education gives us the chance to study any subject you are interested in and become highly knowledgeable.

Interestingly, stories give a sequence of events in which protagonists try to resolve a problem. Therefore, we learn from stories. As Bruner (2002) stated, "stories impose structure on our experience and are essential tools of cultural learning and reflection. Stories and their associated narratives provide the means for children to make sense of their world and create their sense of self. Through narrative, we construct, reconstruct, in some ways, reinvent today and tomorrow". (p. 93)

One important aspect of storytelling is that they help people to transmit cultural knowledge and use wisdom of previous ancestors from generation to generation. What's more, in their everyday lives people come across with numerous stories and to some extent they rely on them.

To move to the pedagogical power of storytelling in high education, they help to arouse interest, enable to exchange information and facts in a simple way, provide a structure to memorize information and, what's most significant, create the environment in which students and teachers interact more closely and pleasantly. What adds to this is the fact that material is memorized in an easier and more enjoyable manner since students are involved in the story. Sometimes, it even happens that time flies so quickly at the lesson that students do not even get bored or tired. All-in-all, it promotes engagement of students, enjoyable learning and positivity since students are fully engaged, communicate freely and interact as they wish.

To cite international cases of applying story-telling in teaching and education, Bower and Clark (1969) state that when stories were used, students could memorize words better. Gunter (2011) very interestingly notes that "when students read popular non-fiction books, there was significantly higher student exam performance compared to course sections using a traditional book". David Swanson (2016) used fictional stories which were replete with ethical content to improve students' ethical behavior".

Most importantly, it needs to be stressed that story-telling works as a pedagogical tool since it ensures specificity, concreteness and narrative organization. What should be emphasized here is that memory accepts stories differently compared with various types of information.

According to Simmons, "remembering is not merely a function of having a good or bad memory. Someone with a "bad memory" can still remember a memorable story. We remember things that are woven together with a plot, are meaningful us, have a vivid impact on our mind, or made us feel good or bad. We remember stories that stir our emotions. A good story etches an image into your listener's mind by linking your words together into your listener's mind by linking your words together into a meaningful whole that is vivid and emotionally stimulating. A counterintuitive secret that all good story tellers understand, is that the more specific the story, the more unreal the connectors."*

One more useful and significant focus in terms of using story telling in communicating the science of psychology is made by Ruschar (2014) who emphasized the three-part story-telling approach: memorability, meaningfulness, coherence. Indeed, psychology offers a wide range of practical applications of storytelling. To be more specific, they are useful for sharing information, organizing and making sense of our memory, drawing us close to characters, connecting events with recollections, looking at things form characters' perspectives.

Thus, storytelling brings harmony between the receiver and the story teller, the use of imagination enables him/her to create an opinion on what was told and shared. As such, storytelling unites us as humans, draws on empathy, emotion and authenticity, requires a clear idea of audience and purpose, paints pictures and, most importantly, it can be found in everything.

As for developing critical thinking, which is the ability to evaluate, interpret and analyze facts and information and decide what's fine and what's wrong, make connections between logical ideas to see the bigger picture, story-telling enables to achieve this in the most efficient way provided that our memory accepts stories differently compared with different types of information.

Since critical thinking is analysis of facts, observation, evidence and arguments, to be able to make a judgement on the basis of unbiased and rational evaluation and analysis, story-telling plays a significant role to stimulate imagination, enhance reflection, encourage students to get actively engaged with narratives, characters and plot lines. These elements provide valuable opportunities for the development of critical thinking skills. More specifically stated, story-telling develops students' understanding and appreciation of other cultures, promote positive attitude to people from different cultures, races and religion and, thus, of course, develops their critical thinking and reasoning skills. In other words, by immersing themselves in stories, students are able to explore various perspectives, analyze complex situations, making connections between the story and their own lives.

Importantly, critical thinking skills developed lead to better communication, logical and problem-solving skills, better memory and the ability to evaluate the situation.

6. Conclusions

All-in-all, it should be concluded from the above-mentioned that storytelling indeed facilitates better communication and connection between humans and using it as a methodological and pedagogical tool in high education, enables learners be focused, activate their emotions and make the learning experience more memorable. Besides, it strongly impacts the audience, alters their beliefs, attitudes and behavior. Obviously, well-structured stories are the most effective means for making impact and serve a transformational purpose for students to respond positively to teaching. A well-selected and structured case study presented in a narrative format helps students to feel themselves as part of the story and experience characters. Therefore, when students are taught to include the details in their stories that generate additional interest from the audience and provide significant context, they study better and communicate more effectively. Additionally, story-telling works for all types of learners – visual, auditory and kinesthetic. In fact, when students identify themselves closely with stories, they imagine how they would have acted in similar cases. Therefore, they are able to have less risk in various situations. What's most important, with a simple personal story they convey values, offer insights and inspire others. So, the pedagogical power of storytelling across disciplines in high education is great and it helps us to train and raise more efficient and mindful generations.

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WORKSHOPS

EFFECTS OF CRITICAL THINKING IN LITERATURE EDUCATION

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Abstract

The workshop 'Effects of Critical Thinking' provides insight into the subject-taught concept of critical thinking and the impact and effects of using this tool on the thinking process of students in secondary literature classes. The academic skill of critical thinking can be useful in facilitating students to think more deeply about a literary text and the relationship of literature to its social context. By consciously working from an intuitive response towards a reasoned judgement, students experience how critical thinking can deepen their thinking process. In doing so, students consistently reflect on the various thinking steps and the effects that can occur. Critical thinking is a useful tool within literature classes that can enhance a teacher's ability to bolster students in four domains: knowledge about literary conventions, the application of critical thinking as an academic skill, the understanding of the individual thought process and the development of citizenship. After a brief theoretical introduction, participants are asked to read an excerpt from a literary text related to the social issues artificial intelligence and racism. After participants give a primary reaction, a joint analysis of content, narrative style and social context is used to work towards a reasoned judgment. The output of this reflection is then compared with the results of the similar intervention in upper secondary school student cohorts. The workshop's concluding discussion focuses on teacher expectations and the effects of the students' actual thought processes. The workshop is aimed at both researchers and language teachers with a maximum of 25 participants.

Keywords: Critical thinking, literature, citizenship, secondary education.

1. Introduction

Interpreting a literary text is closely linked to deep thinking. This connection can be represented with a simple sentence: *for sale: baby shoes, never worn* (Wolf, 2018, p. 41). This sentence can be seen as an objective communication, but in the context of literature, where a story is always being told, it is plausible that a reader intuitively asks questions and thus forms his or her own story: why were the shoes never worn, what drama took place? What might have happened? Readers colour the answer to these questions with their own thought, their own story.

Literature can bridge the gap between the behaviour and way of thinking of a fictional character and the student's reflection on it. Such empathy is not only an important literary competence, but also a core value within citizenship education: the student considers the actions of characters, wonders how the character could have come to a particular act and then asks how he himself would react. Nussbaum (2002) calls this way of thinking moral education: fiction allows the reader to identify with the characters, gains insight into the origins and course of emotions and is thus able to experience how a judgement is made. However, the road to reasoned judgement is not without obstacles. Knowledge about the world reaches the student from two perspectives: the intuitive system and the conscious, rational system. The first system is constantly operational and leads to spontaneous, automatic findings. It is a basic system and provides raw information about, for example, danger and flight behaviour. The second system works slowly and needs to be consciously activated. It needs attention and effort and cannot be used over a long period of time (Kahneman, 2011).

The aim of the study is to construct an educational model of critical thinking that could support students in interpreting literature. After reading the text, the student intuitively formulates an initial reaction and could achieve a conscious and reasoned judgment through an analysis of story, narrative mode, and social context. It is assumed that the student could transfer this way of thinking to opinion formation on social issues.

2. Design

The entire study is conducted according to the methodology of Educational Design Research. This type of research is particularly useful in the development of critical thinking skills, as the iterative form is based on the consistent application of the sequence of analysis, design, and evaluation (McKenney, Reeves & Nieveen, 2014). Based on scientific insights, the design of a lesson is constructed and evaluated and refined after the subsequent interventions. The study consists of four stages that are described in detail in separate chapters: theory and background, a model for critical thinking in literature teaching, critical thinking in the classroom and, finally, critical thinking and the learner.

3. Objectives

The design of the overall study is the construction of an educational model of conscious critical thinking (CCT-model), which allows the teacher to achieve three goals:
   a) the students gain insight into the process of conscious critical thinking at a cognitive and metacognitive level through which they first acquire knowledge about the thought process as an instrument, then learn the skills to be able to use this knowledge and finally develop the attitude to actually use critical thinking.
   b) the students gain insight into the literary techniques and the formal and referential meaning of literature at a cognitive and metacognitive level.
   c) the critical thinking used in the study of literary texts is transferable to situations where citizenship skills are called upon. The students can take a reasoned position in the social debate, considering different views and arguments.

4. Methods

The subject didactic model critical thinking is constructed based on four interventions. The first intervention focuses on formulating the primary response: what is the common thread in the students' reactions while reading the literary text?

The second intervention aims to test the complete model, from primary reaction to reasoned judgement: is it sufficiently clear to the students what to do and does it provide sufficient information for the teacher?

The aim of the third intervention is to examine emphatically and accurately how a student thinks while reading, analysing, interpreting and evaluating literature.

In the fourth and final intervention, the model is used by Dutch teachers from different schools that differ in terms of school organisation, geographical location, and pupil numbers. This intervention is monitored and analysed within a development team, in which the participating teachers, together with the researcher, explore in depth the possibilities and returns of the CCT model. Ultimately, the research yields an evidence-based educational model that teachers can use in a practical and efficient way in their literature lessons.

5. Discussion

Within the current study, two interventions were completed, and it was concluded that some adjustments were necessary. Firstly, the student's thinking process is enhanced when it is explicitly connected to students' competence. At the same time, the student should be challenged by the text to think at an abstract level. Also, a certain autonomy should be offered in the choice of literary texts (Van Tuijl & Van Gijsel, 2015) and sufficient time should be allowed for proper reading. Other concerns arising from the intervention were a sharp distinction in the analysis of content and narrative style, and a conscious reflection on the thought process that proceeds from primary judgment to reasoned judgment. Finally, it was found that linking fiction to issues such as gender, racism and artificial intelligence strongly supported students in increasing their understanding of literary text and a balanced and open-minded thinking about social issues. In general terms, it can be added that a teaching sequence on critical thinking is best introduced with a separate lesson on how conscious critical thinking works in relation to the intuitive and rational thinking system. In addition, it is very useful to use a second, introductory lesson for an open discussion on the value of literature and literature education.

6. Conclusions

Based on extensive literature research, a model of conscious critical thinking was established, in which students work from their primary reaction to a reasoned judgment through the analysis of story, narrative and context. This theoretical model was then tested in an initial intervention, in which it became clear that students' primary reaction to a literary text is primarily to the content and characters. This finding was discussed at the 2023 END Conference. The second intervention shows that the model encourages students to reflect deeply on a literary text, but that the teacher should explicitly consider students' motivation and competence and consciously highlight the links between the components of the analysis. The teacher's expectations do not always appear to correspond with the reality in the literature lesson. In preparation for a third intervention, several readjustments were made, to create enough room to go deep into students' thinking about literature.

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