

EDUCATION AND NEW DEVELOPMENTS

2024 Volume 2

Edited by
Mafalda Carmo



Education and New Developments

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

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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 2 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 second volume focuses on the main areas of PROJECTS AND TRENDS and ORGANIZATIONAL ISSUES, being the contributions of the other two areas published in Volume 1.

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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WORKSHOP

Organizational Issues

Free tools for using data to tell a story

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Ricardo Covarrubias Carreño, Karla Andrew, Geoff Boise, & Bryan Preston

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ORAL PRESENTATIONS



THE VALUES AND LEGAL ISSUES OF AUTHENTIC DATA SOURCES IN COMPUTER EDUCATION AND RESEARCH

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Abstract

Data management, especially text management is a dubious issue in computing education (CE). Some claim that it is only digital literacy. Others, on the contrary, emphasize that text management is part of CE. Our research reveals that not data management, but the approaches meant to handle the subject are responsible for its displacement, where the issue of meaningless formatting and tools are in the focus. To handle data management with standard software tools, we must give up the widely accepted decontextualized approaches, instead, authentic digital sources must be introduced in classes. To teach and research text management, find and reveal errors, and guide student show to avoid them, readymade but editable documents must be collected with real content. The internet, without question, is the largest source of authentic documents, and teachers must give students access to these documents for analysis, treatment and/or interpretation. However, teaching effective, efficient, and sustainable text management with authentic sources, legal issues arise (e.g., copyright, protection of personal data, freedom of expression). For this reason, documents from various internet sources must be considered as lawfully accessible (three-step test, art. 5 (5) InfoSoc Directive). The present paper details the purpose of using authentic data in teaching data management, analysing various documents closely connected to the subject, and provides examples where law allows, while others block their use.

Keywords: *Authentic document, lawful access, legal issues, copyright, text management.*

1. Introduction

For teachers and researchers, it is imperative that information is transferred to the future generation. The present paper describes the background of an educational pull production system (Csernoch, 2017; Sebestyén et al., 2022) that is not only effective by considering all aspects of TPACK (Technological Pedagogical Content Knowledge) (Angeli & Valanides, 2015) but efficient by eliminating end-user generated soft-waste (Csernoch et al., 2022, 2023; Nagy & Csernoch, 2023). The method uses the technique of collecting existing (authentic) data and learning through data analysis and errors, not only of our own but of others as well (McLaren et al., 2012; Metcalfe, 2016; Tulis et al., 2016). Documents are countless and accessible through the internet, and we are convinced that this accessibility can and should be used in education. However, teachers and researchers must know how to select and use the available sources in both classroom and dissemination.

In our paper, we present that data and erroneous documents can be used in education and even in a very productive and important way. The question remains whether teaching (including scientific publication) through available data, including erroneous documents that are accessible online legally authorized to be analyzed, corrected etc. in a classroom or not. The aim of the present paper is to answer this question, which might seem easy at first, but in reality, it is not evident.

2. Sources of authentic documents

The internet, without question, is the largest source of authentic documents, and teachers must give students access to these documents for analysis, treatment and/or interpretation. The question is how the use of these sources is regulated. According to the Universal Declaration of Human Rights (UDHR, 1948) articles 26 §1 “Everyone has the right to education. (...)” and 27 §1 “Everyone has the right freely in the cultural life of the community, to enjoy the arts and share in scientific advancement and its benefits”. Also Protocol no 1 art. 2 of the European Convention on Human Rights (ECHR Prot. No 1, 1952) art. 2 §1 “No person shall be denied the right to education. (...)”. Education, however, needs to follow the development of science and technology. Content that is freely available online should be covered by lawful access (art. 3, Rosati 2021, pp. 27-28 and 45-46).

3. Findings: Handling data – Analysis, interpretation, treatment

3.1. Transparency: Revealing errors

Considering word processors, we must admit that MS Word supports error-recognition the best with the Buttons Show/Hide and View Gridlines (Barnhill, 2017; Curts, 2017) (Figures 1–3). When these buttons are turned on, the non-printing characters, picture anchors, table borders, etc. become visible, they can be revealed in just one look. However, it is not widely accepted to share these findings. Unlike in industry, these errors remain hidden, even if they are recognized. In our time, it is a shame to reveal and share errors.

However, whether the non-printable characters are displayed on the screen or not, end-users’ lack of knowledge, their ignorance and overconfidence (Kruger & Dunning, 1999; Staub & Kaynak, 2014; Gibbs et al., 2017) do not allow automated transparency tools to function properly. This entails that we need further tools to call attention to errors in digital texts and to their consequences, especially the soft-waste generated by negligent text management. Other tools of transparency, designed to reveal errors in digital texts, are ERM (Error Recognition Model) (Sebestyén et al., 2022) which includes the collection, presentation, analyses, correction, and proper formatting of word-processed documents (Csernoch, 2017), ANLITA (Nagy & Csernoch, 2023), and the entropy and sustainability rate of digital texts (Csernoch et al., 2022, 2023).

Figure 1. An erroneous Europass CV whose author claims that she has “excellent command of MS Office tools”. The document itself proves that it is not so.

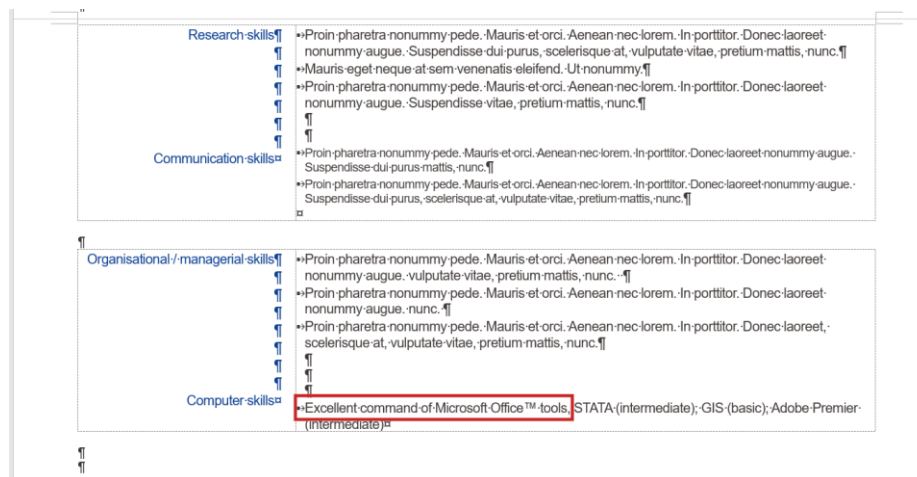
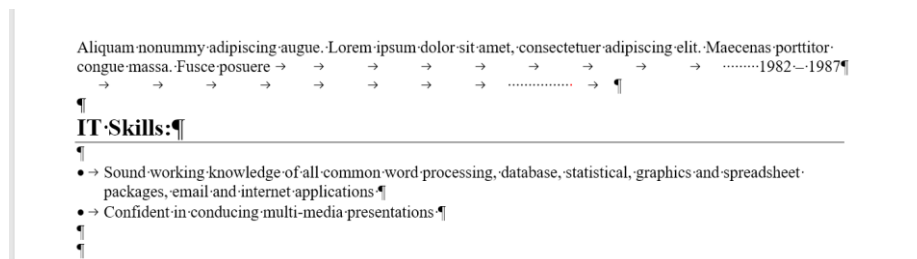


Figure 2. An erroneous individual CV whose author claims that he has “Sound working knowledge of all common word processing...”. The document itself proves that it is not so.



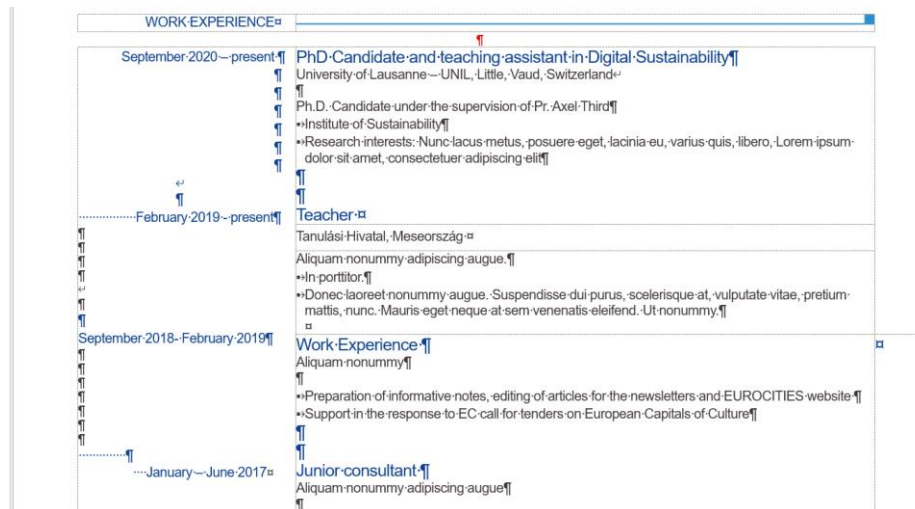
3.2. Digital resource vs. data – Europass CV

For the present paper to call attention to errors in word-processed document, one of the publicly available Europass CV templates are analysed (Bille & Kobosil, 2013) (Figure 3). The legal issues of using these documents are discussed in Section 4.

Templates, including CV templates by default can be considered digital resources, according to the DigCompEdu definition (Redecker, 2017), because officially they are immediately understandable to a human user. Considering the Europass CV Word templates (Bille & Kobosil, 2013) and the CVs created from these templates, it is obvious that the templates carry various errors and users make even more (e.g., Figure 1). Consequently, CV templates cannot be considered digital resources, since thorough analyses are required to reveal their true nature, which again proves the contradiction of the definition of the DigCompEdu (Redecker, 2017).

The Europass CV template carries various errors which should not reach the wide public in this form. One of the main errors is the structure of the template where the text is broken into several small tables open to change the sizes of the tables arbitrary. The original intention of breaking the text into small tables might be to indicate that complete tables should be copied to add entries. However, this message does not reach ignorant end-users.

Figure 3. The work experience section of a Europass CV where instead of copying small tables, the endless use of Enter (Paragraph Mark) and Space characters makes an erroneous and fragile document.



The negligent handling of pictures is another problem of the CV template. The formatting of the pictures is incorrect since their Wrap Text setting is Square instead of In line with text. This erroneous formatting leads to the arbitrary move of the pictures in the document. Several further errors are embedded in the CV template, including incorrect and contradictory font and paragraph formatting, styles, cell margins, etc., misplaced Paragraph Mark and Space characters, and attempts for their compensation.

4. Findings: Legal issues

4.1. Scientific research and freedom of expression

Art. 27 of the UDHR (1948) in §1-2 declares “Every-one has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.”

Scientific progress is important, and as shown above is a fundamental right. It is also necessary to note that scientific research itself is protected by the fundamental right of expression (ECourtHR, 2022b). The article specifies “Everyone has the right to freedom of expression. This right shall include freedom to hold opinions and to receive and impart information and ideas without interference by public authority and regardless of frontiers. (...)” (art. 10 ECHR, 1950). Moreover, the International Covenant on Civil and Political Rights (ICCPR, 1976) recognize the “freedom of expression” as a right that can be exercised “either orally, in writing or in print, in the form of art, or through any other media of [the individual’s] choice” (art. 19, para 2 ICCPR, 1976). However, when exercising one’s freedom of expression potential violation of other fundamental rights need to be avoided.

4.2. Protection of property

The freedom of expression has been demonstrated in the previous section, however, §2 of article 27 of the UDHR declares that “Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary, or artistic production of which he is the author” (UDHR, 1948).

Consequently, documents available online and so accessible to the public (Section 1.1) and protected by copyright (Bosher & Rosati, 2023) (Levola Hengelo BV v Smilde Foods BV (C-310/17, 13.11.2018)) are considered as (intellectual) property. Article 1 of Proto-col No 1 of the ECHR (ECHR Prot. No 1, 1952) provides a protection of property “Every natural or legal person is entitled to the peaceful enjoyment of his possessions. (...)”. (ECourtHR, 2022a) (Alleaume, 2009). Considering all these concerns, the question arises whether analysing documents in the classroom and publishing document sections in scientific papers create a violation of art. 1 of Protocol No 1 and other copyright rules (Bern Convention, 1979; Directive 2001/29/EC, 1997; Directive 2019/790, 2019) or not.

Eventual copyright violations must be clarified. The directive 2001/29/EC (1997) provides an exhaustive enumeration of exceptions and limitations to the reproduction right and the right of communication to the public in article 5 §3 letter A: “member States may provide for exceptions or limitations to the rights provided for in Articles 2 and 3 in the following cases: (a) use for the sole purpose of illustration for teaching or scientific research, as long as the source, including the author's name, is indicated, unless this turns out to be impossible and to the extent justified by the non-commercial purpose to be achieved;”.

Through the three-step test incorporated in article 9 §2 of the Bern Convention (1979), when in presence of limitation and exception it must be proven that (●) it is not overly broad, (●) does not rob right holders of a real or potential source of income that is substantive, and (●) does not do disproportional harm to the right holders (Sobrino-García, 2020).

In the present case, all the criteria are met listed above. Documents to demonstrate the numerous errors are presented objectively and accordingly to rules of computational sciences (Csernoch, 2017; Nagy & Csernoch, 2023), grammar, typology, etc. The content of the document needs to be part of the exercise so that students can better understand, relate to the topics presented, and carry out debugging. Important to add, that the teachers should keep in mind for this reason the age and interests of the group they teach.

It is imperative that error-recognition in teaching text management, described in the present article, is integrated into education systems. Through this, a public interest arises which could potentially harm right holders. With this method, documents are analysed in classroom and results are published in scientific papers, the presentation of these texts must follow a proportional, “fair balanced” way (ECourtHR, 2022a). This requirement is fulfilled since the presentation limits to an objective demonstration of formatting and formatting related errors.

5. Conclusions

The present paper discusses how automation can be introduced in teaching text management and how digital resources can be used in this process.

A further concern of the paper is the legal issues of using digital sources available on the internet and in closed communities for classroom use and scientific purposes for the wider public. We found crucial that authentic sources must be presented in both cases to make content credible, interpretable, and correctable, and to avoid the errors of mass production systems that focus on both hardware and software tools. It is revealed that until the presented data pass the three-step test incorporated in article 9 §2 of the Bern Convention we can use them for educational and research purposes, without further restrictions on them. However, we must avoid the dissemination of personal data even if it is shared on the internet by the author of the original document. In this case, the data must be modified before handed over to students and/or colleagues.

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PERSPECTIVES OF LEARNERS IN MAKING SCHOOLS MORE INCLUSIVE SPACES

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Abstract

Inclusive education has gained prominence as an essential educational approach throughout the world. In South African, inclusive policies recommend the active participation of learners in the education process to develop and extend their potential as equal members of society. This study explores the perceptions of learners regarding inclusive education and its potential to improve teaching practices. This participatory action research study using transformative learning theory as a lens will employ photo voices and narratives. The participants were 25 full-service school learners in Gauteng and North West provinces of South Africa. Thematic data analysis was used to analyse the data. The study findings revealed that learners do not have a voice in the implementation of inclusive policies; only teachers are privileged to influence inclusive teaching, while learners are only expected to be recipients. Although the study has found that learners are disadvantaged in contributing to inclusive practices, it recommends an integrated approach among teachers, learners, and education policy developers to ensure that learners' voices are heard in schools to improve inclusive teaching practices.

Keywords: *Inclusive education, learners voice, full-service school, photo voice, inclusive teaching.*

1. Introduction and background

Inclusive education evolved as a social issue that promotes human rights while challenging any exclusionary policies and practices. The benefit of inclusive education is understanding collective stories that include teachers and learners as a way of upholding a democratic state where all learners pursue their learning potential to the fullest (South African Constitution, Act 108, 1996). Hernández-Torrano, Somerton, and Helmer (2020) argue that asking adults about the views of learners is no substitute for their input. Therefore, as learners are beneficiaries of inclusive teaching approaches (Crawford & Tindal, 2006) in this study, we wanted to hear their perspectives to allow them an opportunity to add their views to enhance inclusive education implementation. This is affirmed by the Global Education Monitoring Report (2020), which states that learners must be at the centre of what the education system and schools do by considering their views, experiences, and opinions (Mabasa, 2021).

Prominent in the literature on inclusive education is a focus on the role of teachers, teacher training, and other aspects (Engelbrecht, 2020) while the quality and relevance of inclusive education can be better enhanced by including learner perspectives on its implementation. To fulfil this mandate, a screening, identification, assessment and support (SIAS) policy requires that learners be involved in the decision-making on how this support is carried out (DBE, 2014). Although policies such as Education White Paper 6 [EWP6] highlight that inclusive education is based on social justice for all learners (DBE, 2001) but learners' voices are still missing, though it is a catalyst for the promotion of inclusive education (Messiou, 2019).

The voices of the learners include their thoughts, emotions, views, and actions to bring about change (Mangiaracina, Kafallinou, Kyriazopoulou, & Watkins, 2021). Even in full-service schools, the preference is for placing learners with learning barriers in separate special classrooms (Engelbrecht, 2020) thus reinforcing the idea that inclusive education is a renamed special education (Engelbrecht, 2019). Against this background, Messiou (2019) asserts that if learners' voices remain marginalised, it impedes the quality necessary for the relevance of the education provided to each learner because their ideas are critical to the formation of school practices. He further suggests a critical role of collaboratively participatory approaches in the field of inclusive education as they allow co-researchers time to have detailed discussions about learning and teaching, thus opening opportunities for the empowerment of all participants who are part of the research. Mangiaracina et al. (2021) assert that the perceptions learners

have of themselves and of their learning are crucial to inform teaching and learning practices. Therefore, Ainscow and Messiou (2017) developed an inclusive inquiry that involves talking about diversity, learning from experience, developing inclusive practices, and engaging learners' views. Research indicates that learners' views make a difference in responding to learner diversity (Messiou, 2019) and in addressing behaviours such as bullying (Siperstein, et al., 2022), thus inventing new possibilities to introduce learner involvement in school improvement. Therefore, we are determined to find out how learners' perceptions can be helpful in facilitating inclusive practices.

2. Methodology

Participatory Action Learning and Action Research (PALAR) is one of the participation action types of research, that was used in the project. The PALAR approach allows all participants to take ownership of the solution to the problem affecting their community as they engage in a cyclical process of learning through action, discussion, and reflection to achieve a mutual goal (Wood, 2019). Purposive sampling allowed 25 learners who are experiencing barriers to learning and now part of the full-service school to be co-researchers (Creswell, 2014). The learners were recruited by an independent person to avoid power relationship issues and were allowed to indicate their interest in the study, their parents signed consent forms on their behalf (Wood, 2022). Photo voice, as a visual research method that allows participants to take photographs and make powerful statements about the issue while making their voices heard, was used to generate data (Evans-Agnew, & Strack, 2022; Wood, 2019). All co-researchers in three action learning sets, with two having eight members, while in the other learning set, nine co-researchers were given a prompt to take photos and write narratives that depict their perceptions on how full-service schools can be made more inclusive. Thereafter a discussion of why a particular object was chosen and how it relates to the research problem was followed to enrich data from individual photo voice. Data were thematically analysed using the six steps of Braun and Clark (2014). Ethical approval for the project was granted with the number (NWU - 00413 - 23 - A2), and the adherence to justice, beneficence, and respect for the people.

3. Theoretical framework

In this study, the integration of transformative learning theory forms a solid foundation for understanding and fostering inclusive education. Transformative learning theory, as proposed by Fleming (2022), underscores the active contribution of learners in their own learning processes, emphasizing the need for effective changes in individuals' frames of reference. This theory challenges the common tendency among teachers to dismiss ideas that do not align with preconceived notions, advocating for an inclusive educational space where learners' perspectives are valued (Messiou, 2019).

Uddin (2019) further contributes to the discourse by emphasizing the importance of allowing learners to have a voice in their education. According to Uddin, teachers play a crucial role in making inclusive education meaningful by showing an interest in meaningful learning experiences and employing suitable strategies that encourage learner participation. Uddin's perspective aligns with transformative learning theory, emphasizing the active role of learners in shaping their educational experiences.

The synthesis of transformative learning theory is particularly powerful in the context of inclusive education because it emphasizes the need to challenge existing norms and systems of oppression and promote equity. Therefore, the application of transformative learning theory underscores the importance of creating an open and inclusive educational space that not only acknowledges diverse ideas but actively seeks to break away from traditional tendencies that may hinder inclusive practices.

This theory suggests that to make inclusive education meaningful from the perspectives of learners, teachers must embrace transformative practices. This approach encourages teachers to recognize the value of diverse ideas, actively involve learners in decision-making processes, and implement strategies that foster meaningful learning experiences. In addition, it emphasizes the potential for transformative change and collective action between teachers and learners to create more inclusive educational spaces (Uddin, 2019).

4. Data presentation and discussion

In this section even though we had 25 participants working in three action learning sets, this study presents only a few responses representing each action learning set due to the restricted number of pages expected for the article. Based on different photo voice and narrational given by learner participants during data generation, learners feel excluded as they are not given the opportunity to voice their views and opinions regarding the implementation of inclusive policies in full-service schools that are supposed to be inclusive spaces. The themes emerged are presented below.

Theme 1: Learners experiencing learning barriers have no voice in inclusive policies.

Figure 1. Photo voice 1.



This picture reminds me of how I saw my education when I was referred to a full-service school. I hoped to get support that would make my future blossom like this plant. The surroundings around the plant represent challenges like getting support depending on what teachers see necessary, and no one bothers to find out in what ways can I be supported. Life in a township is also a challenge, as it is influenced by many things that lead many of us to drop out of school [Participant 1].

Figure 2. Photo voice 2.



I took this picture to show my sense of belonging when I joined a full-service school. Being in the company of other learners who are determined to get an education despite the obstacles caused by barriers they face gave me hope to achieve the education that I long for. The only thing that is a challenge is that there is a big gap between us and teachers; as learners we do not have input on what support should be provided to us as part of full-service teaching practices [Participant 4].

The above extracts indicate that learners have no contribution to how inclusive policies are implemented, and that becomes another barrier to their learning. This finding confirms Messiou (2019) and Uddin (2019) when they assert that inclusion can only manifest when the voices of learners are also heard as necessary to achieve quality education and other school practices. It also magnifies what Engelbrecht (2019) and Mabasa (2021) state where full-service schools are said to reinforce marginalization of learners experiencing barriers to learning as their views are not considered to be central in their learning.

Theme 2: Teachers are privileged to influence inclusive teaching, while learners are only expected to be recipients.

Figure 3. Photo voice 3.



I took this picture to show the loneliness I experience in all lessons in class. Even though I am in school, when teachers teach, I feel lost, like this girl because even though I know how I learn best, no one bothers to find out what I prefer. I feel like we are just treated as recipients of what teachers think will work for us. Sometimes even when I want to share my opinions, I get scared that when I see some teachers, I will look like I am undermining their professionalism [Participant 20].

Figure 4. Photo voice 4.



This picture shows the helplessness and low self-esteem that come with being excluded from the teaching practices that are supposed to accommodate my learning needs. The bag is ruined representing the discouragements I experienced in the mainstream school, as I was criticized by other teachers and other learners. Although there is support that I get in a Full-Service School that brings back long lost hope, I feel excluded when it comes to the support that is supposed to be provided to me [Participant 14].

In the above extracts, it is evident that even though learners saw a future when they were referred to a full-service school, the dominant voice of influence is that of the teachers, while learners are just recipients of what teachers thought best for the learners. This contradicts Uddin's (2019) point of view, which highlights that although teachers are expected to play a crucial role in employing suitable strategies, it does not overrule the importance of collective union between teachers and learners to create more inclusive educational spaces (Uddin, 2019).

5. Recommendations

The support services led by the school-based support team and district-based support team need to incorporate what inclusive policies recommend which is to ensure that learners who are receiving support should have a voice in whatever support that is prepared for them. This is necessary to ensure that inclusive teaching practices are collaborative, as learners guide support providers about their learning styles, preferences, and other aspects that may help ensure that the support given addresses the barriers experienced. On the other hand, teachers in Full-service schools should know how they can engage learners as equal members in support provision.

6. Conclusion

Learners feel that even though they are in full-service school there is no hope in their education, as there is still a gap between what teachers do and what learners would like to be done when it comes to the support they receive. Moreover, they feel excluded in the full-service schools as was the case when they were in mainstream schools. They do not see any implementation of inclusive policies where they are supposed to also have a voice. This implies that even though being referred to a full-service school brought some hope to these learners, thinking that they will get prepared for their future careers, the barrier at hand now is teacher domination that does not allow them space to contribute to such inclusive practices.

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EVALUATING THE IMPACT OF PROJECT-BASED LEARNING ON THE DEVELOPMENT OF DIGITAL COMPETENCES AMONG HIGH SCHOOL STUDENTS

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Abstract

The explored component of this paper investigates the impact of Project-Based Learning (PBL) on the development of digital competencies in 118 students from American College of Sofia (ACS). The research methodology employed includes an investigation based on an online Digital Skills Accelerator (DSA) self-assessment tool for digital skills aligned with the DigComp 2.2 Framework. DSA is a result of collaborative effort involving five organizations from Poland, Belgium, Spain, the UK, and Ireland. Digital competence encompasses a range of abilities, including information and data literacy, communication and collaboration, digital content creation, and safety – all essential for a workforce that must operate effectively in a knowledge-driven society. Therefore, when considering strategies to foster these competences, it is equally essential to develop specific methods and tools for precisely assessing particular aspects of digital competence. The study is divided into two research stages: (i) gathering data on students' performance and progress in relation to the targeted digital competences, and (ii) analyzing the collected data to ascertain whether there is evidence of improvement in these before-mentioned skills. The results suggest that PBL can effectively assist students in enhancing their digital competencies by employing technology for the acquisition, organization, storage, presentation, and communication of information. It is worth noting that assessing digital competences using existing evaluation tools, which establish the initial scales for their measurement, remains a significant challenge for the author. It means that curricula are tailored to develop digital competencies in each of the areas separately, but there is a noticeable gap in students' preparedness to effectively assess their level of each skill proficiency through interdisciplinary projects.

Keywords: *Project-Based learning, digital competencies, digital literacy, DigComp 2.2 framework, digital skills accelerator.*

1. Introduction

The introduction of digital technologies has brought about significant changes in our daily lives and made their use an inevitable process. Consequently, the notion of “digital competence” is being rapidly established as a key skill set. The conventional framework, historically focused on literacy and numeracy, which serves as a benchmark for educational institutions in preparing young people to cope with the demands of the modern labour market, needs a complete redefinition to capture the complexity of the digital age (Heilmann, 2020). Towards the close of 2006, prompted by the Recommendation of the European Parliament and the Council of the European Union on key competences, the European Union officially acknowledged digital competence as one of the eight key competences for lifelong learning (European Council, 2018, p.10). Digital literacy, a concept of recent emergence, has carved its niche within a domain that previously encompassed related concepts such as ICT, media literacy, information literacy, and computer literacy. Various definitions exist for the terms “digital competence” and “digital literacy”. Some authors treat them as interchangeable (Krumsvik, 2008), but Hatlevik and Christophersen (2013) posit distinctions. Whereas “digital literacy” focuses on proficiency with software and hardware, “digital competence” is a broader concept that outlines the skills, reasoning, and critical commentary students should employ. The Council of the European Union’s 2018 Recommendation on key competences for lifelong learning is adopted as the definition of digital competence: *digital competence includes confident, critical and responsible use of digital technologies and engagement with them for learning, work and participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital wellbeing and cyber security competences), intellectual property issues, problem solving and critical thinking* (European

Council, 2018). There are different frameworks for defining digital competence, but each is designed for use in a certain country. To be objective, the analysis is based on the most popular international framework, known as DigComp 2.2, first published in 2013 and revised several times since then.

2. Materials and methods

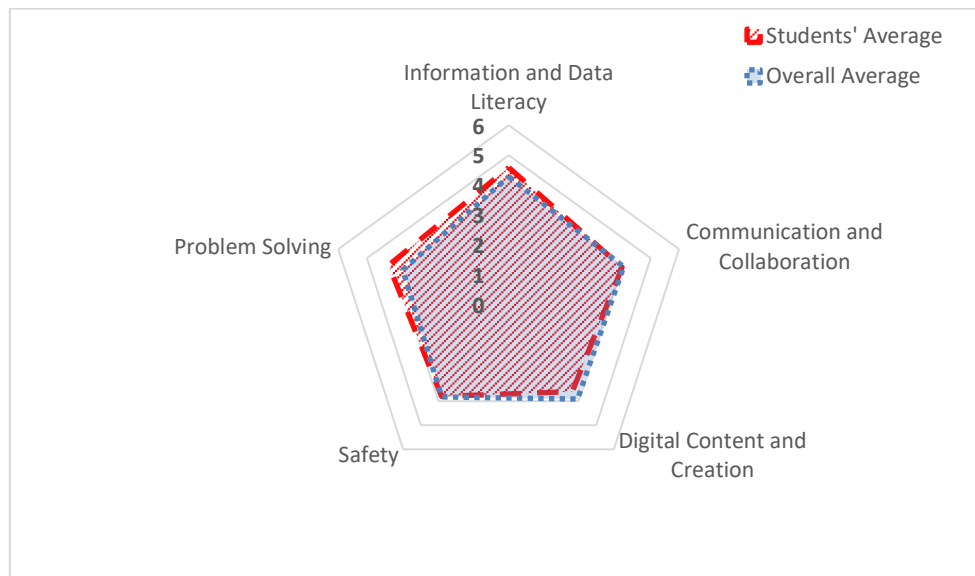
Project-based learning is based on the idea that students who learn by solving real-world challenges will be able to make connections between new concepts and apply their knowledge to real-life problems (Reyes & Orongan, 2023). Engaging in authentic scenarios assists students in grasping the significance of safety across diverse situations. This approach emphasizes active learning, problem solving and collaboration. Developing these competencies not only leads to a more profound understanding of the subject, but also to an increased awareness of responsibility towards the learning process. (Barron & Darling-Hammond, 2008). Furthermore, PBL often involves the use of digital tools for research, data analysis, and presentation. This exposure to technology enhances students' digital literacy, a crucial component of “information and data literacy” (Ertmer & Ottenbreit-Leftwich, 2010). Digital competencies extend beyond mere operational skills and knowledge of how to utilize specific technology or information (Coker, 2020), but creation of videos, websites, presentations, and multimedia materials enhances students' digital content creation skills. They also encompass the capacity to employ digital tools critically and effectively (Shopova, 2014). If students lack the essential digital competencies required to critically use the correct information, they may find the project development process challenging and need to dedicate more time to mastering digital technologies to attain satisfactory outcomes (Scheel et al, 2022). An online DSA self-assessment tool in line with the DigComp Framework, developed by five organizations from Poland, Belgium, Spain, UK and Ireland was used to investigate the influence of Project Based Learning in developing 118 students' digital competencies at American College of Sofia. The evaluation tool was utilized because: i). its creation was in line with the guidelines of the prominent EU research project, DIGCOMP. The initiative stems from the European Parliament's recognition of digital competence as one of the eight essential competences for lifelong learning; ii). the tool is intuitive, easy to navigate, and accessible to a diverse audience. iii). it is adaptable to different skill levels and backgrounds. It is suitable for users with varying degrees of digital proficiency; iiiii). DSA provides clear and actionable feedback to users. It covers 21 competences grouped into five areas (Table 1). The questionnaire consists of 21 questions (one per skill) which includes six proficiency levels (from 1=basic to 6=advanced). In a few seconds after finishing the self-assessment each survey participant received their digital “radar chart” providing with an overview of personal strengths and weaknesses.

Table 1. The DigComp conceptual reference model (Vuorikari et al, 2022).

Competence Areas	Competence
Information and Data Literacy	1.1 Browsing, searching and filtering data, information and digital content
	1.2 Evaluating data, information and digital content
	1.3 Managing data, information and digital content
Communication and collaboration	2.1 Interacting through digital technologies
	2.2 Sharing through digital technologies
	2.3 Engaging in citizenship through digital technologies
	2.4 Collaborating through digital technologies
	2.5 Netiquette
Digital content creation	3.1 Developing digital content
	3.2 Integrating and re-elaborating digital content
	3.3 Copyright and licences
	3.4 Programming
Safety	4.1 Protecting devices
	4.2 Protecting personal data and privacy
	4.3 Protecting health and well-being
	4.4 Protecting the environment
Problem solving	5.1 Solving technical problems
	5.2 Identifying needs and technological responses
	5.3 Creatively using digital technologies
	5.4 Identifying digital competence gaps

3. Results

Figure 1. Comparison of students' results across the five competence areas with the overall average.



Preparing students for self-evaluation of digital competencies involves a combination of targeted instruction, practical experiences, and the development of metacognitive skills. Upon initial observation, the author noted the amount of time it took students to finalize the questionnaire and submit the survey results to Google Classroom. Remarkably, all participants successfully completed these tasks within 18 minutes, whereas the developers of the online tool used had indicated an expected time of approximately 30 minutes to answer all questions. This fact caused concerns that students may not have developed the skills necessary to self-assess their competence accurately. Assessing one's own abilities can be challenging, especially if they lack experience or a clear understanding of what proficiency in a specific digital competence entail. ACS faculty engaged in PBL seamlessly integrate digital skills across subjects, incorporating projects, case studies, and data analysis that necessitate the use of digital tools and technologies. Although students are familiar with a range of learning resources including online tutorials, interactive simulations, and multimedia materials, it is evident that the use of digital tools by themselves does not lead to a detailed understanding of the core of digital skills and their indispensable role in their future growth. Another potential explanation for these results could be that students have been exposed to a limited set of digital tools and applications, which restricts their broad perspective and therefore their ability to comprehensively assess their competence. The researcher chose to conduct individual interviews with each participant before summarizing the results of the study. It was revealed that approximately 79% of the participants lacked clarity about the distractor that closely matched their level of proficiency. It is important to note that this challenge did not stem from the language barrier, but rather from students' lack of clarity in terms of determining their level of digital expertise. Even with established benchmarks or reference points, they encountered difficulties in accurately self-assessing their own proficiency. The remaining approximately 21% of the sample considered themselves to be at the advanced level and accordingly their average results are between 5.3-6.0. Since the students had to upload their "radar chart" at Google Classroom and it was not anonymous, it is too likely 25 students may fear that acknowledging their skill gaps could expose them to criticism or judgment, which can discourage honest self-assessment. Competence is a subjective concept and can vary from person to person. What one person considers proficient, another might view as beginner-level. This subjectivity makes self-assessment more challenging. The evaluation of digital skills has proven to be a real challenge, and existing systems have failed to initiate effective and systematic processes (Cukurova et al., 2017). However, all respondents were unanimous in their conviction that PBL has a key role in establishing digital competencies, presenting compelling arguments to support their position. This implies increased student awareness not only in terms of recognizing definitions, but also in their ability to distinguish between digital competencies and literacy. As an outcome, it is evident (figure 1) that the average results for the sample group closely align with the overall average results (the overall average results are retrieved from the Digital Skills Accelerator website). While it is anticipated that with the growing size of the sample, results should approach points of stability, it is somewhat surprising to observe how quickly this stabilization occurs within a relatively small sample.

Future research directions encompass two key areas: i). exploring points of stability within samples of different social origins and/or levels of education. ii). investigating whether the ongoing efforts to enhance digital competences within society will expand these boundaries, i.e., if the surface area on the charts will grow.

4. Conclusion

The proliferation of various digital competence frameworks, models, and strategies has led to a significant shift in their focus. Rather than primarily addressing the measurement and operational interpretations of digital competence, attention has turned towards the definition and indicators related to this concept. Surprisingly, despite numerous theoretical analyses, there is a noticeable absence of practical tools that schools can use for self-assessing digital competence, which could provide essential guidelines for potential development (Sillat et al., 2021). It's important to highlight that assessing digital competencies using existing evaluation tools, which establish the initial criteria for measurement, remains a substantial challenge for the author. Research studies have consistently shown the positive impact of constructivist pedagogy on the development of digital competences (Romero-García et. al, 2020). Research made by Dolezal et al., (2022). highlights that the significance of the student-centered approach in fostering digital competence is undeniable. The role of project-based learning in developing digital competence is indisputable because when working on a project, students must employ critical thinking, creativity, and analysis, and after selecting the appropriate resource, adapting it to their needs and applying it, achieve a specific outcome (Atanasova & Minkova, 2023). Additionally, they gain experience in applying these skills to solve authentic problems, which is a valuable aspect of their digital competence development. Students in active learning environments often develop a sense of ownership and agency over their education, which further motivates them to explore and utilize digital resources for their projects. In conclusion, it can be said that the integration of PBL in high school has shown a noticeable positive impact on the development of students' digital competencies. However, it should be noted that ascertaining the extent of this impact on each of the study participants is difficult, and for some of them, the acquisition of these skills is probably not completely conscious. More serious attention should be paid to establish clear criteria and rubrics for different levels of competence in digital skills, so students have a reference point for self-assessment.

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MATH'S AND SPECIAL TEACHER COLLABORATION TO IMPROVE STUDENTS' MATH SKILLS USING THE SMART BALANCE BOARD

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Abstract

In recent years, there has been a significant decline in the results of diagnostic mathematics tests and exams in Latvia, which the authors attribute to a decline in pupils' attention span and critical thinking skills, especially after the COVID-19 pandemic. Many studies worldwide show the positive effects of motor coordination and balance on learning achievement, including in mathematics. The authors of this article aim to investigate how the Smart Balance Board, which provides movement coordination and balance engagement, affects mathematics achievement in ages 9-10. The authors suggest that collaboration between a mathematics teacher and a special educator can be a successful tool for the development of students' mathematical skills by designing integrated tasks according to students' age. The first results of a study in Latvia and South Africa confirm the authors' hypothesis that students aged 9-10 years, after pedagogical intervention with the Smart Balance Board, show higher levels of concentration and multiplication on repeated tests. The methodology used in the study was- the multiplication test, Wechsler's attention subtest - Encryption. Pedagogical intervention - balance board with integrated multiplication tasks.

Keywords: *Mathematic skills, attention, motor coordination, balance, learning success.*

1. Introduction

As central exam statistics show, in recent years, there has been a significant decline in the results of diagnostic mathematics tests and exams in Latvia (VISC, 2022).

Based on professional observation in daily schoolwork with children and based on literature, the authors of this study attribute the decline in mathematical skills to a weakening of attention, working memory and critical thinking. The biggest problem, because people's attention becomes shorter, is switching attention from one digital application to another at one time. That makes people's attention and perception shorter. (Mark, 2023). As it is possible to read articles, attention and working memory are important to calculate, read and understand the topic, as well as to memorize the topic (Swanson, 2011).

In the article discussion, it is possible to verify that many studies worldwide show the positive effects of motor coordination and balance on attention, working memory, and learning achievement, including in mathematics.

Mathematical skills include verbal components, such as knowledge of numbers, counting, calculating and reasoning and non-verbal components, such as mathematical notation, reasoning in time and space and performing calculations (Spielberger, C., 2004).

In the study that was held in South Africa (Durban) and Latvia the clinical psychologist and special teacher measured multiplication skills and attention before and after pedagogical intervention with Barboleta Smart Balance Boards. The Balance Board is wooden, and the pupil can stand on and do motor coordination and balance movements, at the time doing cognitive exercise. The Smart Board is connected with an app, where teachers create educational exercises. In the study case, the Math teacher created multiplication questions for children from 9-10. During the study, children had pedagogical intervention with those tasks, and they trained in multiplication skills on Barboleta Smart Balance Board. This Study shows the effect of cooperation between special pedagogical and mathematics teachers. Special educator/clinical psychologist knows the importance of movement in the learning process and in math the teacher is aware of the need to multiply skills.

2. Design, objectives and methods

The article presents a quantitative design study to find real and useful solutions and effective tools to address contemporary students' learning difficulties, such as attention, motivation, engagement, and declining math and reading achievement.

Baiba Blomniece-Jurāne has developed a Barboleta Smart Balance Board based on scientific findings on the impact of movement coordination and balance on learning achievements. The Smart Balance Boards are integrated with app and learning tasks. The study plan is that pupils aged 9-10 in both South Africa and Latvia complete control tests in multiplication and attention. After a five-day intervention from 2-5 minutes for each child, the multiplication and attention achievements of these pupils are measured again. It is important to mention that in South Africa the intervention was held after a one-, two- or three-day break (Table 1).

In South Africa, the measurements are made on 2023 October. In Latvia, measurements will be done in January. Therefore, the comparison and full discussion of the study will be done in February. Till January the article will show results from South Africa.

The methodology used in the study was - the multiplication test, Wechsler's attention subtest - Encryption. Pedagogical intervention - balance board with integrated multiplication tasks. To compare results, the authors will use mathematical statistics.

3. Results

The results in South Africa study show that 50% of children improved their skills less than 20% and 50% of children improved more than 20%.

Table 1. Pedagogical intervention -Kloof Senior Primary School.

Date	11.10.	12.10.	13.10.			16.10.			19.10.	20.10.	20.10.
Activity	Test, Balance	Training 5 min	Training 5 min	Free day	Free day	Training 3 min	Free day	Free day	Training 3 min	Training 2 min	Test

Table 2. The results of Multiplication in South Africa – Kloof Primary School.

Students	Points. 1st	%	Points. 2nd	%	%
SA13	5	33,33333	4	26,66667	-6,66667
SA08	3	20	2	13,33333	-6,66667
SA01	4	26,66667	4	26,66667	0
SA10	1	6,66667	1	6,66667	0
SA02	1	6,66667	2	13,33333	6,66667
SA03	1	6,66667	2	13,33333	6,66667
SA07	2	13,33333	4	26,66667	13,33333
SA04	6	40	9	60	20
SA05	1	6,66667	4	26,66667	20
SA14	1	6,66667	4	26,66667	20
SA09	3	20	7	46,66667	26,66667
SA11	4	26,66667	8	53,33333	26,66667
SA06	1	6,66667	6	40	33,33333
SA12	4	26,66667	12	80	53,33333
SA15	6	40	15	100	60

It is necessary to collect the results of attention tests. The full version of the paper also requires measurements and an intervention in Latvia, a description of the results of the mindfulness tests will be produced in February.

4. Discussion

To analyse the results, it is important to base the discussion on the literature. In 2018 review “Physical Activity and Cognitive Functioning of Children: A Systematic Review” was published and it summarizes the results of different studies on physical activity and cognitive skills. According to the review, the ability to focus attention is improved among children who participate in physical activities, children aged 13–14 years positively affect their ability to focus attention on a given task (Bidzan-Bluma, & Lipowska, 2018) – not in the reference list. Sterr in the article “Attention performance in young adults with learning disabilities” stresses out that attention is essential for cognitive performance, memory, and learning behaviour so that even slight deficiencies in attention can impair learning (Sterr, 2004). These findings are important as we know the connection between attention and performance in mathematical skills, as we mentioned before.

Kashfi, Sohrabi, Kakhki, Mashhadi and Nooghabi, (2019) showed that coordinative exercises versus nonspecific physical education lessons had more effect on the performance of concentration and attention tasks. The type of motor coordination exercises is also important. For example, bilateral movement activities can help develop motor control and coordination. If a child does not master bilateral movements, his or her learning and cognitive development can be negatively affected due to the lack of neural stimulation that promotes brain organization. Cross-lateral movement activities include the movement of the opposite hand and foot simultaneously, also activating complex integrated movement between the two sides of the brain. We have to line that Barboleta Smart Balance Boards are created in a way that children can do bilateral movement, control body balance and motor coordination.

In the 2018 study “The Mediating Role of Cognitive Ability on the Relationship between Motor Proficiency and Early Academic Achievement in Children” was carried out and in conclusions, authors highlight that their study confirms the idea that a child’s motor skills are among the necessary abilities for academic achievement and must receive complete attention from educators and teachers during the early school years. By influencing positively cognitive functions such as working memory and reasoning processes, motor proficiency contributed to math and reading performance. Sufficient effort must be made to support children in their motor development in first grade but also before their formal school entry. For instance, children who are less prepared or who have motor difficulties in kindergarten must be supported to develop their motor proficiency in order to be prepared for the first-grade transition (Cadoret et.al., 2018).

Created tool in the cooperation between special educator/psychologist and math teacher is an option to use effective and innovative pedagogical intervention which is based on movement and motor coordination.

5. Conclusion

Results show that children improved their multiplication skills. It is necessary to finish the study and complete the conclusion. This study has an important role in finding if teachers can find a tool to help children reach higher learning results in math. As we have noticed till now, the results from South Africa let us think that it could be possible. It is necessary to continue with more studies.

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PROVIDING EXPERIENTIAL LEARNING OPPORTUNITIES IN MECHATRONICS: TELEOPERATED ROBOTIC WORKCELL RESEARCH AND DEVELOPMENT

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Abstract

The emerging technology field of Mechatronics focuses on developing and implementing advanced automation for industrial applications. Thus, Mechatronics encompasses advanced fields, including robotics, Artificial Intelligence (AI), and cybersecurity. Though the demand for Mechatronics expertise is growing, available experiential workforce development opportunities in Mechatronics are limited. This project will research and develop educational materials and tools and provide project participants with experiential opportunities through an online Mechatronics Education Portal (MEP), experiential Mechatronics Practice (MP) initiatives, and a Mechatronics Industry Pathways Rotation. The MEP and MP modules are focused on the five Mechatronics pillars of Robotics, Mechanics, Electronics/Controls, Cybersecurity, and Artificial Intelligence. This project leverages partnerships among Michigan Technological University, West Shore Community College, Gogebic Community College, three nonprofit organizations, and nine regional industry collaborators. The main project objectives are to improve interdisciplinary Mechatronics training through experiential learning opportunities; develop a flexible and comprehensive program to promote a diverse and inclusive STEM workforce; and facilitate sustainable collaboration amongst project partners centered on Mechatronic workforce preparation and placement. As part of the project research and development of the Mechatronics Educational Portal, the Teleoperated Robotics Workcell (TRW) allowing for remote robot manipulation and programming is being developed. The TRW consists of a Fanuc collaborative robot, three cameras for real-time feedback to the user and a computer server to host the developed software. The interface for the client will consist of the virtual teach pendant with an overlaid display screen of the real teach pendant and two display windows showing the robot from different angles transmitted by the cameras installed in the physical robotic workcell. The TRW will enable remote access to the robot by users from anywhere in the world via the internet in a safe environment. In this paper, the authors provide details of the research and development stages of the TRW.

Keywords: *Robotic, mechatronics, Fanuc, STEM, workforce.*

1. Project goal and objectives

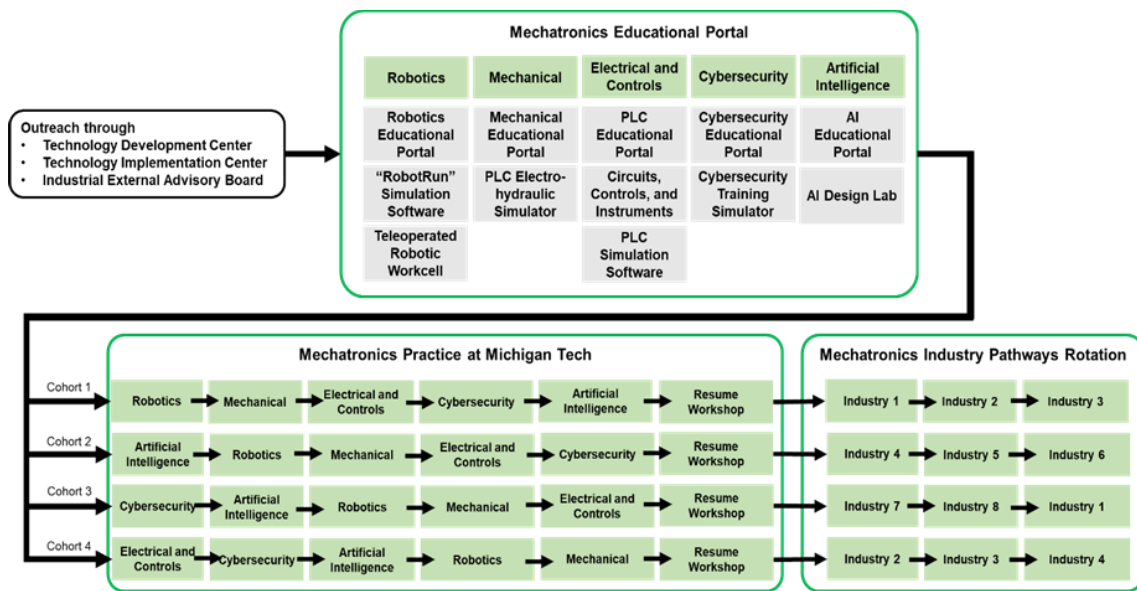
This project, sponsored by ExLENT NSF program, aims to provide experiential learning opportunities in Mechatronics to promote a diverse STEM workforce in emerging technology fields, including robotics, mechatronics, and advanced manufacturing. The project is aligned with the regional economy in the Upper Peninsula and Northern Michigan; resources will be broadly applicable and disseminated widely. In pursuit of this goal, project objectives are to:

- Promote a diverse and inclusive STEM workforce through flexible and accessible training programs;
- Improve existing mechatronics education and training by cohesively teaching advanced emerging technology fields in an interdisciplinary fashion for foundational and applied Mechatronics;
- Develop a pipeline centered around mechatronics workforce preparation and placement through a sustainable partnership amongst industry, community colleges, and four-year universities;
- Provide experiential learning opportunities in Mechatronics through state-of-the-art training facilities;
- Demonstrate a career-oriented outlook in Mechatronics through real-world experiences in advanced industry facilities.

2. Experiential learning opportunities

This project seeks to address the educational needs in Mechatronics through experiential learning opportunities. Focused on the Beginnings Track, this project will develop a STEM pipeline between 2-year and 4-year institutions while engaging industry partners to offer experiential opportunities in Mechatronics. Students will participate in online Mechatronics modules through this pipeline to build foundational knowledge in Mechatronics-related STEM topics. Students will then experience Mechatronics labs at Michigan Tech to engage in experiential learning. Participants will end their enrollment in the program through rotational site visits at advanced industrial in the region to provide an industry-oriented outlook for Mechatronics. The following figure depicts the structure of the proposed project plan. Outreach and recruitment will be conducted to ensure the participation of diverse and inclusive cohorts within the ExLENT program.

Figure 1. Experiential Learning Process Flow.



2.1. Mechatronics educational portal

Based on the solid foundation of an already established robotics and controls curriculum at Michigan Tech (Sergeyev et al., 2015), the authors intend to develop and launch a standalone Mechatronics Educational Portal (MEP). The proposed MEP will be freely available to individuals possessing some existing STEM competencies, including stackable certificates in STEM or those enrolled in associate's degree programs. The MEP will stand on the five pillars of a mechatronics foundation: robotics, mechanical, controls, cybersecurity, and artificial intelligence. Each pillar will include theoretical modules on the subject matter and relevant simulation and/or virtual training tools to enable laboratory exercises.

The Robotics Educational portal (REP) will be comprised of the "RobotRun" robotic simulation software (Hooker et al., 2017), robotic tutorials, and online lectures developed via this project. The robotic tutorials will be established with the assumption that the user has limited initial robotics knowledge. Online lectures will complement the tutorials, and industry-like scenarios will be incorporated into the "RobotRun" software (Sergeyev, Alarajie & Kuhl, 2018). The portal will include self-assessment tools. The Teleoperated Robotic Workcell (TRW) will enable remote training on industrial robots by providing the remote access to the robot by users from anywhere in the world via the internet in a safe environment.

The Mechanical portion of this program will include both theoretical and hands-on effort. The theoretical effort will be comprised of the Mechanical Educational Portal (MechEP) and Electrohydraulic System Simulator carried out through a virtual environment. The hands-on effort will be comprised of basic hand calculations, laboratory demonstrations, and experiments at Michigan Tech.

Programmable Logic Controllers Educational Portal (PLCEP) is comprised of a set of open-source and online learning modules designed to give students interactive, hands-on experience with programming PLCs on a standard desktop or laptop computer. The learning modules will include multimedia materials that introduce the content. Utilizing the Advanced Circuit Controls and Instrumentation (ACCI) module, the individuals will be trained in designing, analyzing, and enhancing advanced circuits and control systems are in high demand in the industry. The main mechatronics objectives are the interdisciplinary skills to

manipulate a complex control system and measure variables with instruments. A combination of worksheets, presentations, simulation manuals, and hands-on projects will be developed as open-access learning modules. PLC Simulation Software (Sergeyev, Alaraje, Kuhl, Kalenauskas & Li, 2014) is the integral part of the PLCEP and provides the users with the opportunity to simulate advanced mechatronics systems commonly present in today's manufacturing processes.

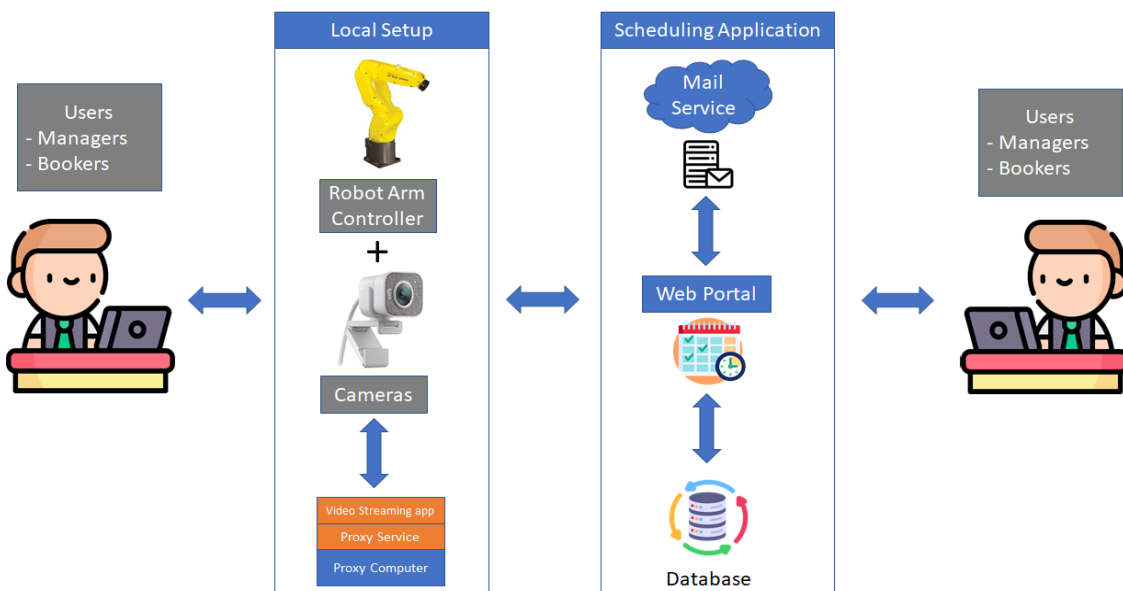
Cyberattacks are becoming more common, sophisticated, and damaging as Mechatronics technologies become more interconnected. A pressing issue is a need for a well-trained and well-prepared cybersecurity workforce. Developed via this project, a Cybersecurity Educational Portal (CEP) will provide hierarchical knowledge of cybersecurity threats to Industrial Control Systems (ICS) and the security controls to mitigate those threats. A Cybersecurity Training Simulator (CTS) will be developed as an online lab platform to provide students with simulated demonstrations and practice in best practices for cybersecurity. Both the CEP and CTS will be tailored to participants without a deep background in cybersecurity or ICS.

AI is an essential tool for modern industrial processes including electrical, mechanical, computer, robotic, control engineering, and cybersecurity areas. While Industry 4.0 brings new technologies, the industry faces challenges of a shortfall of skilled workers in AI, particularly to service advanced Mechatronics technologies. An AI Educational Portal (AIEP) and AI Design Lab (AIDL) three-module approach is proposed to address this issue. The modules are: fundamental concepts; software implementation with Python programming; and advanced applications such as production analytics and vision-based robotics. The modules include tutorials, recorded online lectures, and virtual practice implementation.

3. Teleoperated robotic workcell

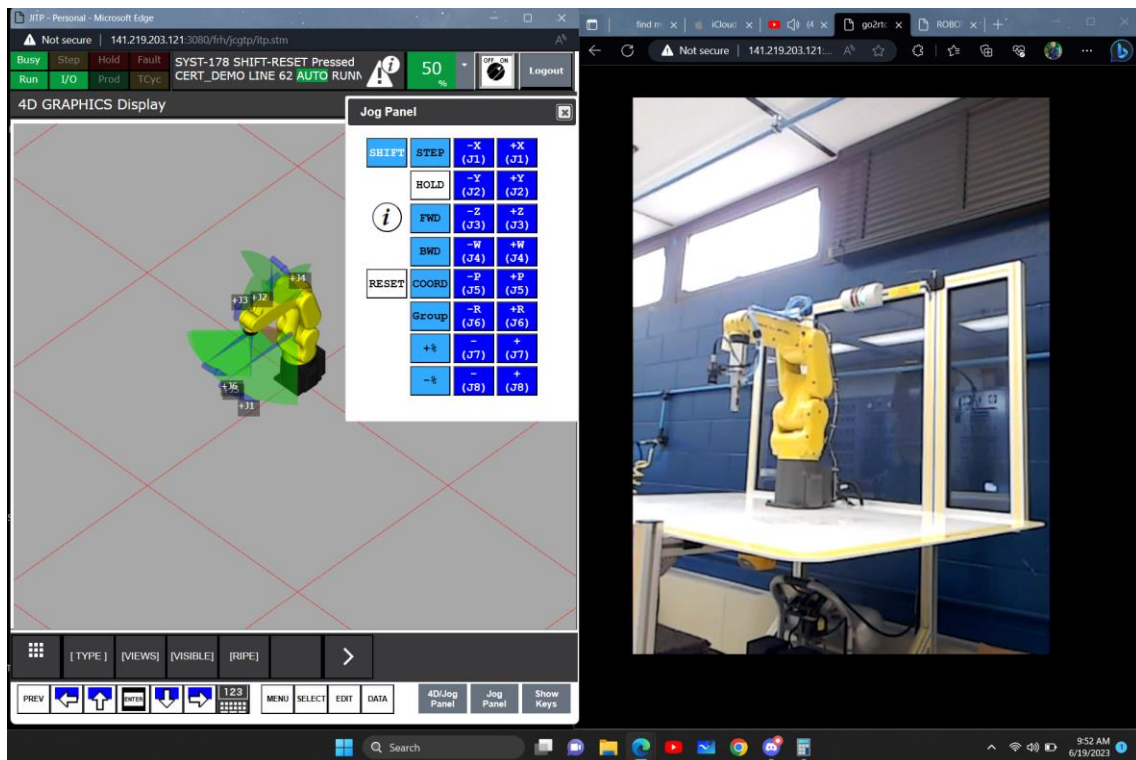
The TRW is designed to provide training opportunities to college students, industry representatives, and displaced workers wishing to retool their skills and become more competitive in the job market.

Figure 2. Teleoperated Robotic Workcell Overview.



The TRW enables remote access to the robot by a user anywhere in the world as long as an internet connection is available. The user can jog, program, and do any operations on the robot that the student can do if physically present in the lab. The developed system consists of a Fanuc robot with an added remote i-Pendant feature and R30iD controller, multiple webcams for providing a video feed to the user, and a web-based portal for remote access. The portal has admin and user features allowing complete control over scheduling and training sessions. The admin section of the portal allows the manager to enable specific time slots for the users to request training on the teleoperated Fanuc robot. The user section of the portal is used to request time and receive training. During the training, the user utilizes a web-based interface to control and program the FANUC robot and receives a real-time video feed of the robot's motion from two webcams, providing a close-up and overall view of the robot. In this paper, the authors provide the details of the system, including hardware and software options.

Figure 3. The Developed Teleoperated Robotics Workcell with Controls.



Connection Details

Teach Pendant	Link to Fanuc Industrial Robot Web Interface
Camera 1	Link to Video feed
Camera 2	Link to second video feed

3.1. TRW hardware

The Fencelless Fanuc LR-Mate R30iD robot has a safety scanner preventing the user from approaching the robot during operation. The cell also features robotic vision systems and interchangeable end-effectors.

The proxy computer that connects to the Fanuc robot via an Ethernet connection uses at least two webcams to allow remote users to see the robot and has a second Ethernet connection to the Internet with a fixed, globally accessible IP address. The computer runs a "proxy" service that allows users to access the robot's teach pendant via their web browser during their approved, previously scheduled timeslot.

Multiple Webcams for video streaming. The cameras are situated to provide a multi-angle view of the robotic workcell. The computer runs a service that allows external users to see the robot's webcam video feeds. The two weblinks provided at the start of the session will lead to the FANUC robot homepage, which is a PC version of the teach pendant, and the second web link will lead to the webcam link of the FANUC robot. The user can enable the split screen to stream the video link and operate the robot via the virtual pendant. The robot homepage provides a medium to browse through teach pendant menus, and the jog panel/4D jog panel offers a medium to move the robot with the help of x, y, z, w, p, and r buttons. The video stream helps the user switch between the two webcam feeds as per their preference to interact with objects and environment

3.2. Booking process

Booking starts with a robot manager creating time ranges in the system from which end users can book. End users can then access the system and book sessions within those time ranges. Once the sessions are booked, they are reviewed by the robot manager and either accepted or declined. Whatever the review decision, an email is sent to the email provided during the booking process. If approved, a link is sent to the end user to access their booked session when the time comes.

3.3. Remote operation

After the user has scheduled a time slot and has it approved by the scheduling manager, they will begin a session where they can control the robot remotely at the scheduled time. The end user can view the video streams, interact with the robot's teach pendant, and control the robot. Only the authorized end-user should be allowed to control the robot during the scheduled session.

The end user will need a Windows machine running Microsoft's Edge browser in Internet Explorer compatibility mode. A large monitor or multiple screens may also be beneficial to view various video feeds and the teach pendant simultaneously. The system requires a reliable 100Mbps or similar internet connection for smooth operation. If the user's IP address changes while using the system, their connection may be temporarily interrupted. The system will re-establish the connection to resume operating the robot.

4. Conclusion

The paper describes a successful collaboration effort between several universities improve interdisciplinary Mechatronics training through experiential learning opportunities. The research, develop, and implement a State-of-the-Art Teleoperated Robotic Workcell (TRW) as part of the ExLENT project to enable enhanced remote training for industrial robots is described in details. The system is designed to provide training opportunities to college students, industry representatives, and displaced workers wishing to retool their skills and become more competitive in the job market. The TRW enables remote access to the robot by a user anywhere in the world as long as an internet connection is available.

Acknowledgments

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LARGE LANGUAGE MODELS IN THE ENGINEERING WORKPLACE AND ASSOCIATED CURRICULAR IMPLICATIONS: AN EXPLORATORY STUDY

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Abstract

The disruptive appearance of ChatGPT in November '22 has spurred considerable debate and research on student use of Large Language Models (LLMs) in higher education. Although divergent viewpoints exist, many institutions of higher education have gravitated towards a policy that can be succinctly characterized as “informed and responsible use”. A categorical ban on generative AI tools would fail to adequately prepare students for the future workplace where such tools are anticipated to be harnessed for their productivity enhancement, so the argument goes. Conversely, an all too uncritical embrace would undermine indispensable learning objectives of higher education curricula. This exploratory research paper seeks to identify the extent - and purposes - to which professional engineers are currently using LLMs and to examine associated curricular and pedagogical implications. In a student-driven action research project, engineering students of the second bachelor of the industrial engineering technology program at University of Leuven (Belgium) surveyed 249 engineers in October 2023. Results show that about half of respondents do not make use of LLMs for professional purposes and have no immediate intention of doing so, with some engineers referring to prohibitive corporate policies. About one-third of respondents are currently not employing LLMs, but they state the intention to explore their potential in the (near) future. The remaining respondents state that they already make use of LLMs for professional purposes, with over half using them for content generation. Other common modes of usage are instructing an LLM to revise a self-written text to optimize phrasing, spelling and grammar or to repurpose it for different audiences or media; to summarize texts; to write computer code; to explain technical concepts; to provide references or sources; and as a search engine. It is worth noting that several of these types of usage do not fit within the commonly accepted boundaries of “informed and responsible use”, underscoring the need for didactic interventions in higher education that raise student awareness of how LLMs actually function, what their inherent limitations are and which ethical concerns they entail. This paper describes how such interventions can be designed and integrated within an engineering program. Furthermore, it suggests ways in which higher education programs can monitor the fast-evolving landscape of AI workplace practices to ensure students are well-prepared to navigate the opportunities but also the challenges presented by LLMs.

Keywords: *Engineering education, large language models (LLMs), generative ai, ChatGPT.*

1. Introduction

Since the end of November 2022, teachers in higher education may have observed an unexpectedly high quality of academic writing in some student papers, alongside surprising substantive, factual, or logical errors. It was quickly understood that at least some students were happily outsourcing their tasks to ChatGPT, a generative AI (GenAI) application that is built on a pretrained large language model (LLM) (Cassidy, 2023). Such language models tend to be particularly proficient at writing, but being the “stochastic parrots” that they are, they are also prone to hallucinations and factual mistakes.

Responses from institutions for higher education were varied (Sullivan, 2023). Some universities argued for an outright ban of ChatGPT and other GenAI tools, and a return to invigilated examinations. The main reason cited was academic integrity: use of GenAI is understood to be paramount to plagiarism, as students are passing off work as their own while it is clearly not. Moreover, using GenAI, students are not meeting the learning objectives embedded in the task design; they are effectively bypassing the learning process and that bypass should be blocked off by clear regulations (Brody, 2023). Some universities, in contrast, were not so much focused on the potential threats of GenAI but rather on its

promise. Many commentators have pointed out that GenAI has the potential for revolutionizing the white-collar labor market much in the same way as the industrial revolution did for manual labor. If cognitive functions can be automatized, then the productivity of post-industrial economies is destined to accelerate, if not explode. Recent research has found that, indeed, the use of generative artificial intelligence substantially increases white-collar productivity while also compressing productivity distribution, as low-ability workers profit more from using GenAI tools (Noy & Zhang, 2023). From this viewpoint, it seems very imprudent - or even irresponsible - to educate students for their professional future while shielding them from a technology that is likely to transform the workplace in fundamental ways. Therefore, some universities have opted for a full embrace of this new technology rather than a unilateral ban. The university of Florida, for instance, has opted for an “AI Across the Curriculum” approach that integrates GenAI into all courses of the curriculum. The aim is to create an “AI-ready workforce” that is equipped to tackle the challenges of a rapidly changing workplace (Southworth et al. 2023).

In between these extremes, it appears that most universities are currently gravitating towards a more nuanced viewpoint that takes into account both the pitfalls and the promises of GenAI. Such universities argue for a responsible, informed and critical use of GenAI, allowing it within certain bounds. At University of Leuven (Belgium), for instance, students are allowed to use GenAI tools as a language assistant for checking or rewriting self-written text or as a search assistant to gather information, on the condition that the teacher did not provide instructions otherwise. Students are always expected to be transparent about their use of ChatGPT, and to acknowledge it clearly and reference it properly. Teachers, on the other hand, are expected to make explicit to students what the bounds are within which GenAI may or may not be used for certain tasks and also to make students aware of the limitations and pitfalls inherent in LLM technology.

This paper focuses on two research questions: a) which interventions can be integrated into course design to make students aware of the potential, but also of the problems linked to using LLMs? And b) to what extent, and how, do engineers in the workplace currently make use of Generative AI in their professional role? These questions will be explored in the context of a course in academic writing for second-year students in Engineering Technology at the University of Leuven, Belgium, at Campus Diepenbeek. Both questions share the same intention, which is to align the structure and shape of higher education onto the needs and realities of the workplace, both current and future.

2. Method

In the second-bachelor course Statistics+, we have been running an action research project with students and the workplace for more than ten years now. The main focus of the action research project is to investigate and monitor the perceived importance of several communication skills and tools for professional engineers. Students send out a standard questionnaire to engineers in their wider circle of acquaintance. Then, they process the quantitative data and supplement the resulting figures with qualitative data in the form of interviews with engineers. Finally, they write out their findings in an academic paper using a self-formulated research question. Statistics+ is a compound course, consisting out of sessions relating to statistics and quantitative data analysis as well as sessions dedicated to academic writing. Witnessing the sudden emergence of LLMs in the course of 2023, we decided to add a question to the standard survey focused on exploring the current use of GenAI tools by professionals. The 2023 survey was completed by 249 engineers in between September 29th and October 6th.

To answer the first research question, the teachers of the academic writing classes developed a range of small in-class interventions to make students aware of both the potential and the pitfalls of LLM-based GenAI tools. Some examples are listed here.

- Students were asked to write an argumentative paragraph prompted by the question: “Are communication skills important for engineers?”. Students were then asked to prompt this question to ChatGPT, and to compare their paragraph to the one outputted by ChatGPT. Students were then instructed to compare content and argumentation, the use of a topic thesis statement, the use of signal words, academic register and spelling and grammar correctness.
- Students were asked to prompt ChatGPT to add academic sources to the paragraph written by the tool to corroborate the proposed arguments. Students were then asked to verify the veracity of the proposed sources.
- Students were given an academic paper relevant to the topic. They were asked to write a synopsis of the paper, and then they were asked to prompt ChatGPT to write a synopsis as well. Then, students were asked to compare their own synopsis, the ChatGPT-generated synopsis and the abstract of the paper.

- Students were asked to research which guidelines are currently provided by academic journals regarding the use of ChatGPT.

A pre- and post-test regarding their use and their perception of GenAI tools was developed to analyze whether these interventions affected their understanding of and attitudes towards these tools. Since the post-test was not completed at the time of writing this paper, the findings of this pre- and post-test are not included in this paper.

To answer second research question, the data generated by the question that was added to the questionnaire was used. The question was phrased as follows: “Do you use GenAI tools (e.g., ChatGPT) for professional purposes?”, with the following options, of which the respondents could select more than one:

- No
- Not yet, but I intend to investigate their potential
- Yes, to generate content
- Yes, to optimize self-written text for structure and register
- Yes, to optimize self-written text for spelling and grammar
- Yes, in other ways: ...

To complement these quantitative data, qualitative data was gathered through semi-structured interviews with six engineers that had indicated in the questionnaire that they were already using GenAI tools for their jobs. Questions included, but were not limited to:

- Which tools do you use and to which purpose?
- Which advantages and/or pitfalls do you discern?
- How do you relate to ethical issues surrounding the use of GenAI tools (data privacy, ecological concerns, authorship issues...)?
- What is your company’s corporate policy regarding the use of GenAI tools?
- How do you expect the use of GenAI tools to evolve in your domain?
- Which recommendations do you have for educators and institutions teaching the engineers of tomorrow, with regard to GenAI tools?

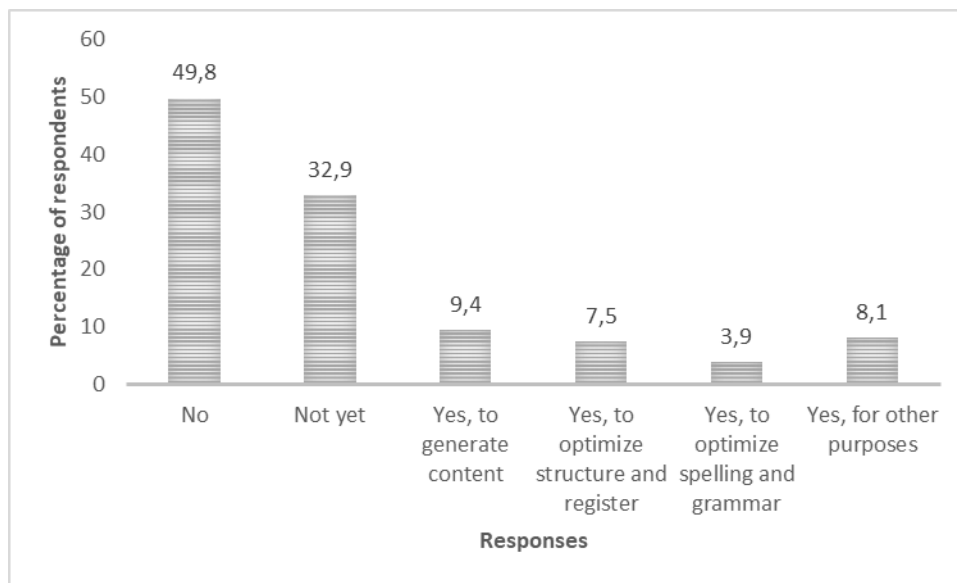
3. Results and discussion

From the in-class interventions, students learned that ChatGPT is proficient in matters of academic writing: the paragraphs produced by ChatGPT were led by a well-phrased topic thesis statement; the argumentation was solid and coherently structured using appropriate signal words; the register was academic; and linguistically, the paragraph was entirely correct. Comparing their own paragraphs to these machine-generated paragraphs, students could actually learn a lot, which highlights the didactic potential of LLMs in academic writing education. Students also learned that ChatGPT was quite able to generate a meaningful synopsis of an academic paper, which opens up an understanding of the ways in which such tools may be used to expediate the academic process.

However, when students verified the factuality of sources provided by ChatGPT, they were forced to recognize the disconnect between the LLM and the external, “real” world. ChatGPT obliged them with source references that closely simulated the structure and shape of actual references, but, which, upon closer inspection, turned out to be entirely fictitious. This finding occasioned insight into the operational design of such LLMs, which generate text on the basis of next-word statistical probability rather than real world meaning or correspondence. When investigating the guidelines issued by leading academic journals regarding the use of GenAI, students’ understanding of the capabilities as well as the limitations of LLM tools was further reinforced: Elsevier, for instance, allows the use of LLMs “to improve the readability and language of the research article, but not to replace key tasks that should be done by the authors, such as interpreting data or drawing scientific conclusions” (qtd. in Park, 2023, p. 105). Furthermore, the guidelines emphasize ethical use as they stipulate that authors must declare if and how they used an LLM-based tool, for instance in the Methods section of the paper.

For the second research question, quantitative data was obtained from the 249 engineers that completed the questionnaire in October 2023. Figure 1 shows the results.

Figure 1. Percentage of surveyed engineers making use of GenAI for professional purposes.



From these data, it appears that, in October 2023, close to 50% of the engineers responded that they did not make use of GenAI tools, with some referring to prohibitive company policies, while one-third of respondents indicated that they did not make use of GenAI yet, but that they intended to investigate the potential of such tools. Around 17% of responding engineers were already using GenAI applications in their jobs, with over half of them using the tool for content generation. Other common modes of usage are instructing an LLM to revise a self-written text to optimize phrasing, spelling and grammar or to repurpose it for different audiences or media; to summarize texts; to write computer code; to explain technical concepts; to provide references or sources; and as a search engine. Some of the above-listed functions are language-based, for which an LLM-based GenAI is indeed well-equipped, but other functions are clearly not. For instance, a LLM-based GenAI-tool is not suited for providing references or sources, as one of the in-class intervention made apparent. Also, an LLM-based GenAI is not a search engine; it is a conversational model trained on data but it does not have direct access to a search index. As such, it can be inaccurate and it is known to hallucinate. Using GenAI tools in professional contexts for purposes they are unfit for may lead to a host of unintended consequences, underscoring the need for proper training, whether in higher education or on the work floor.

The numbers produced by the small-scale questionnaire conducted by the second-bachelor students align quite well with findings published by Salesforce on the basis of a large-scale survey conducted in the same period (18-31 October, 2023) with over 14,000 employees across 14 countries. This survey revealed that 28% of employees were already using GenAI tools, a number that is slightly higher than our small-scale questionnaire produced. Quite similar to our findings, the Salesforce survey found that an additional 32% were expecting to use GenAI tools soon. The Salesforce survey also revealed that over half of the employees using GenAI tools were doing so without the formal approval of their employers. About 7 in 10 workers never received any training on how to use AI safely and ethically at work and a large majority of companies did not have clearly defined GenAI policies. These findings were echoed in the six semi-structured interviews conducted as part of our qualitative approach. Only two of the six interviewed engineers indicated that their employers had issued a GenAI policy stipulating use restrictions, while all of the interviewees expressed concerns relating to data privacy. Furthermore, it appeared that none of the interviewed engineers had been offered to engage in any training relating to GenAI. At the same time, all interviewees expected the significance of GenAI tools for job execution to increase in the future. In all, the interviews affirm the conclusion of the Salesforce survey that on the managerial level, efforts relating to GenAI training and guidelines are lagging behind a pioneering group of users.

4. Conclusion

Generative Artificial Intelligence defines an emerging field of workplace practices and use cases that is evolving at a rapid pace, and which needs to be monitored closely. Workforce adoption is picking up speed, while managerial concern seems to be trailing behind. This discrepancy underscores the importance of a comprehensive and well-designed approach to addressing the potential as well as the limitations of GenAI. Interventions such as described in the paper could be usefully integrated across the curriculum, highlighting the productivity increase that can be gained from these tools while also drawing attention to concerns relating to ethics, privacy, safety and ecology. The alignment of educational practices with the dynamic landscape of GenAI use in the workplace necessitates a) a continuous awareness of the changing realities of the workplaces, which can be extracted from a variety of sources (alumni meetings and other platforms where higher education meets workplace representatives, ongoing student action research projects such as described here etc.), and b) an agile approach to curriculum development, one that is responsive to the rapid technological changes and the evolving needs of the engineering profession. This approach can ensure that future engineers are prepared to meet the challenges and seize the opportunities of a rapidly transforming professional landscape.

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INTERCULTURAL TRANSLATION - ACHIEVING DYNAMIC EQUIVALENCE IN TRANSLATING SPECIFIC TERMS OF MATERIAL AND SPIRITUAL CULTURE

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Abstract

A text is shaped not only by the author's individual style but also by his culture, because each text is always produced in a situation and this situation is embedded in a culture. The context of culture includes everyday traditions, values, norms, perspectives, etc. What the author chooses as the topic, what guiding motives he weaves into the text, what characteristics he assigns to his characters, how he structures the text, even more how this text is understood by its recipients, depend on the cultural context. This cultural context is also present at the micro level, i.e., in individual words, syntagms or sentences, and it causes translation problems, particularly where there are no exact equivalents for the elements in the target language. Translating such culture-specific elements is quite difficult because translating them literally could not produce the same effect on the recipient in the target culture. As a solution to such a seemingly insoluble problem, the American linguist Nida, an important representative of the communicative translation theory, offers the creation of the so-called 'dynamic equivalence'. We conduct this research in order to see how applicable this kind of equivalence for translating specific terms of material and spiritual culture is.

Keywords: *Culture, translation, culture-specific term, realia, equivalence.*

1. Introduction

Every country has its own geographical location, ethnic groups, religious beliefs, political systems, values and so on. All these shape the differences of culture, which are also embodied in the language. The influence of culture on language certainly brings difficulties in translating. Translation is seen as a complex process of interlingual and intercultural transferring contents because translation occurs in rather different circumstances and is aimed at target readers other than the source text. "For a truly successful translating, biculturalism is even more important than bilingualism, since words only have meanings in terms of the cultures in which they function." (Nida 2001: 82)

Taking into consideration Nida's concept for translating the "untranslatable", we have come to the idea to conduct research with the goal to reveal how applicable Nida's concept in translating culture-specific terms is. Furthermore, we consider, in a narrow sense, the problematical nature of the lexemes relating to objects or phenomena from the material and spiritual culture, and in the wide sense, the interculturality as a very significant entity in the process of succeeding interlingual communication through a mediator, i.e., translator. During the research, we apply different methods, starting from definitions of relevant terms, through comparative and translational analysis of original texts parallel with their translations, up to observation of gathered material and interpretation of the achieved results. We expect to prove that, to sustain a normal course of interlingual communication, the translator needs to aim at achieving dynamic equivalence.

2. Intercultural translation and Nida's theory of equivalence

Especially since the end of the 1990s, research in translation studies began to focus more and more on culture in translation, so culture has increasingly been incorporated into the definitions of the term 'translation'.

Translation is seen much more as a mediation between knowledge, behaviors, attitudes, perspectives or with other words between cultures. Vermeer (1994:36) sees translation primarily as an "intercultural transfer", because translation is an offer of information in a target culture and its language through an offer of information from a source culture and its language (Reiß/Vermeer 1984:105).

For Snell-Hornby translation is a reshaping of the text, according to a given situation, as part of the target culture (Snell-Hornby 1994:13).

Many linguists also deal with the term ‘culture-specific items’. For Nord (1993:22), culture-specific items are all forms of action and behavior (linguistic and non-linguistic) that are different from those of other communities on the basis of the norms, conventions and opinions prevailing in one cultural community. Hansen (1996:63) defines cultural specifics as all the cultural and socio-economic circumstances of a linguistic area that lead to a certain understanding and behavior in a particular situation. In linguistics the term *realia* also circulates as a synonym. Markstein defines *realia* as elements of the everyday life, history, culture, politics, etc. of a given people, country, geographical place, which do not have any correspondences in other peoples, other countries, or other geographical places (Markstein 1998: 288). According to her, *realia* are furthermore identity carriers of a national/ethnic entity and are associated with a country, a region, or a continent (Markstein 1998: 288). An important aspect of her definition is based on a specific distinction: *realia* are objects, phenomena, etc. which have no correspondence in other cultures, and not just in other languages (Markstein 1998: 288). Crucial in this context is the problem of equivalence. Most translation theorists and even practitioners agree that the goal of translation is achieving equivalence, which mostly refers to correspondence. However, for Lederer (2014:45) the basic difference between equivalence and correspondence is following: “equivalence exists between texts while correspondences between linguistic elements, words, syntagms, set expressions or syntactic forms within the text”. We, like many other linguists are of the opinion that, despite slight differences of correspondence and equivalence, achieving equivalence is the goal of translation.

For Nida (in his noted book *Toward a Science of Translating* published in 1964), the entire focus in translation is on the message itself both in form and content. Formal equivalence for him supposes that a target language item represents the literal equivalent of a source language item. Dynamic equivalence, on the other hand, is based on “the principle of equivalent effect”. In his opinion, “in such a translation one is not so concerned with matching the receptor language message with the source language message, but with the dynamic relationship, that the relationship between receptor and language should be substantially the same as that which existed between the original receptors and the message”. (Nida, 1964:159). That means that what the translator tried to do is to reproduce the text in such a way that the target language reader can understand the message clearly and exactly. Following this principle, he defines dynamic-equivalence in translation as finding “the closest natural equivalent of the source-language message” (Nida, 1964: 166). In other words, dynamic equivalence represents shaping a target text that is as understandable and natural as possible for the recipient in the target culture, so that similar reactions can be achieved, regardless of how big changes in language, even in meaning, must be made (Nida 1964, Nida & Taber 1982). In the following text we will reveal if translators have made big changes in translating culture-specific terms aiming at the creation of understandable and natural target-texts.

3. Research methodology

For the purposes of this research, we extract examples from source texts in both German and Macedonian, parallel with their translations in both Macedonian and German. The target of the analysis is the culture-specific terms of the material and the spiritual culture that would help us in coming to results considering the challenges in translating a text, especially its cultural segments. The extracts are presented in tables, followed by their interpretations. Each table consists of the author’s name, the novel’s title, the language, and the extract with its minimal context, as it has been found in the source. Beside the interpretation of each item, there is a description of each used methods as well as the type of equivalence (according to Nida’s classification) the translator has aimed at. Textual analysis is used as well, but also the observation of some relevant components of the complex semantic entities such as syntactic, lexical, stylistic, etc.

4. Results and interpretation

4.1. Specific terms of material culture in translation

Table 1.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Arthur Schnitzler</i>	<i>Leutnant Gustl</i>	<i>German</i>	<i>...um jeden <u>Kreuzer</u> muss man extra betteln. p. 11</i>
<i>Артур Шницлер</i>	<i>Поручникот Густл</i>	<i>Macedonian</i>	<i>...треба екстра да се моли за секоја <u>парицка</u>. p. 46</i>

The Lexeme *Kreuzer* (sometimes also *Kreutzer*) is an original silver coin with two embossed crosses which was widespread in southern Germany, Austria, and Switzerland. Over time, however, it lost more and more value until it consisted of less precious and inferior metal. The translation was fulfilled via generalizing the term with the hypernym - *napa* (engl. *money*) in its diminutive form - *паричка*. With this approximate method the most important characteristic of the original lexeme has been covered and the dynamic equivalence has been achieved, which is very important for understanding the target text by the new recipient.

Table 2.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Gottfried Keller</i>	<i>Romeo und Julia auf dem Dorf</i>	<i>German</i>	... <i>sich ein allerbescheidenstes <u>Sonntagskleid</u> zu erobern...</i> p. 20
<i>Готфрид Келер</i>	<i>Ромео и Јулија на село</i>	<i>Macedonian</i>	... <i>да изнуди за себе најскромн <u>неделен фустан</u>...</i> p.40

A *Sonntagskleid* (eng. *Sunday's dress*) is a woman's clothing that was only worn on special occasions, e.g., when going to church on Sundays. This lexeme is rarely used today, alluding to the typical way of life of Germans in the past, where the celebrations took place on Sunday. Its literary translation by introducing minor changes in the grammatical structure (the determinative compound is given as a syntagma consisting of an adjective and a noun) is *неделен фустан*. The translation also evokes a picture of a dress worn on Sunday, which also refers to a kind of solemnity, but it does not sound so natural in the target culture.

Table 3.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Игор Додовски</i>	<i>Големiot куфер</i>	<i>Macedonian</i>	<i>Командирот, ми вели, те чести ручек, <u>сарми</u></i> ... p. 40
<i>Ivan Dodovski</i>	<i>Der große Koffe</i>	<i>German</i>	„ <i>Der Kommandeur spendiert dir ein Mittagessen</i> “, <i>sagte er...</i> „ <i>Sarma</i> ...p.33

The realia *Сарма* denotes one of the most famous Macedonian¹ traditional dishes and is problematic for translating because it is strongly culturally embossed. In the translation, this term has been borrowed by simple transcription in German without any explanations. So, the recipient has no idea what kind of dish it is. The establishing only of a formal equivalence accrues gaps for appropriate understanding in the target culture.

Table 4.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Венко Андоновски</i>	<i>Папокот на светот</i>	<i>Macedonian</i>	... <i>дека на главата имаше маска; црна <u>маска</u>, <u>бабарска</u></i> ... p. 232
<i>Venko Andonovski</i>	<i>Der Nabel der Welt</i>	<i>German</i>	<i>dass er eine Maske vor dem Gesicht hatte, eine schwarze Maske, <u>eine aus dem Neujahrsritus</u>...</i> p.63

The realia *бабарска маска*, as part of the Macedonian cultural heritage is a kind of mask made of sheep or cattle fur that used to be worn by the so-called *Babars* during the New Year's rituals according to the Julian calendar (January 14th), under the superstition that this ritual could drive away evil and demons. When translating into German, the translator has aimed at a dynamic equivalence by explicating the term as *mask from the New Year's ritual*.

4.2. Specific terms of the spiritual culture in translation

Table 5.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Gerhart Hauptmann</i>	<i>Bahnwärter Thiel</i>	<i>German</i>	<i>Auf dem geteerten Plankenzaune eines <u>Kossätenhofes</u>...</i> p.13
<i>Герхард Хауптман</i>	<i>Тил, чуварот на железничката пруга</i>	<i>Macedonian</i>	<i>Врз накатрената испреплетена ограда на еден <u>косетски двор</u>...</i> p.159

¹ but of some other neighboring cultures as well

The German realia *Kossätenhof* testifies to the way of life of a group of people, so-called *Kossäten*, who in the past, somewhere from the XIV century onwards, owned houses or workshops outside the village community. In order to fill this gap, the translator has aspired at formal equivalence, by simple transcription of the first constituent in the compound (*кочетски*), not letting the target reader know what it means.

Table 6.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Hermann Hesse</i>	<i>Der Steppenwolf</i>	<i>German</i>	<i>...erschreckte mich ein Mensch, ein einsamer später Heimkehrer...p.51</i>
<i>Херман Хесе</i>	<i>Стенскиот волк</i>	<i>Macedonian</i>	<i>...ме преплаши еден човек, осамен и <u>задоцнет</u> повратник дома...p.49</i>

The expression *später Heimkehrer* (eng. *late returnees*) testifies of the history of the German people. Late returnees were the former prisoners of the Second World War who were released from Soviet prisons after 1946. In the translation, we have formal equivalence with grammatical changes of the discourse (the adjective is given as a participial form and the determinative compound is translated by a noun-adverb-syntagma), not alluding to German history or to any kind of imprisonment.

Table 7.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Folk tale</i>	<i>Трите самовили, стариот слепец и келешот</i>	<i>Macedonian</i>	<i>...та се ватиле <u>оро</u> да играат...p. 159</i>
<i>Народна приказна</i>	<i>Die drei Feen, der Blinde und der Aussätzige</i>	<i>German</i>	<i>...um einen <u>Oro</u> zu tanzen, wie die <u>makedonischen Bauern</u>...p.19</i>

Oro is the traditional Macedonian¹ folk dance where the people hold hands and dance in an open circle to the rhythm of the folk melody. In the translation the word *Oro* has been taken as a borrowing with additional explanations: *as the Macedonian farmers*. By paraphrasing this realia, the translator has aspired for dynamic equivalence.

Table 8.

<i>Author</i>	<i>Novel</i>	<i>language</i>	<i>text</i>
<i>Владо Малески</i>	<i>Прва вечер</i>	<i>Macedonian</i>	<i>...на изутрина на <u>блага ракија</u> ќе ти дојдеме...p.48</i>
<i>Vlado Maleski</i>	<i>Diptychon, Erster Abend</i>	<i>German</i>	<i>...morgen früh kommen wir <u>zum heißen Schnaps</u> zu dir! p.30</i>

The Macedonian expression *доаѓа на блага ракија* (eng. *to come to sweet liquor*) describes a traditional ritual of Macedonian culture, which is performed the day after the wedding where the guests drink heated and sweetened liquor. In the German translation there is an adaptation by the paraphrase *zum heißen Schnaps kommen* (eng. *to come to hot liquor*) By mentioning one other semem of the meaning of the culture-specific expression (the liquor is both sweet and hot) the translator managed to more nearly describe the custom for the German reader again by aspiring at dynamic equivalence.

5. Conclusion

Language functions as a culture-specific phenomenon, but many culture specific phenomena are also part of a language. Realia of the material and the spiritual culture are often present in literature as well as in any kind of communication. However, without culture-specific items in the source text, the translation process would be like pure transcription. From a translator's point of view, realia are problematic in their nature, because if literally translated, they could not produce the same effect as for the recipient of the original text, as we saw in Tables 2, 3, 5 and 6. Furthermore, translation is a creative activity and the translator uses all disposable tools, that means, where the formal equivalence seems to be insufficient for a correct and esthetically solid translation, he needs to reach to achieving a dynamic equivalence. This especially refers to the realia in the translation process. According to the results of our research in 4 out of 8 analyzed examples (50%), the translator aimed at achieving dynamic equivalence. But, with literary

¹ but also of some other neighboring cultures

translation or borrowing words from the source language, the target recipient is though deprived of getting the real picture the original author had in mind. There occur even more losses, because there are losses in all forms of communication, whether it involves translation or not (Bassnett & Lefevere, 1990:35).

Despite claiming that the translator should show big respect for the original by not changing the content of the original cultural words at his own will, the culture-specific terms can be successfully translated if the translator manages to make the target language reader feel like reading the original cultural-specific terms in their own familiar culture.

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SUSTAINABLE LEADERSHIP AND INNOVATIVE LEARNING ENVIRONMENTS

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Abstract

After the pandemic, work environments and social cultures have changed, requiring new insights into leadership. Sustainable leadership competencies, in particular self-leadership and resilience have also been highlighted. Leadership development initiatives are widely researched however evidence of their effectiveness is lacking. The sustainable leadership competencies of the leaders can be improved using innovative learning environments. In this study, innovative environments include nature, equine-assisted environments, collegueship networks, and technology. The present study aimed to develop and pilot sustainable leadership training for leaders to develop their self-leadership and resilience competencies. Two training pilots were carried out between Feb23-Jun23 and 10 participants in leader positions from diverse fields were selected for each pilot. The training pilots made use of innovative learning environments, such as the nature environment and horses (also in virtual settings), which are known to provide a trustful environment for the training of self-leadership, interaction, and practicing emotional intelligence. The leaders also worked in multidisciplinary small groups applying collegueship practices. To answer the research question, how different learning environments are perceived in the context of training pilots, the effectiveness of the training and innovative learning environments on participants' self-leadership and resilience competencies were measured twice through questionnaires including both Likert scale statements and open-ended questions. The participants (N=19) were asked to respond using their diary reflections and smart ring data (a device that measures electrical conductivity and reflects emotional states and stress levels). Also, a qualitative co-creation workshop provided data for this study. The results showed that all participants highlighted working with horses as a great experience during the training. Working with horses was inspiring and left a strong emotional impression. Being in nature was natural and pleasant, the environment made the participants relax. The training discussions were seen as good and in-depth. Collegueship was perceived as important. The support of networking with people in the same position and life situation was very useful and it was felt that hearing and understanding different perspectives and opinions contributed to a deeper identification of one's own role and support for different leadership situations in everyday life. The smart ring divided opinions. Some participants found the smart ring clumsy and cumbersome and its functionality lacking, although at the same time, it helped them to understand their strengths.

Keywords: *Self-leadership, resilience, sustainable leadership, training, innovative learning environments.*

1. Introduction

Returning to workplaces or moving to hybrid work after pandemic requires new insights into leadership. Sustainable leadership practices, and in particular, self-leadership and individual resilience have emerged as important competencies to enhance the creation new working methods aiming to foster innovation and sustainability (Djourova, Rodríguez, Tordera, & Abate, 2020).

Self-leadership can be explained as a self-influencing process wherein individuals attain the self-direction and self-motivation essential for effective performance (Neck, Manz, & Houghton, 2019). Self-reflection, self-awareness, and self-regulation are also drivers of the self-development process (Nesbit, 2007). Self-leadership is the key to building resilience. According to Poijula (2003, p. 48), resilience refers to a person's ability to withstand and adapt to uncomfortable, unexpected events and changes. Resilience is expressed as the ability to recover from adversity, problems, and shortcomings, either on one's own or with the support of others. Like self-leadership, resilience can also be learned and developed (Poijula, 2018, p. 17). Changes in the operating environment predispose to learning (Valli, 2020).

However, the focus of the previous research has been strongly on the competencies of the leaders, not on the leadership development initiatives and their effectiveness (Krampitz, Seubert, Furtner, & Glaser, 2021). Furthermore, there is a necessity to explore innovative and unconventional learning environments for leadership development (e.g., Rauén, 2017). For example, engaging with horses, which can serve as a valuable means of acquiring leadership competencies. Horses possess a remarkable ability to discern a person's emotional state, intentions, and needs by interpreting their body language and the feelings they attempt to conceal. Also, nature could be better utilized as a learning environment, as nature environments reduce stress and increase positive emotions, improve people's attention and concentration in general, induce better self-regulation, and make learners more interested and involved (e.g. Kuo, Barnes, & Jordan, 2019). Moreover, technology enables people to develop their competencies and monitor their impact on well-being, particularly stress related to resilience. Technological devices can also motivate and support learning (Lyll & Robards, 2018). Collegueship refers to the peer experience of being on a common cause across organizational boundaries (Laiho, Ryömä, & Teerikangas, 2019). This kind of peer-to-peer interaction can be very useful for leadership development (Goldman, Wesner, & Karnchanomai, 2013).

Right now, it is important to focus on developing leaders' self-leadership and resilience competencies, which will reduce stress and help them cope with the daily workload. Innovative learning environments and technology can support competencies development (Maijala, 2023). All this has a major impact on the well-being of the whole work community and organizational learning. Research shows that sustainable leadership leads to more sustainable development and resilience in the long term (Avery & Bergsteiner, 2011).

2. Context of the study

The context for this study consists of two Hohtaminen® Towards Sustainable Leadership training pilots (5ects), which took place between 2023 February and 2023 June. For each pilot, 10 leaders or entrepreneurs from different sectors were selected.

The theoretical framework for Hohtaminen® is Avery and Bergsteiner's pyramid of sustainable leadership (2011) and so-called higher-level practices: internal motivation, self-direction, teamwork, trust, organizational culture, and knowledge sharing. In developing leadership competencies, these practices improve not only the resilience of the leaders but of the whole work community, and its individuals. Sustainable leadership can create long-term well-being and long-lasting value for all stakeholders in the organization.

The aim of the training is that the participants:

- can reflect on their competencies and set new development goals,
- can regulate their own behavior in a leadership role (resilience),
- know how to apply innovative learning environments to enhance development of competencies.

The training will experiment with innovative and creative learning environments. Participants' self-leadership competencies are the starting point for all development and creating a trusting learning environment is the key to these rapid experiments. This project will work in natural and equine-assisted environments, traditionally used in occupational therapy and social pedagogy, for example. In leadership training, this is a rarely used learning environment. The project also uses technology as a tool for self-leadership, i.e., participants wear a smart ring during the training. The ring allows them to monitor their own stress levels (Varhelahti, Laiho, Orava, & Syrjänen, 2023). The training is multifaceted, i.e., part of the training is carried out virtually.

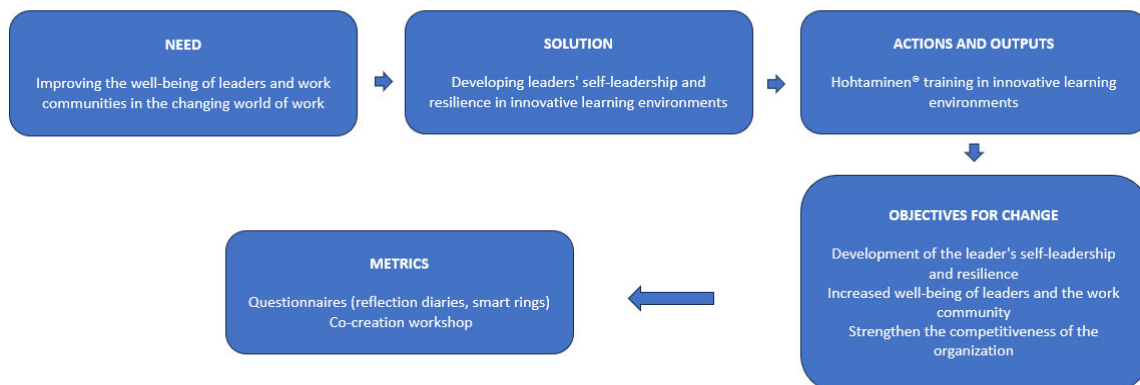
The training was created at Turku University of Applied Sciences in 2023 as part of the *Hohtaminen* project. The project was funded as part of the European Union's response to the covid 19 pandemic. The training responds to the key objectives of the Finnish Structural Funds program REACT-EU ESF (Priority 9), focusing on the specific objective 12.4 "Promoting the rapid change capacity of enterprises and entrepreneurs".

3. Objectives

The study aims to provide information for the implementation of effective sustainable leadership training. It focuses primarily on the effectiveness of leadership training at the individual level. Measuring the effectiveness of competence development initiatives is important, as effectiveness describes the ability of the measures to achieve the objectives set and produce the desired effects (see (Krampitz & al., 2021). The training aims to achieve effect, which is reflected in the development of competencies. This in turn is expected to be reflected in increased efficiency, improved quality, and ultimately improved conditions for organizational success and profitability. The study will also analyze the factors that have contributed to,

hindered, or possibly prevented effects from being achieved. Figure 1 illustrates the effectiveness chain of Hohtaminen® leadership training.

Figure 1. Measuring the effectiveness of the training.



The effectiveness will be examined from the perspective of innovative learning environments and sustainable leadership competencies, particularly self-leadership and resilience. The study seeks answers to the following questions:

- How do the participants perceive their self-leadership and resilience to be developed during and after the training?
- How do different learning environments support the development of participants' competencies?

Effective training ensures that leaders can lead and feel well. At the same time, it supports a change in the leadership culture of the workplace. This ensures learning and readiness for change throughout the work community and the organization.

4. Methods

The study mainly uses qualitative methods. The data were collected as follows:

- “Training of dreams” - co-creation workshop at the end of the training (N=19)
- Effect questionnaire 1 at the end of the training (N=10)
- Effect questionnaire 2, 6 months after the end of the training (N=3)

At all stages of data collection, the participants were asked to utilize the data they had reflected in individual diaries and stress level data they had measured with the smart ring during the training. Research practices consider ethical conduct and privacy. The reflection diary and smart ring data were only accessible to the participants themselves. They reported the information they received to the extent that they wanted to in the training co-creation workshop and the effect questionnaires.

Mainly qualitative open-ended questions were used in the questionnaires, but some quantitative items were included. Content analysis was used for the analysis. There were two pilot trainings: training pilot 1 took place 16 Feb- 25 April 2023 and training pilot 2 took place 2 May – 6 June 2023. Altogether, 19 people completed the training and 16 of them were female. Of them 13 stated that they worked as entrepreneurs and 6 were in leading positions.

5. Results

The study investigated the effectiveness of Hohtaminen® leadership training and aimed to identify how leadership training using innovative learning environments supported the participants' sustainable leadership competencies more specifically self-leadership and resilience. In addition, it examined how the participants perceived the use of innovative learning environments. The study was based on the results of virtual “Training of dreams” co-creation workshops conducted in connection with the training pilots in the spring of 2023 and surveys conducted twice after the training pilots.

The results of the study show that the training was beneficial, as most of the participants felt that the training had strengthened their ability to cope with working life. Participants reported that their self-leadership competencies and resilience improved. The development of self-leadership competencies was reflected in improved self-reflection and self-awareness. The training increased understanding of personal limits and coping. Many of the participants already had strong resilience, but the training strengthened their resilience and helped them to identify their habits and adapt better.

The results also indicate that the innovative learning environments used in the training (nature, horses, the smart ring, and the colleagueship network) were perceived positively. Nature supported the creation of a trustful environment for discussion between the participants. Being in nature was natural and pleasant, the environment made the participants relax. Training discussions were seen as good and in-depth. The results highlighted working with horses as a great experience in training. Working with horses was inspiring and left a strong emotional impression. The presence of horses brought empathy and calmed the participants. The concrete visual data of the smart ring made people think about their work and its impact on their emotions. On the other hand, the smart ring divided opinions. Some participants found the smart ring clumsy and cumbersome and its functionality lacking, although, at the same time, it helped them to understand their strengths. Colleagueship was perceived as important. The support of networking with people in the same position and life situation was very useful and it was felt that hearing and understanding different perspectives and opinions contributed to a deeper identification of one's own role and support for different leadership situations in everyday life. Nature and colleagueship were learning environments that the participants intended to use even after the training.

In addition, the greatest improvement in the participants' competencies was in their ability to use different learning environments (nature, technology, animal-assisted learning) in leadership not only in self-leadership and -development. The results suggest that the participants have applied or are aiming to apply new competencies and knowledge in their work community. The participants emphasized that such training could also support the culture of the work community.

6. Conclusions

This study examined the effectiveness of Hohtaminen® training. The training can be considered effective because the learning objectives set have been achieved. Furthermore, there is evidence that what has been learned will be or has already been put into practice in work communities.

Leaders' sustainable leadership competencies, including self-leadership and resilience, can be enhanced through competence development interventions. In addition, innovative training solutions are now expected, and different learning environments are part of this. A greater focus on such learning environments can also create a safe and confidential learning environment for leadership training, where everyone is encouraged to share their knowledge and reflect on their learning.

Acknowledgments

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AUTISM SPECTRUM DISORDERS AND AI: APPLICATIONS AND AREAS OF PROMISE

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Abstract

Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by challenges in social communication and repetitive behaviors. The spectrum is broad, with individuals exhibiting a wide range of strengths and difficulties that affect their daily functioning and learning. The World Health Organization estimates 1 in 100 children globally having been diagnosed with ASD, whereas the United States Center for Disease Control and Prevention reports 1 in 36 children with ASD diagnosis in the U.S.A. Artificial Intelligence (AI) has shown promise in both assessing and supporting interventions for individuals with ASD. The present article reviews the multifaceted relationship between ASD and AI, including assessment, emotional recognition and regulation, social skills training. Concerns regarding accessibility, ethical use, and oversight are discussed.

Keywords: *Autism Spectrum Disorder, Artificial Intelligence, assessment, intervention.*

1. Autism Spectrum Disorder: Diagnosis, characteristics and prevalence

Autism spectrum disorder (ASD) is a complex, life-long, neurodevelopmental condition characterized by challenges in social communication and repetitive behaviors. Although the causes of autism are not yet understood, there are risk factors that have been identified, such as low birth weight, having a sibling with ASD, parental age, and certain genetic conditions (National Institute of Mental Health, 2024). The ASD spectrum is broad, with individuals exhibiting a wide range of difficulties in several areas of life. Such deficits can significantly impact daily functioning, adaptive behaviors, and social interactions. Depending on the severity of deficits in communication as well as restricted and repetitive patterns of behaviors, severity of ASD is expressed in three levels, with level 1 being the milder form and level 3 the most severe (American Psychiatric Association, 2013).

The World Health Organization (2023) estimates that worldwide about 1 in 100 children has autism noting that for many middle- and low-income countries ASD prevalence is not known. The US Center for Disease Control (2023) reported that 1 in 36 children has been diagnosed with ASD. Prevalence has significantly changed between 2000 and 2020, with the identification rates increasing from 1 in 150 children in 2000 to 1 in 36 in 2020. It is important to note that the ASD diagnosis cuts across socioeconomic and racial strata, while it is four times more common in males than females.

Autism is usually diagnosed before the age of three. Research has shown that interventions which occur before or during the preschool years take advantage of brain plasticity and, therefore, can produce better and longer-lasting intervention effects. Beginning behavioral interventions and targeting other areas of development such as speech and language as soon as ASD is diagnosed, or even when ASD is suspected, leads to better outcomes (National Institute of Child Health and Human Development, 2021). Since early identification and intervention is key for best outcomes, knowing the signs is critical for parents and early childhood educators, in addition to clinical practitioners (CDC, 2023).

2. Artificial Intelligence and autism screening

Given the multiple and multi-faceted benefits of early intervention, using technological advances to expedite and improve the accuracy of ASD diagnosis is of paramount importance. Artificial Intelligence (AI) has been increasingly discussed as a critical contributing tool in health and mental health diagnostics. Given the complexity of diagnosis and the volume of information to be taken into consideration, AI can significantly contribute to the identification of ASD. Additionally, it can address a lack of trained specialists who are able to diagnose individuals with ASD, something that currently exacerbates the existing delays in diagnosis (Cavus et al., 2021).

Recent years have seen a sharp increase in the amount of research on the impact AI can have on the assessment and treatment of ASD. There are various AI forms contributing to diagnostics such as Machine Learning (ML), Natural Language processing, and Rule-based Expert Systems (Davenport & Kalakota, 2019). Machine Learning algorithms can analyze behavioral patterns and identify signs of autism in children. The model receives input data that it cleans and extracts pertinent information. Subsequently, the model ranks the extracted features, organizes, and classifies the inputted data accordingly (Barua et al., 2022). AI algorithms can assist clinicians in analyzing biological markers and behavioral patterns such as speech patterns, eye contact, gestures, and facial expressions to identify specific traits associated with ASD (Pandya et al., 2024). It's important to note that artificial intelligence models are often still inscrutable and complex, even to their creators (Mahmud et al., 2022), and that the effectiveness of these models is based on the data that is inputted which may not comprehensively inform any given model (Anagnostopoulou et al., 2020).

2.1. AI diagnosis and screening for ASD

AI tools have increasingly been used to shorten the assessment process for ASD by utilizing data from traditional ASD assessments and MRI results (Anagnostopoulou et al., 2020; Song et al., 2019). Cavus and colleagues (2021) found that ML models which utilized behavioral measures had higher rates of diagnostic accuracy than those that used MRI measures. These shortened assessments have also proven to yield equally or even more accurate results than traditional methods (Anagnostopoulou et al., 2020; Erden et al., 2021; Joudar et al., 2023; Megerian et al., 2022). Importantly, the shortened assessments have also allowed clinicians to decrease the age of diagnosis for ASD, creating earlier interventions and treatment (Joudar et al., 2023; Mahmud et al., 2022; Song et al., 2019). These shortened assessments decrease the cost of the diagnostic process, and thus have the potential to make such diagnostics more affordable to more people around the world. Mobile platforms also make it easier to implement through telemedicine, reaching rural and remote populations more easily (Megerian et al., 2022). Some scholars raise concerns that AI tools are an oversimplification of a nuanced assessment process (Song et al., 2019) and should not be a substitute for traditional assessment methods (Joudar et al., 2023). Other reservations regarding AI tools include viewing classification of ASD as binary, not capturing the complexity of the disorder (Cavus et al., 2021; Erden et al., 2021). Overall, findings to date are encouraging regarding AI assessment tools, though more testing and development is needed for a wider clinical picture (Cavus et al., 2021; Erden et al., 2021; Joudar et al., 2023).

3. AI interventions for ASD

To date, research has been focusing mostly on the use of AI in assessment of ASD, compared to interventions. Care for people with ASD is costly, with AI increasingly becoming an accessible and relatively cheaper alternative to traditional interventions (Ghosh et al., 2021). The effectiveness of such alternatives can be even greater for children with ASD as they have positive attitudes towards technology and they have shown increased motivation to use AI interventions (Mosher and Carreon, 2021). Particularly, human-robot interactions, AI-based gaming, and object-based visual graphics have been proven effective with individuals with ASD (Gosh et al., 2021). As people with ASD report high levels of comfort with technology, these AI advancements have the potential to allow individuals with ASD to live more independently (Ghosh et al., 2021; Mahmud et al., 2022).

3.1. Social skill development with AI for ASD

Empirical evidence consistently indicates that social-emotional competence is critical for healthy development and for counteracting the negative effects of exposure to contextual risks (Domitrovic et al., 2017). Being socially aware and applying interpersonal skills (e.g., listening, perspective taking, social problem solving) are essential for successfully interacting with others. Individuals with ASD display significant social skills deficits which adversely impact their academic achievement and relations with peers and adults (Silveira-Zaldivar et al., 2021). Using AI-based social skills training such as video modeling or virtual reality can be an efficient and effective approach (Hughes-Roberts et al., 2022). For example, Socially Assistive Robots (SARs) connect with virtual-reality activity platforms to enhance interactions and social skills. While much of this research focuses on the utilization of SARs with older adults, the few studies that have examined AI and social skill development for children with ASD have found it to be a beneficial way for these children to gain tangible skills.

3.1.1. Virtual reality and Socially Assistive Robots. A subset of AI is virtual reality (VR), which provides a realistic, safe, and controlled learning environment for children with ASD to practice skills free from negative consequences (Hughes-Roberts et al., 2022; Chaidi & Drigas, 2023). Specifically,

virtual environments are free from distracting social stimuli; allow children with ASD to stay on task more easily; do not penalize children for wrong answers as it may be in the real world; and have a low risk of stigmatization, which in turn can result in improved autonomy and self-esteem (Chaidi & Drigas, 2023). In addition to the benefits of VR for children with ASD, initial reports indicate that interactions with robots also improve real-world social interactions. The significant potential of SAR use is that they can personalize social skills' support to enhance therapies already in place (Scassellati, 2007). Socially Assistive Robots, also offer the opportunity for caregivers and educators to be engaged in the intervention, further enhancing interpersonal interactions. In such interventions, SARs can adapt difficulty of activities based on past performance, model appropriate social skills, and encourage sustained engagement. For example, in a triadic, 30-day home-based intervention targeting social communication, a SAR modeled eye-contact and perspective-taking, behaviors with which children with ASD struggle. Children showed improvement in attention, and overall increased communication even when not in the presence of the SAR, a significant indication of generalizability of learned effects (Scassellati et al., 2018).

3.2. Emotional recognition and regulation with AI for ASD

Overall effective behavioral functioning includes both interpersonal (e.g., social skills) as well as intrapersonal (e.g., emotional regulation) characteristics (Domitrovich et al., 2017). There is a strong, positive relationship between emotional regulation (ER) and social skills; improvement in one area can reinforce improvement in the other (Restoy et al., 2024). Self-regulation is a component of Executive Functioning, which, when operating efficiently, coordinates various cognitive processes to select and apply socially-appropriate behaviors in various circumstances. Individuals with ASD struggle with ER, show significantly more maladaptive strategies, and fewer adaptive ER strategies compared to their non-ASD counterparts (Restoy et al., 2024). Socially Assistive Robots can provide useful AI interventions for individuals with ASD because they express emotions in relatively basic ways compared to traditional human emotional expression, thus limiting sensory overload. Interactions with SARs have been shown to improve attention, ability to identify emotions, and development of social competence in children with ASD (Cano et al., 2023). In addition, SARs have been used to encourage children with ASD to express their thoughts and emotions either verbally or non-verbally. In such scenarios, SARs provide immediate feedback, validation, and enhance responses. Other studies have explored the use of smartwatches and biofeedback to provide ER interventions. For example, a computer application monitors the wearer's heart rate through their smartwatch, and if the rate exceeds a certain level, the smartwatch vibrates and provides pictograms of coping strategies for the user to apply. Over the course of few days, participants were able to self-regulate in less time than before by applying appropriate regulation strategies (Torrado et al. (2017). Research on AI and emotional recognition and regulation for those with ASD is not as extensive as that on assessment and diagnosis, but it is increasing rapidly, and as more data are collected to enrich AI input, the capabilities of these tools will be further refined.

3.3. AI applications supporting educators working with ASD students

Traditional teaching methods for students with ASD are time-consuming and slow-paced to produce results (Barua et al., 2022). They also vary in effectiveness depending on the individual applying them. As discussed in previous sections, AI applications show significant promise to enhance the social and emotional learning of students with ASD. AI and VR tools are most effective for students with ASD when they are first introduced by a teacher who is able to walk the student through the expectations prior to implementation (Hughes-Roberts et al., 2021; Mosher & Carreon, 2021). In their 2021 study, Lamos and colleagues assessed more than 5,000 interactions between a teacher and seven students with ASD to create a ML model that was able to effectively predict what type of teacher communication would yield a positive student response. Similar AI educational tools have been reported by parents and educators as being effective for teaching students with ASD (Barua et al., 2022). AI is capable to detect learning patterns in ASD students and tailor interventions accordingly, offering pointed, personalized interventions that can enhance teacher strategies (Mahmud et al., 2022). Anecdotal evidence from the field also includes the use of open AI platforms such as ChatGBT offering critical support for the daily adaptive functioning of individuals with ASD such as to create social stories and lists of steps for completing various tasks. Research on the application of AI to support educators working with ASD students is still limited, but it is clear that there is a great potential for AI use in educational settings.

4. Challenges and limitations to Artificial Intelligence and ASD

The potential of AI tools for delivering individualized interventions, targeting specific skills is exciting. Artificial Intelligence applications are not a replacement for educators, therapists, and other specialists, but a tool to enhance supports for individuals with ASD. As groundbreaking as the strides in

AI-based approaches to ASD diagnosis and intervention are, there are key limitations that make it difficult for AI to currently be adopted more broadly. Perhaps the largest limitation of AI in ASD assessment and treatment is the lack of availability of large quantities of quality data. Research on ASD does not produce the same quantity of data that research in other medical conditions yields, limiting AI models, as the more data an AI model is provided, the better the results (Erden et al., 2021; Joudar et al., 2023). Issues have been raised regarding the complexity of input required in order to address the multitude and diversity of ASD symptoms in each case. Since AI models do not respond to inputs autonomously, but rather they still primarily respond in predetermined ways based on data (Cano et al., 2021). Therefore, reliance on existing datasets makes it difficult for such tools to be personalized to individual users (Barua et al., 2022). It must be noted that although AI contributes to minimizing biases, such as gender or cultural, that diagnosticians and educators may display, it does not yet have the capacity to address the nuances involved in working with individuals with ASD. Whereas a clinician or educator may assess individual cases based on a variety of shifting factors and tailor their interventions accordingly, an AI tool will assess a case based on previous cases and will have a given set of intervention options (Erden et al., 2021).

When data use relates to humans, ethical concerns around privacy are raised. Data collected for AI-based ASD tools are sensitive, especially for a population that is vulnerable to discrimination. Many researchers have raised concerns about the viability of data protection for these emerging tools (Erden et al., 2021; Joudar et al., 2023; Mahmud et al., 2022; Song et al., 2019). Another consideration for AI development is the cost. Artificial Intelligence applications are still a relatively new intervention in healthcare and the tools are expensive to purchase and maintain (Joudar et al., 2023; Mahmud et al., 2022). The cost of the tools and their maintenance will likely decrease as the tools become more mainstream, but during the experimental and early stages of adoption, cost is cited as a concern for effective implementation.

Lastly, given the complexity of this topic, there is a pressing need for coordinating and combining information across multiple fields involved in the investigation of AI and ASD in order to address it most effectively (Mazzocchi, 2019). Research on this broader topic is produced by several fields such as computer & mechanical engineering, education, human development & exceptionality, informatics, medicine, robotics, and psychology to name a few. Multi-, inter- and trans-disciplinary research in ASD and AI has the potential to produce more comprehensive and applicable interventions to address the academic, social, and emotional needs of individuals with ASD.

5. Conclusion

Individuals with ASD struggle with their intrapersonal and interpersonal skills, which significantly affect their learning, daily functioning, and overall quality of life. The earlier they are assessed and receive interventions in various areas of development, the better the prognosis for school adjustment and transition to post-secondary life. Although in its early stages of use with individuals with ASD, AI can assist in delivering early and consistent interventions. As AI tools become more refined, such applications show tremendous promise in the diagnosis, assessment, as well as clinical and educational interventions.

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DIGITAL SUBJECT INTEGRATION: HISTORY TURNED INTO GRAPHICS

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Abstract

In education, digital subject integration is one of the major issues of our time. The primary questions are how digital education (informatics, computer sciences) and other school subjects, sciences and the different fields of informatics are connected. It is observed that digital education mainly focuses on hardware and software tools, tries to build up huge knowledge inventories, prefers fictitious data to real world problems, emphasizes theory to practice, in general developing computational thinking skills is reduced to coding and interface navigation. We are convinced that to make digital education effective and efficient, we should expand it to end-user computing, it should be socially sanctioned intellectual advances for everyone, and embedded in rich cognitive context. Considering all these requirements, a novel approach to subject integration is presented, where a digital interpretation of a triband is detailed. For the present paper a short paragraph of a history course book is selected which explains (writes about) the colors of a flag. It is found that with our solution the text-based paragraph can be converted into a graphical product, where different digital subject areas and classical school subjects are involved (e.g., searching the internet, analyzing data, arguing, checking correctness and reliability, designing and creating a presentation, handling graphical digital objects, understanding coordinates, RGB codes, etc.). Furthermore, the paper emphasizes the various skills and competencies (primarily digital but not exclusively) which can be developed during the problem-solving process.

Keywords: *Computational thinking, subject integration, searching, reading comprehension, graphics.*

1. Introduction

Education should be ready to prepare students for skills required in the future. According to 'The Future of Jobs Report 2023' (2023), the seven core skills are 'analytical thinking', 'creative thinking', 'resilience, flexibility and agility', 'motivation and self-awareness', 'curiosity and lifelong learning', 'technological literacy', and 'dependability and attention to detail'. However, the same report states that among the digital skills 'software use and development' and 'understanding digital systems' are the less developed. We must find methods which can narrow this gap and bring closer existing and required skills.

In the present paper one such experience is detailed, where a conventional text-based paragraph explaining the meaning of the Hungarian flag (Borhegyi, 2020) is converted into a digital graphical project. The original purpose of the paragraph is to develop the reading comprehension of the students and provide information on the flag. However, the digital solution allows space for developing both the students' and the teachers' computational thinking skills (Wing 2006), a great opportunity for subject integration by applying all the components of TPACK (Technological Pedagogical And Content Knowledge) (Mishra & Koehler, 2006).

2. How to draw a flag in the digital world? – Understanding the problem

A short description of the Hungarian flag is presented in the Grade 5 History book (Borhegyi, 2020, p. 13) (

Figure 1), which is an extract from the Fundamental Law of Hungary (Magyarország Alaptörvénye, 2011; Balázs et al., 2011). From this short text we can learn the colors of the flag and the meaning of the colors. However, the provided information is not enough to draw a digital flag, consequently, we must find further information. The primary source is the mentioned Fundamental Law of Hungary which is available in at least two formats: a webpage (Magyarország Alaptörvénye, 2011) and a PDF file (Balázs et al., 2011).

2.1. Problem solving

Similar to other sciences, the creation of a digital project requires a concept-based problem-solving approach, following its four major steps: understanding the problem (including the collection of data), designing the project and building algorithm, acting (the realization of the digital project), and discussion (including error recognition, generalization, abstraction) (Polya, 1945).

Figure 1. The original text (left) and its translation (right) from the Grade 5 History book (Borhegyi, 2020).

1 „Magyarország zászlaja három, egyenlő szélességű, sorrendben felülről piros, fehér és zöld színű, vízszintes sávból áll, amelyben a piros szín az erő, a fehér szín a hűség, a zöld szín a remény jelképe.”

(Részlet az Alaptörvényből, 2012)

- Milyen kevésbé ismert jelentéstartalmat ismerhetünk meg a részletből?

1 “The flag of Hungary consists of three horizontal stripes of equal width, arranged from top to bottom in the colors of red, white, and green. The red symbolizes strength, the white loyalty, and the green hope.”

(Extract from the Fundamental Law, 2012)

The selection of application and its connected document is up to the students and the teacher, but the choice might affect the data collection process. For our purposes, we select PowerPoint, which is a presentation software, but exaptation – a change in the function of a feature during the evolution process, Hatamleh & Tilesch (2020) – allows us to use it as a vector graphic software. The simplicity of the software matches the students’ age and background knowledge, consequently, perfectly serves our purposes. We must keep in mind however that the design should be carried out unplugged, where we use a piece of paper to imitate (substitute) the page (slide) of the presentation. Drawing a Hungarian digital flag requires the following data:

- the size of the flag,
- the proportion of the width and the height of the flag,
- the RGB codes of the colors,
- the size of the paper (slide),
- the layout of the slide,
- the position of the flag (stripes).

Furthermore, digital objects require names for clear identification. Consequently, when our digital flag is planned, we must find names for the objects of the flag and record them on the unplugged slide, along with the content-related data.

3. Searching for data

3.1. Data from the original sources

Pictures of the flag provided in the mentioned two documents (Magyarország Alaptörvénye, 2011; Balázs et al., 2011) are presented in Figure 2. As the samples show, there are differences in both the color and the size, consequently these data are not enough to create our digital flag. Furthermore, the quality of the webpage picture is questionable since it is extremely noisy. On the other hand, the picture from the PDF file seems clear, so we can request (colorpicking in GIMP, eyedropping in PowerPoint) its size and colors in a graphical software. To carry out this process we must download the figure and open it in a software. In this case, we can use both pixel and vector graphical programs.

To tell the size we can use the size boxes, to tell the colors, the eyedropper tool. The size, according to GIMP is 136×272 px and according to PowerPoint is 3.6×7.2 cm. This implies that the proportion of the height and width is 1:2. The color triad in GIMP is RGB (206,32,42), (255,255,255), (5,135,80) in decimal, and #CE202A, #FFFFFF, #058750 in hexadecimal values. Since data connected to the flag are officially not declared, we cannot be sure whether our measures are correct or not.

We must look for further data. In this case we can turn to the internet for both conventional keyword-based search engines and AI chatbots. In the first case, the Fundamental Law offers a document, the ‘Act on the Use of the Coat of Arms and Flag of Hungary and on State Honours’ (Szilner 2013) which might help. However, this piece of text does not provide the data we are looking for.

Figure 2. The pictures of the flag provided in the Fundamental Law webpage (left) and PDF file (right).



3.2. Data from ChatGPT

We started our internet search with the popular ChatGPT with the ‘Give me the size and the colors of the Hungarian flag’ prompt both in Hungarian and English. The results of ChatGPT are presented in Table 1, where the Hungarian answer is translated to English with ChatGPT.

Table 1. Data from ChatGPT answering out prompt.

Hungarian answer (translated to English by ChatGPT)	English answer
<p>The official dimensions and colors of the Hungarian flag are as follows: Dimensions: The Hungarian flag has specific proportions regulated by law. The length is approximately one and a half times the width. The official dimensions are: length 2 units, width 1.4 units. Colors: The Hungarian flag uses three colors, and they are as follows: Red: The vibrant red color forms the base of the flag. White: In the middle of the flag, there is a white stripe symbolizing the purity and innocence of the nation. Green: On the other side of the flag, a green stripe represents Hungarian nature and hope. These colors and proportions are officially defined and accepted in Hungary.</p>	<p>As of my last knowledge update in January 2022, the Hungarian flag consists of three horizontal stripes of equal width. The top and bottom stripes are red, while the middle stripe is white. The aspect ratio of the flag is 1:2, meaning the width is twice the height. Please note that national flags can occasionally undergo changes, so it's a good idea to verify this information with a current and reliable source to ensure accuracy.</p>

The Hungarian answer refers to the law (without sources) which we already checked and found that it does not tell either the size or the proportion of the flag and the stripes. Considering the colors, the answer mentions three colors, which is correct. Apart from the colors, the output provides rather unrelated, messed up data, but not much information. The English version is completely out of track when the colors are in question. Furthermore, it provides a different proportion of the width and height of the flag. The question arises, who is right? Both cannot be. There are three further options: (1) the Hungarian is correct, (2) the English is correct, and (3) neither of them is correct.

Based on these data the flags are drawn in PowerPoint. For the vibrant red color, mentioned in the Hungarian ChatGPT output, the #FF272A RGB code is applied, the white is #FFFFFF by default, and the green is up to our selection (the theme color Green, Accent 6, Darker 25% with the #548235 RGB code is selected without any further consideration).

At present we have three sources: the figure in the PDF file, answers of the Hungarian and the English ChatGPT. The results are presented in Figure 3. The figures show that we have three different flags which implies that the available data are not sufficient.

Figure 3. Flags drawn in PowerPoint based on the data available in the PDF file (left), in the Hungarian ChatGPT (middle), and in the English ChatGPT (right).



3.3. Data from keyword-based conventional internet search

We continue the search on the keyword-based conventional search platforms. One of the matches is the webpage entitled ‘The Use of the Hungarian Flag with Legal Requirements’ that provides

official sources and data which seems reliable (A Magyar Zászló Használata Törvényi Előírásokkal, 2020). The webpage states that the proportion of the width and the height is 2:1 which is in accordance with the data of the PDF file and with the answer of the English ChatGPT. However, the page does not say anything about the colors, consequently, we must continue the search.

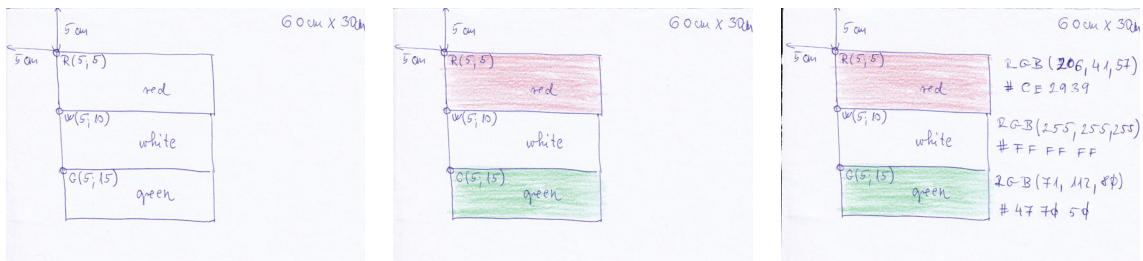
The further search leads us to the webpage of Flag Color Codes (n.d.) and its Hungarian page (n.d.). The webpage states that ‘The Hungarian flag has 3 primary colors, which are red, white, and green. A table below has the common and popular codes of these colors...’. Sources are not presented, but it is remarkable that the colors are marked as ‘common and popular’. This result seems to be the most reliable, so we use the RGB codes offered here (red: #CE2939, green: #477050) to design our flag.

4. Drawing the flag

4.1. Design

All the data are collected which needed to design the flag. This process is carried out on a piece of paper which imitates the digital page (slide). In the design phase, first the slide size must be set up. We know the proportion of the width and the height, and we also know from previous studies that whole numbers are much more convenient than real numbers. Considering these data, we plan the slide size as 60×30 cm.

Figure 4. The three phases of the handmade (unplugged) plan of the flag.



In the following step the position and the size of the rectangles (stripes) must be decided, then the names of the objects and the RGB codes. The three major steps of one possible solution are presented in Figure 4. For the RGB codes, both the decimal and the hexadecimal codes are available whose use should match the target conditions of the task.

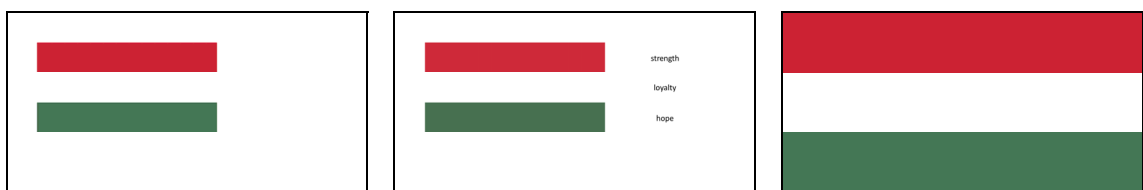
4.2. Act – Realization

Once the plan is set up, we create the PowerPoint presentation following the design. One possible algorithm is the following:

- saving and naming the empty file (the repeated savings are not listed in the algorithm)
- setting the paper (slide) size
- setting the grids
- inserting a rectangle (red stripe)
- naming, coloring (setting the fill color and removing the outline), positioning the rectangle
- duplicating the rectangle
- naming and formatting the second rectangle (white stripe)
- duplicating the rectangle
- naming and formatting the third rectangle (green stripe)

Setting the grid is not mentioned in the design, since it has no connection to the flag, however a wisely selected grid setup can speed up the work (the realization). For our convenience, a 5 cm grid is selected with the automatic snap to the grids. Based on the design and the algorithm, three possible results are presented in Figure 5 (solutions are available at <https://bit.ly/hungarianflag>).

Figure 5. Three possible results for the digital flag.



5. Discussion

As the details above indicate, a short description of the flag in the history book (Borhegyi, 2020) turns out to be a rather demanding data/information search and a graphical (drawing) project in digital environment. To draw a paper-pencil flag does not require too much information, however, to create a digital flag we must utilize subject integration and TPACK. Subject integration allows us to apply a pull education production system, where the task provides the requirements, the target conditions (the subtasks), and the tools applied, not the other way around when the tools are in the center.

The collected data allow us to create several different flags, which is always the decision of the class and/or the teacher, depending on the target conditions. Four examples are the following:

- a flag that totally fill in the page (Figure 5, Column 3),
- one that partially fill in the page, but the proportion of the flag equals to the proportion of the slide (Figure 5, Column 1) (the presented algorithm is set up to this solution),
- adding extra objects with the meaning of the colors (Figure 5, Column 2),
- static or animated objects on the page(s).

6. Conclusions

The paper provides the details of how a short descriptive paragraph with a paper-pencil flag drawing and reading comprehension task can be converted into a digital project. The details of the solution reveal that various computational thinking skills can be developed with the digital solution, and subject integration plays a crucial role. On the one hand, the task can provide real content to computer lessons, on the other hand, learning history can adapt computer supported solutions. Consequently, computational thinking can play a similar role to the three fundamental skills – reading, writing, and arithmetic (3R) – which is the goal and the requirement of the future.

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NURTURING EQUALITY AND COLLABORATIVE LEARNING: A CASE STUDY OF STUDENT VOLUNTEERS AND COORDINATORS' RELATIONSHIP DYNAMICS

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Abstract

School volunteer programmes (SVP) facilitate students' community engagement, their personal growth and contribute to positive social change (Medlobi et al., 2021). Within the Croatian educational system, SVPs are integrated into school curriculum as extracurricular volunteering clubs, operating on the tenets of tolerance, solidarity, justice, inclusivity, and sustainable development. However, they facilitate a meaningful connection between students and teachers who coordinate SVP, as well. Such a relationship is defined by structured, continuous, and enduring students' engagement in volunteering endeavours within and beyond school's confines (Kamenko Mayer et al., 2019). This paper explores the dynamics of the relationship between student volunteers and coordinators of SVPs. A qualitative case study involving six focus groups with 38 student volunteers was conducted to describe and better understand such relationships. The thematic analysis reveals that coordinators foster a supportive, inclusive, and safe community. They cultivate quality relationships on mutual understanding, acceptance, respect, and equality. Students portray coordinators as inspiring figures who don't convey strict hierarchical settings and treat young people with high respect. These relationships play a pivotal role in dispelling preconceptions about hierarchical dynamics between students and teachers, thus promoting equality and democratic interactions. These interactions and experiences also lay a foundation for effective collaboration, teamwork, creative expression, and collaborative learning. The SVPs thrive in a relaxed and informal atmosphere, and are characterised by close, nurturing, and collaborative relationships. Trust is created between student's volunteers and teacher-coordinators, with the relationship being portrayed as warm-hearted and affectionate to that of a 'maternal figure'.

Keywords: *School volunteer programmes, student - teacher relationship, secondary school, sustainability citizenship, qualitative case study.*

1. Introduction

The aim of democratic societies is to cultivate the characteristics of sustainability citizens (UNESCO, 2014). These characteristics imply the interrelation between the cognitive, socio-emotional and behavioural domains. Such citizens must have critical thinking skills, the ability to reflect and self-reflect, as well as values, attitudes, and motivation for sustainable development to act in accordance with its goals (Littlelyke, 2008; UNESCO, 2017). The concept of citizenship in general can be indistinct for students if its teaching is not approached in an appropriate way (Čulum et al., 2016). Volunteering within the formal education system has the potential to create space for exercising the role of an active and socially responsible citizen (Arnot, 2005; as cited in Čulum et al., 2016), or in this context, the role of a sustainability citizen. In this paper, school volunteer programmes (SVPs) are recognised as a model of education for sustainable development as they encompass its fundamental characteristics. As such, it is understood as a model that has the potential to contribute to the development of the characteristics of sustainability citizenship. SVPs promote students' engagement with the community, their personal development and contribute to positive social change (Medlobi et al., 2021). In the Croatian education system, SVPs are integrated into the school curriculum as extracurricular volunteering clubs and are based on the principles of tolerance, solidarity, justice, inclusivity, and sustainable development. However, they also enable a meaningful connection between students and the coordinators of SVPs (teachers and/or professional associates). Such a relationship is characterised by a structured, continuous, and sustained engagement of students in volunteering (Kamenko Mayer et al., 2019).

Coordinators typically include teachers and professional associates, such as pedagogues, psychologists, and librarians, affiliated with the school. They are recognised as one of the key actors in shaping these programmes as a platform where young people have the opportunity to develop the characteristics of a sustainability citizen. Coordinators of SVPs are a key figure in all segments of the programme and have a dual role. On the one hand, they are responsible for the organisation, implementation, and promotion of the volunteering activities, and on the other hand, they motivate and mentor student volunteers. As part of the programme organisation, coordinators are expected to advocate volunteering in their school community and work with external stakeholders, i.e., potential partners, in the implementation of volunteering activities. When working with student volunteers, the coordinator's tasks include encouraging students to volunteer, finding numerous and diverse volunteering activities, providing support when students organise volunteering activities on their own, and ensuring the necessary conditions for the realisation of these activities. Furthermore, coordinators have multiple tasks. They introduce students to volunteering and equip them with the necessary knowledge and skills. They also maintain constant communication with student volunteers. This includes monitoring the students' work and establishing a system to evaluate their engagement. Beyond monitoring the implementation of the volunteering activities, coordinators also play a vital mentorship role for student volunteers. They support students throughout the process and provide mechanisms for reflection and self-reflection. These mechanisms enable students to contemplate their volunteering experiences, facilitating self-awareness regarding the knowledge, skills and values they acquire. Coordinators help students understand how these competencies can be transferred into the framework of the formal educational process, but also personal growth and development (Kamenko Mayer et al., 2019). This type of support and guidance ensures long-term student engagement in the SVP and in the future. This empowerment is crucial as it prepares students to make positive changes in the community.

The relevant literature points to the need for role models and mentors in the educational process in general, i.e., people who stand for the realisation of a particular idea and with whom students build long-term and close relationships characterised by support and qualities such as empathy, trust, and patience (Reid & Jones, 1997; Sadler, 2015). According to social learning theory (Bandura, 1977, 1986), human behaviour is primarily mediated through contact with role models, and teachers should embody qualities worthy of emulation (Kristjánsson, 2006). Previous research has also confirmed that longer and more intense interaction between students and mentors in an environment that supports pro-sustained behaviour is more likely to lead to the adoption of such behaviour (Higgs & McMillan, 2006; Hill, 2012; Payne et al., 2003).

Wahrman and Hartaf (2021) suggest that in order to be role models for students, coordinators should be "good" citizens themselves and believe strongly in active citizenship. The same viewpoint is reflected in the findings of Moore and Allen (1996) who suggest that role models can influence adolescents in recognising prosocial values, developing social skills, and reducing risky behaviours. Furthermore, it is necessary for coordinators to have a strong pedagogical tact, i.e., to question and challenge traditional pedagogical constraints, especially those reflected in formal education, with the aim of achieving social change (Vrcelj et al., in press).

2. Methodology

The results presented in this paper are part of the doctoral dissertation and aim to describe and understand the phenomenon of SVPs in Croatian high schools and its role in cultivating characteristics of sustainability citizenship. Thus, the main research question is focused on experiences, processes, and activities within SVCs that foster high school students' potential to develop characteristics of sustainability citizenship, and how? Specifically, the doctoral dissertation was interested in the related influential characteristics of the school context, community collaboration, volunteering activities, the structure of SVPs and the role of coordinators in the overall phenomenon of cultivating sustainability citizens. This paper specifically focuses on the findings related to the role of coordinators of SVPs and their relationship dynamics with student volunteers.

A qualitative case study was chosen as the research strategy, as it enables detailed observation of a case from multiple perspectives and in different ways (Patton, 2002; Thomas & Myers, 2015). In this study, the triangulation strategy was applied to data collected from different sources and using different methods: I) semi-structured in-depth interviews (coordinators), II) focus groups (student volunteers) and III) qualitative content analysis (school curricula), all with the aim of gaining a deeper and more comprehensive understanding of the researched phenomenon. This paper presents the results of focus groups with student volunteers.

For the purposes of this study, six cases were selected, all rich in information and with strong potential for providing answers to the research question. Between April and November 2021, focus groups were conducted involving 38 student volunteers aged 15 to 18. The collected data was then transcribed and analysed using MAXQDA software. The rigour thematic analysis was conducted according to the phases proposed by Braun and Clarke (2006).

3. Results and discussion

3.1. The irreplaceable role of coordinators in school volunteer programmes

Thematic analysis clearly expresses that the coordinators are the merit of the SVPs. They are the ones who make volunteering in the formal education system possible, who plan and organise all the activities within the volunteer programme. Furthermore, their activities have a significant impact on the student volunteers. Firstly, they are often the main actors in the recruitment of new volunteers and serve as significant others who motivate, inspire and guide. Secondly, they monitor student progress and make a positive contribution to the school and community as a whole. The importance of coordinators in this study is clearly irreplaceable, as students expressed:

"When I grow up, I want to be like our coordinator."

"She is a great motivation in everything."

The results of the focus groups also make it clear that the students perceive the coordinators as key figures in the programme. They create a safe environment for the student volunteers and support them throughout the process of implementing the programme. Such an environment is considered particularly important in intense and stressful situations that sometimes occur during the realisation of volunteering actions and that can pose a certain risk to young people (Millora, 2023). It is therefore necessary to create an environment in which student volunteers feel protected, with the aim of having a positive experience of volunteering.

3.2. Coordinators have a special status among student volunteers

The results of the analysis illuminate the profile of coordinators based on the descriptions and perspectives of student volunteers. It is recognised that coordinators are individuals who have a strong desire to help and a commitment to activism, individuals for whom there are no barriers to ensuring the progress of SVPs and involvement of other stakeholders of interest. In the eyes of the students, all coordinators are exceptional coordinators, teachers, professional associates, and human beings. Student volunteers describe them as proactive, determined, persistent, innovative, and creative with a strong enthusiastic commitment.

The student volunteers also describe experiences where the coordinators showed understanding and proved to be people they could confide in. They perceive them as best friends and some of them view them as motherly figures. All students indicate that the friendly relationship with the coordinators does not undermine their respect for them. They highlight that coordinators can set clear boundaries during class and within SVP, as illustrated in the following excerpts:

"It's not that when we meet, we only talk about volunteering, but if someone has a problem with the school, she arranges a meeting with the pedagogue and say we can also talk to our parents if someone needs something like that."

She takes great care of us."

"We can tell her everything openly, about teachers, about absolutely everything that bothers us at school. But she immediately had this approach that everything is open and relaxed, it's not like she was reserved at the beginning. She allowed us to talk openly."

3.3. Building democratic and inclusive relationships in school volunteer programmes: equality and collaborative learning

In almost all volunteer programmes, harmonious relationships are built between students and coordinators. Students describe the atmosphere as relaxed and emphasise the equality of all participants. The relationships that develop within the volunteer programme are often described by the students as "democratic" and they are proud of this. Above all, such equality is reflected in the allocation of tasks and mutual cooperation and respect.

The coordinators often participate with students in the implementation of the volunteering activities. Some students emphasise that they are particularly happy that the coordinators take part in the volunteer activities with them. This makes the students feel even closer to the coordinators and gives them the feeling that everyone is equal in the SVP.

"She goes to the volunteering activities with us, it's not like she just organises them and then sends us off on our own."

As adults who treat the students with respect and seriousness, the coordinators represent stable figures who do not insist on strict hierarchical settings. In such an environment, the students feel safe, accepted, and free to actively participate without any fear of judgement. One of the most significant results is that the coordinators openly display their humanity and vulnerability to the students, showing them no fear in revealing their weaknesses. This openness, together with their participation in volunteering activities, helps them to get to know and understand each other better. Such examples assist in overcoming prejudices about hierarchical relationships between young people and teachers, while promoting equality along with democratic relationships. In addition, such experiences create a good basis for good cooperation, teamwork, creative work and collaborative learning. The closeness that is created is a source of even greater respect for the coordinators.

"When we take part in these workshops, there is no teacher-student relationship, the difference disappears. It's not so official and strict."

The positive relationships between students and coordinators, as well as the relaxed atmosphere in SVPs are largely attributed to their cooperation both inside and outside of school settings. Thematic analysis reveals that student volunteers recognise coordinators as relatable individuals, especially through moments observed outside of school. These instances include informal interactions, witnessing coordinators in casual attire, and seeing them express emotions, all of which reinforce their humanity. Understanding coordinators as people first and foremost plays a crucial role for students, diminishing any fear towards teachers and fostering a deeper appreciation for their work. This realisation also helps in dispelling common prejudices towards teachers and professional associates, promoting a more inclusive and understanding school environment.

"As part of the SVP, I realised that professors are not just professors, but can also be friends."

Echoing the findings from the literature, the research results underscore the importance of regular, clear communication, as well as honesty, openness, and authenticity. These elements are fundamental to fostering a friendly and relaxed atmosphere (Medlobi et al., 2021). The conclusion that a positive atmosphere and close relationships play a key role is not new in the context of volunteering and education for sustainable development. Both Badger et al. (2022) and Schröder et al. (2020) came to similar conclusions in their studies. The importance of an equal relationship, which implies active listening and mutual respect, is emphasised as a key factor for joint decision-making (Jennings et al., 2006). Kirk et al. (2017), in their study of the student empowerment model, identify equality between teachers and students, the teacher's confidence in the student's abilities and a developed sense of community between students and teachers as key incentives for the development of emancipation.

4. Conclusion

Based on the results presented in this paper, it can be concluded that students and coordinators in SVPs tend to develop high quality relationships. The analysis presented indicates harmonious relationships based on mutual understanding, acceptance, respect, and a sense of equality. There is a relaxed and informal atmosphere within the SVP, characterised by close, caring, and collaborative relationships.

This indicates that the coordinators of SVPs are passionate and enthusiastic individuals dedicated to nurturing a positive and democratic atmosphere within the programme. By breaking down traditional hierarchical structures, they foster an environment of equality and mutual respect where students are encouraged to participate freely in volunteering activities without fear of judgement. This approach not only empowers students to express themselves creatively but also builds a foundation of respect and personal responsibility. The coordinators' commitment to maintaining a respectful and inclusive environment ensures that there is no room for fear or unconstructive criticism, creating a healthy atmosphere that fosters collaborative learning and progress for all participants.

Given these insights, it is evident that the coordinators play a pivotal role as organisers, mentors, and role models. They inspire students to personal growth, community involvement and the adoption of pro-sustainable behaviour. Their approach fosters an atmosphere that encourages collaborative learning and empowerment. It promotes the development of the characteristic of sustainability citizenship among students. By engaging with students as equals and embodying the characteristic of sustainability citizenship themselves, coordinators encourage deeper involvement and collaboration, enhancing the effectiveness of SVPs.

In conclusion, the research advocates for the recognition and support of coordinators of SVPs in formal education. Their role is critical not only in the context of successfully managing SVPs, but even more, in cultivating sustainability citizens. This study emphasises the indispensability of coordinators for the educational and personal development of students in SVPs that are aligned with the sustainable development goals.

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THE 'ENCOUNTER' BETWEEN POSTHUMANISM, TECHNOLOGY AND EDUCATION

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Abstract

The starting point is a definition of posthumanism as a critical theory in humanities that deals with the question is what it means to be a human in the present conditions of globalization, technoscience, and climate change. There is the prospect of opening up new possibilities of how to be a human and what kind of a human. This does not mean that the end of humanity is near, but rather the end of a certain conception, a conception which at best was considered to refer to "a fraction of humanity that had wealth, power, and enough leisure to conceptualize itself as autonomous beings fulfilling their will through individual action and choice" (Hayles, 1999). The prefix "post-" in posthumanism, therefore, does not mean a complete break with that main part of the term, but rather is a sign of the ongoing deconstruction of what it "prefixes". It is a kind of "conceptual parasite that inhabits humanism itself and tries to get it to address its own contradictions" (Herbrechter, 2018b). Through this conceptualization of posthumanism, the author reflects on the relation between technology and education, and the understanding of the influence and use of digital technology in school. Does the latter enable education to be "better" (more effective, more available to everyone)? Following will be the reflection on the relationship between the conceptualizations of new technologies within a given theory of education and the kind of subject that is envisaged as the outcome of such education. Is technology purely a tool or perhaps it changes the outcomes and conceptualization of education? What kinds of changes are happening in schools in this regard? The changes, as it seems, are not (only) educationally-based, but are economically induced too.

Keywords: *Posthumanism, education, knowledge, technology, digitalization.*

1. Introduction: Prefix

I would like to start by paying some attention to N. Katharine Hayles' book *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999), which is certainly a reference work for the field of cybernetics (as discourse and technology) and the posthuman as a phenomenon that brings both horror and pleasure. Horror, says N. K. Hayles, is relatively easy to understand, since the "post-" suggests that man's days are numbered (I will return to this prefix immediately). Many authors believe that what is at stake here is not only the intellectual replacement of the definition of one kind of human being by another, but also, in a quite literal sense, the replacement of human beings as the dominant form of life on the planet by intelligent machines – which would mean, that "humans can step meekly into that good night and join the dinosaurs as a species that once ruled the earth but is now obsolete, or they can stay a little longer by turning themselves into machines" (Hayles, 1999) (The poetic expression must be explained a bit. It is the rephrasing of the line "Do not go gentle into that good night" by Dylan Thomas from the poem of the same title (night as a metaphor for death). However, N. K. Hayles does not mention Thomas).

There is the prospect of breaking out of old frameworks and opening up new possibilities of how to be human and what kind of human. This does not mean the end of humanity, but the end of a particular conception of humanity. This conception is at best applied to "the fraction of humanity that had the wealth, power, and leisure to conceptualise themselves as autonomous beings who fulfill their will through individual agency and choice" (Hayles, 1999).

As Stefan Herbrechter (2017) puts it – this is more of a conceptual remark, but it is also partly terminological – in this ongoing "deconstruction" of humanism, it is necessary to distinguish between the figure of the "'posthuman' (and its present, past and foreseen avatars, such as cyborgs, monsters, zombies, ghosts, angels, etc.) and 'posthumanism' as a social discourse", which tackles "the pressing question of what it means to be human under conditions of globalisation, technoscience, late capitalism, and climate change".

The prefix "post-" therefore does not mean a complete break with the main part of the expression, but rather a sign of the ongoing deconstruction of what it "prefixes". It is a kind of "conceptual parasite that inhabits humanism itself and attempts to get it to address its own contradictions" (Herbrechter, 2018b).

Rosi Braidotti defines the posthuman as a convergent phenomenon between posthumanism and postanthropocentrism, which, on the one hand, implies a critique of "the universal ideal of the thinking Man and, on the other, a rejection of the multivalence of the species" (Braidotti, 2019). (This refers to a biological species.) "The political implications of this shift are significant. If the revision of humanism enacted by feminist, queer, anti-racist, ecological and postcolonial critiques has empowered sexualised and racialised – but still human – 'others', the crisis of *Anthropos* supports naturalised others" (which means non-human entities – animals, plants, cells, etc. – as a sort of conceptual personae) (ibid.).

As to the methodology of this short contribution: I use an interpretative approach and am interested in concepts, and in examining some fundamental questions regarding human and education. I find Donna Haraway's idea of scientific practice as a story-telling practice extremely compelling (Lykke, Markussen, & Olesen, 2000). This means that theoretical content, methodology, style, and epistemology are interconnected (ibid.). So, I do not offer an evidence-based approach, my main objective is to reflect on the issue in question.

2. Conceptual work: Posthumanism

I take posthumanism as a critical theory that thematises a series of ruptures with the traditional assumptions of Western culture, in particular a different (perhaps new?) understanding of the human subject in relation to the world. This brings with it a new epistemology that is no longer based on dualisms and that undermines/attempts to undermine the traditionally set boundaries between human, animal, and machine (actors in the so-called cybernetic triangle). Posthumanism could therefore be a discourse on what it means to no longer be human, at least not in the (traditional) humanistic sense (Herbrechter, 2018b).

Technology enters posthumanist debates through the mediation of feminism or feminist theory, in particular Donna Haraway as one of the most important authors in this field, and the figure of the cyborg (Ferrando, 2013; see also Haraway, 1991). This figuration is perhaps the most familiar in her work, on the one hand as a synthesis of man and machine, which is mainly a figure from science fiction films and literature (and, with some minor extrapolation, also contemporary medicine), which is perhaps less interesting here.

Donna Haraway, through the character of the cyborg, shows that the old established dualities can no longer hold. In short, she is not concerned with synthesising man and machine into one, but with the view that the binary oppositions of humanism must be overcome if unjust privileges are to be overcome. These stem from an understanding of difference as inequality, opposition, and a hierarchical relationship between the two.

It is now clear that posthumanism is not an entirely new "discourse", but (perhaps more accurately) a way of recognising and incorporating a wide range of different critical approaches (feminism, anti-colonialism, technology studies, even ecology ...) that are "directly based on contesting how humanism has constrained politics and education" (Snaza et al., 2014). And it is precisely the process of "humanisation" – leading students towards humanity – that is one of the central foundations underpinning the whole concept of education in Western culture or society.

3. On education

Formal education in the West, as Helena Pedersen (2010) argues, is firmly rooted in humanist ideals. "'Becoming human' through the cultivation of certain cognitive, social and moral capacities has even come to symbolise the idea of education as such in Enlightenment philosophical traditions" (ibid). William Spanos (1993) explains the traditional view of education as leading away from something (say, the darkness of ignorance) towards a universal light (knowledge or knowing), while at the same time leading towards humanity.

The question is then how the “encounter” between posthumanism and education can work, how posthumanism can help to change educational theory and practice, how to “enrich”, “change”, and “improve” knowledge-acquisition practices, etc.

Another point to pay attention to is the issue arising from the emerging (in fact, largely already emerged) global information society and the establishment of distance learning environments, which is taking place in the form of a "repackaging of the (humanistic) notion of education as 'knowledge transfer'" (Herbrechter, 2018c). This means that the previous humanist consensus that another important task of education – i.e., to develop an idea of "personality" – has almost completely disappeared (ibid.).

One of the current views on education and technology is that the latter makes education "better", i.e., more efficient, more available, etc. – which, incidentally, is proving to be highly problematic. So, all the implications of the digital aspects of contemporary education need to be weighed up: the assumption that the value of digital technology is largely or purely instrumental cannot stand (Bayne, 2018).

Moreover, technology does not stand in a vacuum, of course, but reflects, and often exacerbates, social problems that already exist. Communication via the computer network is far from blurring social divisions because the markers of these divisions or unprivileged placements are inscribed in various ways in the act of digital communication. A utilitarian understanding of technology, in the sense that it is better to learn something or even better to connect with children or teenagers who are more tech-savvy than teachers, by their very nature, etc., is therefore not enough (Herbrechter, 2018a); nor, of course, is the path that would lead us to technophobia (ibid). The task of critical posthumanism is precisely to navigate between the mirrored antitheses of discomfort and euphoria (Zefelius Igrek, 2015). The simplification does not benefit either the research field or the field of practice. It loses complexity and reduces our understanding of the phenomena with great social significance, which is not, as Bruno Latour has said (cited in Bayne, 2018), about instrumental thought, but about the substance of our societies. That is to say, the idea of a "post-humanist" education must at least be placed in a historical and broader social context, and "models of emancipation" must be re-established that would apply to a growing number of actors.

4. Conclusion: Coordinates for navigation

We have touched on the relation between human and technology with a focus on education in several places. As far as education is concerned, it is true that the “threat” to education today lies primarily in the combination of the neoliberal economy and the rationalising processes of learning/teaching made possible by new media/technology (Herbrechter, 2018c). Thus, changes are taking place in educational institutions, which are supported in different ways: economically, technologically, through the media, etc. The leap in reflection (which in some contexts has yet to be made) goes from the “false opposition” mentioned above to understanding the human being not as a tool user, but perhaps as a being that exists precisely because of its relationship to technology and that is continuously transformed by this relationship (Müller, 2016).

In this paper, I have therefore tried to identify "posthumanism" as a valuable and theoretically grounded notion that is a starting point for reflection, on the one hand, on the relationship between the human being (the traditional liberal subject) and technology, and, on the other hand, on the role of technology in the school and the changes it brings about. Besides, the not-so-far-away moment of health crisis linked to COVID-19 exposed crisis at various levels of society, in which existing inequalities (such as poverty or the deterioration of living conditions linked to the climate crisis) are being exacerbated and new ones are emerging, including in relation to technology or the "digitalisation" of everyday life.

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TRANSFORMATION OF MARKETING AND SALES ROLES IN B2B COMPANIES: IMPLICATIONS FOR HIGHER EDUCATION

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Abstract

The evolving landscape of B2B marketing and sales faces multifaceted challenges spurred by digital transformation, AI integration, efficiency measures, and the pandemic's shift from personal to virtual interactions. These changes prompt a reevaluation of departmental functions and collaboration between marketing and sales, impacting the education of future managers. This study delves into the roles of marketing and sales in technical B2B companies and their implications for higher education. Three investigations were conducted: analysis of 150 job ads, four focus groups, and a quantitative survey (N=114), exploring marketing-sales interfaces. Findings stress the need for enhanced digital skills and customer-centricity in marketing education. Marketing and sales professionals require heightened analytical prowess for managing extensive customer data. Evolving job titles like customer relationship manager and omnichannel marketing manager denote a growing fusion between departments, focusing on individual customers rather than on target groups as suggested by classic marketing textbooks. Lead generation, once exclusive to sales, now spans both realms, yet disparities in perceptions lead to potential conflicts. Curricula should emphasize direct customer interaction for marketers and analytical depth for sales, enabling effective digital negotiations while preserving customer relations. Lastly, educational institutions should reconsider the traditional division between marketing and sales in curricula, fostering a more cohesive and collaborative mindset among future managers.

Keywords: *Marketing education, sales and marketing functions, marketing-sales integration, marketing curricula, sales education.*

1. Introduction

This study examines digitalization's impact on marketing and sales in industrial B2B firms and its implications for marketing and sales in higher education. It highlights the growing importance of technical and digital skills for managers in these fields, accentuated by the increasing digitalization, notably accelerated by the recent global pandemic. (Fabrizio & Vo, 2023; Rodrigues, Takahashi, & Prado, 2021). Empirically, the research focuses on industrial B2B entities, which encompass companies involved in producing and delivering goods and services, including specialized software for industrial purposes. This sector represents around 80% of businesses in Europe according to Eurostat. (2020). The presence of B2B-focused marketing and sales positions in Austrian job listings underscores their significance in the local market. However, there remains a gap in understanding digital capabilities within B2B sectors (Herhausen, Miočević, Morgan, & Kleijnen, 2020), as well as the ability to break down disciplinary silos between marketing and sales in education calling for further exploration in these areas.

2. Digital technologies in marketing

Digitalization transforms B2B marketing, enabling platforms that enhance firms' capabilities and foster value co-creation in the market (Kim & Moon, 2021). Technology revolutionizes marketing, emphasizing customer relations and the service economy, reshaping traditional approaches and urging the bridging of knowledge gaps (Lilien, 2016). Marketers leverage technology to build personalized connections, anticipate needs, and offer tailored solutions. Digital data provides profound insights into consumer behavior, guiding data-driven decisions to optimize strategies. The digital realm blurs the lines between marketing and sales, allowing marketing to take on roles historically attributed to sales across industries. Yet, a definitive understanding of digital innovation's precise impact on marketing remains elusive. The complexity and evolution of these concepts hinder a comprehensive grasp of their effects on present marketing practices. The potential use of artificial intelligence (AI) in personalized B2B

marketing strategies is anticipated, signaling advancements in this field (Chen, Jiang, Jia, & Liu, 2022). The question remains as to what extent universities are already prepared in their teaching for these dramatically changed practical requirements.

3. Interplay of marketing and sales in B2B companies

Kotler and colleagues (2006) outlined the historical tension between marketing and sales, citing marketing's customer disconnect and sales' short-term focus. Decades of discourse have scrutinized their blurred boundaries in B2B settings (Le Meunier-FitzHugh & Piercy, 2009). Recent scholarship forewarns of digitalization potentially shifting responsibilities from sales to marketing, reigniting conflicts (Baycur, Delen, & Kayışkan, 2022; Khan & Basak, 2021). Traditionally, marketing crafts strategies for broad audiences, while sales nurtures individual relationships and closes deals. Digitalization transforms collaboration, yet debates persist about the impact of integrating these functions (Rouziès & Hulland, 2014). This high level of technology-driven interdisciplinarity also poses significant challenges for universities.

4. Marketing and sales in higher education

The lag between evolving employer demands and business curricula arises due to the rapid evolution of the knowledge economy, which outpaces management education's adaptation in universities. This discrepancy becomes pronounced, particularly in the case of AI education, due to AI's interdisciplinary nature, posing challenges for cross-disciplinary integration in academic settings (Sollosy & McInerney, 2022). In academia, despite numerous academic programs available in Europe labelled "Marketing and Sales", the challenge lies in the disconnected teaching of marketing and sales. The segregation between these fields in education perpetuates silos that affect graduates' mindsets, while companies focus on cross-departmental collaboration to enhance efficiency (Markovitz, Long, Fain, & Sandler, 2021). Another issue pertains to students' inadequate inclination toward quantitative analysis within marketing education. Many students hold misconceptions about the mathematical rigor required in marketing programs, resulting in limited exposure to data-centric study content, a crucial need in modern industries (Flight, 2021; Miah, Solomonides, & Gammack, 2020).

This research employed a tripartite approach comprising job ad analysis, focus groups, and surveys to delve into the evolving requirements and overlaps between marketing and sales roles.

5. Methodology

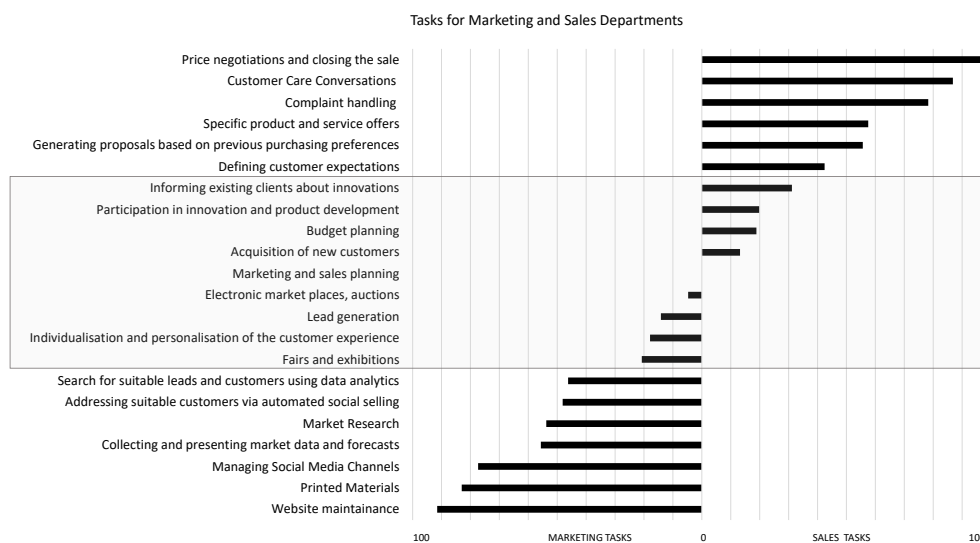
Initially, a comprehensive analysis of 150 recruitment advertisements sourced from three popular job platforms (karriere.at, willhaben.at, LinkedIn) provided insights into evolving job requirements. The job advertisements were analyzed and categorized based on several key themes, such as *Interconnection between Sales and Marketing Roles*; *Fusion of Sales & Marketing Jobs*; or *Technological Proficiency*. Subsequently, a series of focus groups engaged experienced marketing and sales professionals from B2B companies, extracting deeper insights into evolving job roles, functions, and the impact of digitalization on daily operations. Guiding set of questions was developed, encompassing several key inquiries, such as: *How is the alignment of sales and marketing structured within your company? How do you foresee the evolution of collaboration between sales and marketing? What were the most significant changes observed within your department?* Four focus groups with 3-6 people each were administered. Lastly, a quantitative study targeted marketing and sales professionals, gathering 114 responses that assessed the changing landscape of tasks, digitalization-induced changes, and anticipated future developments in their domains. The interviews were done online with a structured questionnaire and mostly scaled questions. The respondents were distributed as follows: 15% in top management, 12.5% in sales management, 13.3% in marketing management, 11.7% in marketing staff, 16.7% as Key Account Managers, 8.3% in sales staff, and the remainder held various positions. 90% of the respondents originated from B2B companies, 70% from international corporations, 31.7% from large enterprises, and 25% from small and medium-sized enterprises (SMEs). Of the respondents, 59.2% were male, 39.2% were female (with the remainder choosing not to specify). The most prominent age groups were between 19 and 25 years old (8.3%), 26 and 30 years old (26.7%), 31 and 35 years old (24.2%), and 36 and 40 years old (16.7%).

6. Findings

The *job ads analysis* highlighted a surging need for digital marketing skills like SEO, web design, and programming, alongside vital analytical competencies in business analytics and data management for marketers as well as for future salespeople. Notably, there is an increasing number of job titles like *customer relationship manager*, *customer success manager*, *customer onboarding manager* and *omnichannel manager*, which underscore the merging of marketing and sales, prioritizing individualized customer focus. Lead generation, once a sole sales task, now spans both departments, emphasizing the evolving synergy. Among analyzed marketing roles, 56% include elements of sales, focusing on sales strategies, pricing, and customer interaction. Conversely, 28% of open sales positions call for traditionally marketing related activities, such as collaborative strategies, product positioning, and introducing new products. KAM positions largely link to sales, aligning with its current placement in the sales department. However, 50% showcase ties to marketing, involving campaign creation, document design, and even integration within the marketing team. This suggests a potential future shift of KAM towards marketing or a bridging role, aiming to enhance customer satisfaction through joint marketing-sales efforts.

The *focus group investigation* uncovered enduring divides between marketing and sales, with sales dominating, undermining marketing's value. Strategies like cross-departmental rotations were mentioned to be essential for integration. The emphasis on digitalization, including AI and CRM tools, is critical for survival. Various digital marketing tools and skills, such as SEO, Google analytics, and graphic design, underscore technology's role in cost-saving and problem-solving. Marketers need advanced technical skills and a customer-centric approach. Misconceptions about sales overtaking marketing persist despite both departments being crucial. Most respondents agreed that AI and CRM tools underscore the necessity of closer collaboration, especially for tailored products. Sales prioritizes revenue, while Marketing focuses on R&D, and the significance of personal contact in B2B relationships remains evident. The imperative for enhanced collaboration between marketing and sales was emphasized by both marketing and salespeople, still highlighting the current dominance of sales over marketing, but recognizing the latter's pivotal role in product promotion and strategy. Addressing this divergence involves potential job rotations while maintaining distinct departmental functions. Marketing, often confined to stereotypes, needs recognition for its strategic role in paving the way for sales success. Collaborative training initiatives and either physical proximity or structured meetings were mentioned as an avenue to enhance their joint efforts. Ongoing efforts for improved collaboration between sales and marketing departments necessitate changes like smaller teams and reciprocal trainings. While their complete dissolution isn't expected, improved communication and cooperation are deemed valuable, particularly for production and product management. Suggestions to discard stereotypes and elevate marketing's strategic role aim to align with a leadership (and compensation) model emphasizing joint objectives for improved market readiness.

Figure 1. Tasks allocated to marketing or salespeople.

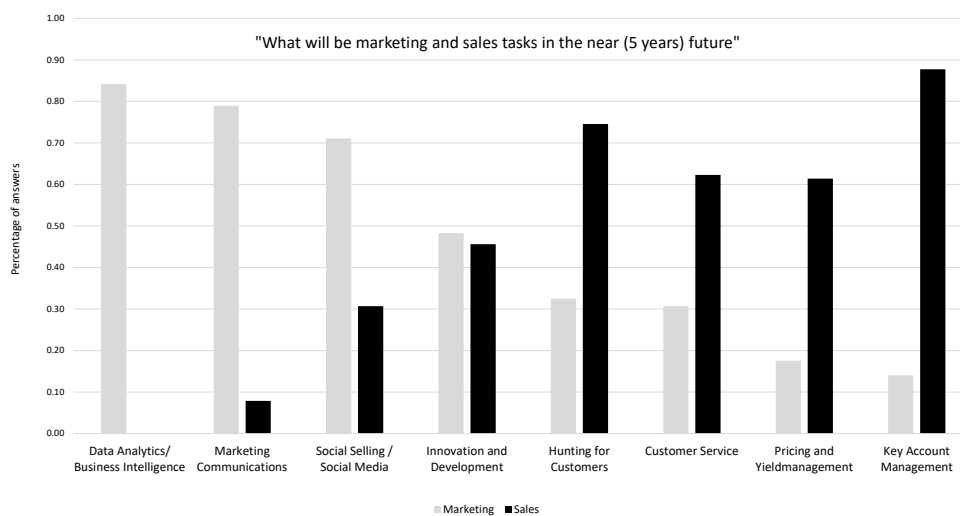


The *survey* highlighted defined tasks like marketing and sales planning, customer acquisition, lead generation, and involvement in innovation and product development (figure 1). While certain areas of responsibility were distinctly attributed to expected roles, numerous tasks lacked clear delineation

within these assignments Tasks marked in the gray area of figure 1, lack clear singular assignment, potentially leading to operational inefficiencies and conflicts, necessitating focused managerial attention to address such challenges. Alternatively, these areas could represent an opportunity to demand and foster systematic collaboration between marketing and sales. Moreover, they present potential for greater integration between disciplines in the academic education of marketing and sales.

In forecasting the competencies expected from marketing and sales departments in the next 5 years, trends indicate a demand for diverse skills. Marketing personnel are anticipated to possess analytical skills, data management expertise, social selling, and social media management abilities. Conversely, sales staff are projected to excel in prospecting, customer service, price and yield management, and key account management (Exhibit 2). Notably, "Social Selling" predominantly falls under marketing, reflecting the growing acceptance of social media in B2B sales. This trend signifies marketing's specialized proficiency in leveraging social platforms for sales endeavors.

Figure 2. Future perspective: Tasks required from marketing and sales departments in 5 years.



Lastly, the examination of the level of integration between marketing and sales, based on Kotler's (2006) categorization and measurement instrument, revealed an integration level of 66.8 (of max 100). This indicates a positive understanding of collaboration between marketing and sales departments, however with potential for improvement. This observation suggests that organizations are recognizing the need for specialized roles that bridge the gap between the two functions and facilitate a more integrated approach. The potential for reaching an integration of marketing and sales lies in the development of shared processes or business funnels designed to manage and measure revenue-generating activities.

7. Implications for higher education

The studies emphasize the importance of integrating technological and digital competencies into marketing and sales related curricula. Institutions can introduce specialized courses focusing on pertinent digital technologies like big data analytics, social media management, and AI-driven marketing strategies for both marketing and sales disciplines. Interdisciplinary collaboration among professors from diverse fields and across academic units of varying disciplines could mirror contemporary corporate organizational structures. Universities can facilitate joint projects or collaborative initiatives among these fields, fostering practical experience similar to real-world business interactions. For example, rotational programs or collaborative projects between marketing and sales classes can deepen students' understanding of their interdependence. To address industry demands, institutions should offer training in analytical skills, social media management, and customer-centric competencies. Incorporating practical training, internships, or case studies that mirror industry requirements can better prepare students. Preparing for future trends entails instilling adaptability, agile thinking, and an understanding of emerging technologies. Universities must equip graduates to navigate evolving industry landscapes effectively. Encouraging faculty to research the impact of digitalization on marketing and sales dynamics can contribute to thought leadership. By integrating these implications, higher education institutions can produce agile professionals well-versed in the evolving realms of marketing and sales, especially in the context of digital transformation.

8. Limitations and avenues for future studies

While this research delved into a specific B2B industrial setting, caution must be exercised when generalizing these results to other domains like services, retail, or B2C sectors. Future studies encompassing these sectors might yield more holistic findings. Additionally, the study utilized mixed methods with relatively small sample sizes. A larger sample, particularly in the quantitative survey, could enhance the robustness of findings and bolster the reliability of conclusions. Acknowledging that this research transpired post-COVID, the pervasive influence of the pandemic, including accelerated digitalization, might have skewed results toward an overly optimistic view of digitalization's impact. Subsequent studies could explore long-term effects beyond immediate post-pandemic dynamics.

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WHEN QUANTITY FOSTERS QUALITY: B-LEARNING AS A WAY TO ACHIEVE THE HIGHER EDUCATION PURPOSE

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Abstract

It is fundamental to create conditions in Higher Education (HE) to support all students in promoting autonomy and the power to act concerning their employability, as job transitions are becoming more frequent, impacting individual trajectories. As an answer to this context, the aim was to create a training programme that proved relevant and accessible to a large number of participants. Likewise, there was a focus on promoting a secure and challenging context to apply the programme's contents and the development of tools that would be useful both during and after its conclusion. A Curricular Unit (CU) was designed in a B-learning format targeting HE students. This CU combines a remote (asynchronous and synchronous) and presential format. The components are organized in steps, which allow students to reflect on their past, their future, and the labour market, and to have an autonomous role in the construction of their learning by selecting the activities they consider most relevant. A monitoring and impact evaluation model for this CU was also constructed. The development process of this CU started with the auscultation of students and companies, combined with a bibliographic review regarding employability. This led to the first design of the CU, which was applied to a pilot edition composed of 32 Bachelor and Master Engineering students, between February and July of 2021. Since then, this CU has been implemented for four semesters, involving over 1200 students. The results of the monitorization and impact evaluation showed that on a scale of 1 to 5, the students attributed an average of between 4.1 and 4.7 to the relevance of the CU's contents and tools. Regarding the future utility of these materials, the students attributed an average classification of between 4.1 and 4.7. The applicability of the CU's resources was also verified through an increase between 15.2% and 20.9% in the actions taken by the students regarding their employability in pre and post-test results. These results remained stable independently of the number of enrolled students. This study appears to show that the auscultation of relevant agents combined with a bibliographic review promotes high content relevance and future utility. Simultaneously, creating a safe context for experimentation during the CU facilitated the students' implementation of a set of actions. Lastly, this study demonstrates that it is possible to involve up to 500 students per semester in a CU without compromising the quality of their learning or their singularity.

Keywords: *B-learning, higher education, lifelong employability, training.*

1. Introduction

Faced with the challenge of an increase in professional transitions (Hareven & Masaoka, 1988; Bridgstock, 2009; Savickas, 2021), exacerbated by ongoing global transformations such as technological and demographic changes (Volkoff, 2011; Savickas, 2021), that impact each person's work and individual paths, there is an urgent need to support people to expand their choices, provide autonomy to manage change and promote the expansion of their power to act (Clot, 2008). The aforementioned changes imply a paradigm shift in vocational development, with the most recent paradigms (Nota & Rossier, 2015; Savickas, 2021) advocating for a lifelong approach, from childhood to retirement age, highlighting the importance of flexibility in career decision-making (Callanan, 2017), derived from the conceptualisation of careers as multidirectional paths, as an alternative to the previous linear paths (Baruch, 2004). In this context, it is essential to establish an effective lifelong learning ecosystem, which is a shared responsibility that requires the active involvement and support of governments, employers and workers, as well as education and training institutions (International Labour Organization, 2019).

Higher Education (HE) students are typically associated with a heightened experience of labour market integration and, as such, increasing attention has been paid to the role of Higher Education Institutions in promoting the students' employability (Bridgstock, 2009; Clarke, 2018). For this reason, it

is crucial to create conditions in HE that support all students in developing employability and career management skills, by promoting a higher level of self-exploration and other proactive career behaviours (Okay-Somerville and Scholarios 2015), integrating these themes into HE curricula (Bridgstock, 2009).

Despite the existence of several programmes aimed at addressing these challenges, empirical research has focused less on those in established adulthood than those in adolescence or early adulthood (Whiston, et al., 2017; Jiang, et al., 2019). The existing literature, says little about how interventions can be disseminated to an increasing number of adults, and according to Guichard (2016), the implementation of group-based interventions at the vocational and professional level deserves further development in terms of how to combine the advantages of this format with the difficulties that can arise in establishing a relationship of trust. At the same time, it is recognised that, considering that everyone can expect to make numerous transitions throughout their lives, it would be important for everyone to be able to learn a systematic method of making decisions in the face of the reconstruction of their career path (Whiston et al., 2017) in an autonomous way.

In this context, the demand to meet the growing needs of students and changes in the field have been challenging HE, which is largely based on an individual guidance model, to develop new models (Young, 2016), that are capable of involving a large number of students (Torii, 2018), expanding access to topics that they consider relevant to their future (Bridgstock, 2009), allowing them to consolidate their own developmental story (Vygotski, 1997), providing tools that they find useful and offering a challenging and safe context in which to apply them (Dacre Pool & Sewell, 2007). To meet this challenge, it is considered essential to use new researched learning models (European Council, 2017) and to ensure that the programme is co-constructed with the effective involvement of various agents, such as students, teachers, companies, and employability services, among others. At the same time, recognizing that scalability must be considered from the outset and at each stage (Gottfredson et al., 2015), the construction and implementation of a monitoring and impact assessment model is considered very important.

Based on the above, our aim was to create a Curricular Unit that proved relevant and accessible to a large number of participants, without compromising the quality of their learning or their singularity, focusing on promoting a safe and challenging context for applying the programme's contents and the development of tools that would be useful both during and after its conclusion. By demonstrating it is possible, we will contribute to creating conditions in HE that support all students in promoting their power to act (Clot, 2008) in relation to their employability, as career transitions become more frequent.

2. Method

A blended learning based Curricular Unit (CU) was created to support the development of the knowledge and skills of Bachelor's and Master's students in order to foster their lifelong employability. The integration of this CU into the students' HE curriculum sought to enable students to work on their employability skills alongside their technical skills.

The development of this CU was composed of several elements, beginning with bibliographical research focused on employability related topics. Afterwards, an auscultation took place, involving 189 companies that were relevant and recurrent employers of Engineering students, and 219 Bachelor and Master's students in Engineering. This data collection process required the use of a survey and interviews for each group of participants. This auscultation sought to gather the companies' views on what they valued most in newly graduated students regarding their previous experience and skills, as well as candidate selection tools. Likewise, the auscultation aimed to gather students' perceptions of their preparation for employability and their knowledge of relevant recruitment and selection tools.

Following the analysis of the collected data and of the information obtained through bibliographic research, the CU's three-stage learning roadmap was developed. The first two stages are mandatory while the third is flexible by allowing each student to play an autonomous role in the construction of their learning, by selecting the activities they consider most relevant. The learning roadmap consists of a combination of presential and online lessons, as well as synchronous and asynchronous activities.

The first stage was designed to encourage students to reflect on their past experiences, their skills, their future goals and the actions they need to take to achieve them. Therefore, this stage consists of a presential workshop with the purpose of exploring current world trends that impact career paths, along with the individual completion of three work tools with the aid of micro-learning in video format, to incentivise the students' reflection on their past, present and future.

"Employability toolkit", the second stage of the CU, consists of five modules based on content regarding different employability-related topics, namely: how to analyse the labour market; how to prepare a CV; how to write a cover letter; how to manage a digital footprint and network; and how to prepare for an interview. Throughout this stage, students have to complete several exercises and explore a series of resources related to each topic.

The third and final stage of the learning roadmap was designed to promote the students' participation in various initiatives, such as visits to real work contexts, events focused on professional paths and employability skills offered by the University, Student Associations, the City Council or companies, as well as listening to a podcast developed for this programme, based on short conversations with Alumni about their professional paths. Apart from pre-defined activities, in this stage, students can suggest additional initiatives that are subject to curation by the teaching team, encouraging their singularity and individual interests. These activities are then available for all the students.

Following the development of the CU's learning roadmap and contents, a monitoring and impact evaluation architecture was created. The monitoring portion consisted in applying a questionnaire after the completion of each stage of the learning roadmap. The impact evaluation process involved pre and post-test data collection based on the application of a questionnaire specifically developed for this purpose. The decision to develop this questionnaire was deliberate, due to the difficulty in identifying an adequate scale for this analysis, therefore confirming the differentiated scope of this study. The data collection for the impact evaluation took place each semester before the students entered the CU and after they completed it. Thereafter, an official description of the CU was created and approved by the HEI's Ethics Committee, allowing for the implementation of a pilot edition of the CU. This edition took place between February and July of 2021, involving 32 Bachelor and Master's students in Engineering.

Subsequently, the data collected through the auscultation of companies and students along with the results of the pilot edition were shared with the respective participants, through an infographic and a webinar. The data collected before, during and after the pilot edition showed positive results, which allowed for the implementation of this CU on a larger scale, specifically up to 500 hundred students per semester. Thus, between September of 2021 and July of 2023, more than 1200 students of various fields of Engineering and various years of study have participated in this CU, over the course of four editions, each lasting one semester.

The monitoring took place throughout the four editions, using a questionnaire for each stage of the learning roadmap, consisting of ten questions. Given the scope of this study, we focused on the first and second stages, since the third stage is dedicated to students' autonomous participation in various activities, which we chose to analyse through the impact evaluation. On average, in each edition of the CU, 148 responses were collected after the first stage and 104 after the second stage. For this study, we focused on two specific questions related to the relevance and future utility that students attributed to the content and tools of the first and second stages. As shown in Table 1, the question of relevance was assessed using a five-point Likert scale, where one meant "not relevant" and five meant "extremely relevant". The question of future utility was assessed using a five-point Likert scale, where one meant "not useful" and five meant "extremely useful".

In terms of the impact evaluation, 173 complete responses (pre and post-test responses from the same student) were obtained over the course of three editions. Regarding the impact evaluation questionnaire, we focused specifically on a question about the actions the students completed regarding their employability, composed of a total of fifteen items (e.g., "I created a Curriculum Vitae"; "I went to a job fair or took part in some other employability event"). These items were assessed with the use of "yes" or "no" answers.

3. Results

As shown on Table 1, the analysis of the monitoring results regarding the relevance students attributed to the CU's contents and tools, revealed that, over the course of four editions, students considered the CU's contents and tools to be very relevant, attributing them an average classification of between 4.1 and 4.7. Regarding the future utility of the CU's contents and tools, the students attributed an average classification of between 4.1 and 4.7, revealing a significant recognition of the future utility of these resources.

As presented on Table 2, pre and post-test results obtained through the impact evaluation allowed for the verification of the applicability of the CU's resources, by showing an average increase of between 15.2% and 20.9% in the employability-related actions undertaken by the students, before and after their participation in the CU.

Regarding the possibility students had to suggest additional initiatives that were subject to curation by the teaching team, during the third stage of the learning roadmap, up to sixty initiatives were validated each semester.

Table 1. Results from the applied monitoring questionnaires: relevance and utility of the CU's contents and tools.

	Edition No.1		Edition No.2		Edition No.3		Edition No.4	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
How do you rate the relevance of...								
1st stage: "Be Aware" Workshop	4.41	0.68	4.32	0.68	4.32	0.73	4.29	0.75
1st stage: "Be Prepared" tool	4.42	0.69	4.53	0.63	4.25	0.78	4.24	0.79
1st stage: "Be Yourself" tool	4.52	0.61	4.4	0.64	4.36	0.71	4.3	0.78
1st stage: "Be Wise" tool	4.64	0.58	4.46	0.67	4.53	0.64	4.43	0.77
2nd stage: "Labour Market"	4.27	0.75	4.46	0.61	4.35	0.75	4.27	0.78
2nd stage: "CV"	4.59	0.64	4.69	0.54	4.64	0.68	4.53	0.72
2nd stage: "Cover Letter"	4.30	0.81	4.37	0.68	4.37	0.80	4.29	0.95
2nd stage: "Digital Footprint"	4.30	0.78	4.13	0.78	4.33	0.81	4.13	0.94
2nd stage: "Selection Interview"	4.61	0.67	4.63	0.56	4.55	0.68	4.55	0.70
To what extent do you think the contents/tools shared with you in this stage will be useful to you in the future?								
1st stage	4.33	0.7	4.18	0.8	4.19	0.81	4.12	0.86
2nd stage	4.67	0.6	4.59	0.57	4.48	0.73	4.49	0.69

Table 2. Results from the applied impact evaluation questionnaire: pre-test and post-test.

	Edition No.1			Edition No.2			Edition No.3		
	% Pre-test	% Post-test	% Increase	% Pre-test	% Post-test	% Increase	% Pre-test	% Post-test	% Increase
Actions completed by the students	41.6	62.5	20.9	46.9	66.9	20.0	49.3	64.5	15.2

4. Discussion

This study highlighted the importance of creating appropriate conditions in HE to make the development of lifelong employability skills accessible to a large number of students, promoting their autonomy and expanding their power to act (Clot, 2008) regarding the challenge of an increase in professional transitions (Hareven & Masaoka, 1988; Bridgstock, 2009; Savickas, 2021).

At the end of the various steps that make up the learning roadmap of the CU, the students recognised the relevance and future utility of the shared content and tools, highlighting the importance of establishing an effective involvement of different agents since the design stage, allowing for the development of resources that are truly relevant and useful to students both during and after their participation in the CU. Additionally, after each edition of the CU, the number of employability-related actions taken by the students, partly during the third stage of the learning roadmap, had increased significantly, proving that a safe context for experimentation and application of the acquired knowledge is an important element of the learning process regarding employability-related topics.

As a final contribution of this study, the consistency of the results obtained over four different editions of the CU proved its scalability, demonstrating that it is possible to use a B-learning format, where students are given the flexibility to set their own learning pace and choose and suggest the activities they consider most relevant to their singular paths. This approach allows simultaneous access to a CU for up to 500 students while guaranteeing the quality of their learning.

Nevertheless, the use of longitudinal cohort tracking may be useful to investigate the true impact benefits of this CU on the development of graduate attributes relevant to employability and short-term graduate employment outcomes.

5. Conclusions

In conclusion, combining the active involvement of various agents, the equilibrium between access to theory and space for practical experimentation, as well as new learning models, it is possible to ensure the simultaneous participation of a high number of students in a CU, while fostering the quality of their learning and the respect for their idiosyncrasies. Therefore, there is no doubt that Higher Education Institutions have an important role to play in creating the necessary conditions for the implementation of new learning models, which democratise access to the development of relevant skills, achieving the Higher Education purpose.

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TRAINING AND INCLUSION: THE IMPORTANCE OF PREPARATION TO USE THE LEGO BRAILLE BRICKS KIT IN AN INCLUSIVE CLASSROOM

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Abstract

There are approximately 18.6 million people with disabilities in Brazil, representing 8.9% of the population (IBGE, 2023), with 1.5 million students enrolled in Basic Education (INEP, 2023). The Dorina Nowill Foundation for the Blind (DNFB), a leading organization in the rehabilitation of people with visual disabilities (VD), conceived the Lego Braille Bricks (LBB) kit, a pedagogical resource including Lego pieces representing the Braille alphabet and its respective letters. This resource is suitable for both people with VD and sighted individuals, facilitating the development of inclusive activities. The LBB kit is produced and distributed globally by the Lego Foundation in Denmark to schools serving students with VD. DNFB has already distributed to 91 municipalities in Brazil, significantly contributing to the literacy process of children with VD. Considering its nationwide impact, this article aims to describe the foundations underpinning the Educators' Training Program for the use of LEGO Braille Brick (ETPLBB) for education professionals to utilize the LBB resource in school practices. The ETPLBB is an online program offered via the Virtual Learning Environment of the Center for Promotion of Digital, School, and Social Inclusion. Since its inauguration in 2018, the program has trained over 4,000 education professionals in 12 Brazilian states. The ETPLBB consists of three modules that include the development and application of an inclusive strategic intervention plan in an inclusive environment for children with and without VD. The ETPLBB utilizes the Constructionist, Contextualized, and Meaningful (CCM) pedagogical approach (Schlünzen, 2000; 2015), drawing on educational theories of Dewey, Ausubel, Papert, Vygotsky, and Freire. The CCM approach emphasizes: the importance of solving real-world problems (Dewey, 1938); knowledge construction through the use of technology (Papert, 1985); the significance of connecting new information with existing knowledge (Ausubel, 1963); the role of social and cultural contexts in learning (Vygotsky, 1998; 1993); student autonomy (Freire, 1997). Through this approach, the ETPLBB aims to create a dynamic and constructive educational environment, where education professionals can develop and reflect on their teaching methods, and students can actively participate in their learning process (Schlünzen, 2000; 2015). This holistic approach to education is integral to the development of literacy skills in children with or without VD, promoting a specialized and inclusive learning environment.

Keywords: *Lego braille bricks, constructionist contextualized and meaningful approach, inclusive education, training program.*

1. Introduction

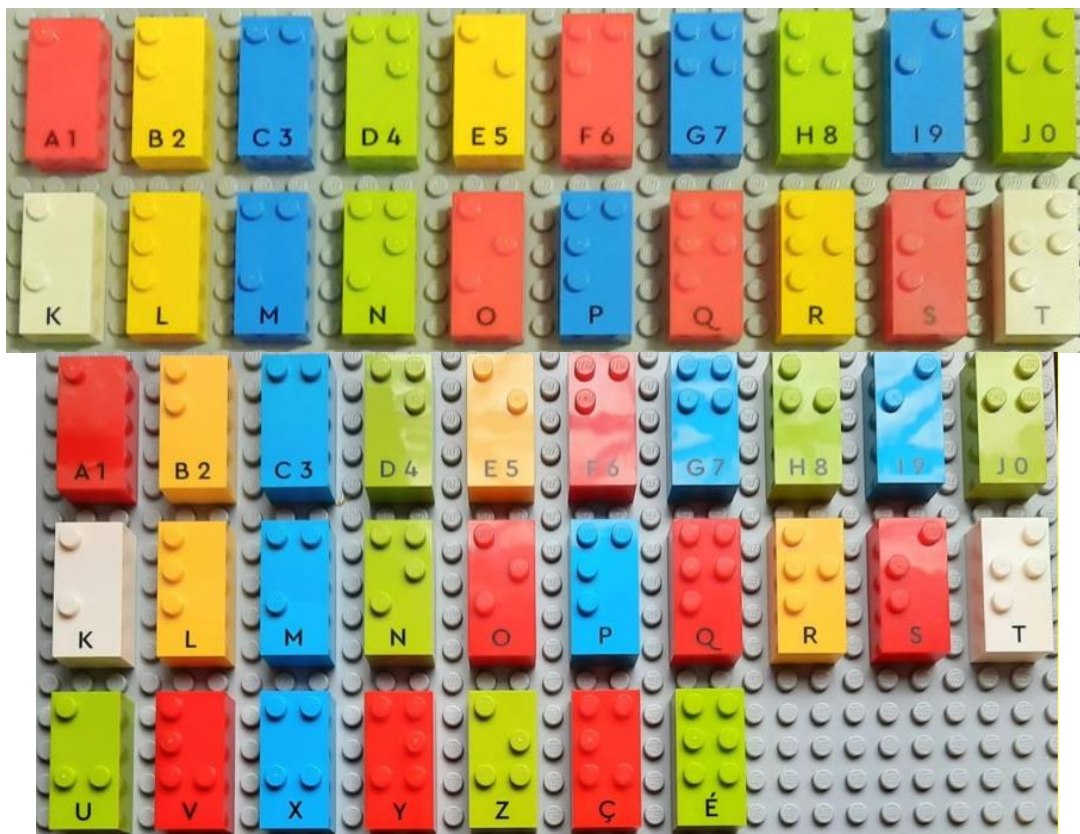
Since the beginning of the 21st century, Brazil has been committed to improving its legislation to promote inclusive education. This initiative aims to ensure that all children, with or without disabilities, are enrolled in mainstream classes. In this context, laws and regulations have been developed that are essential to support such initiatives.

Law No. 9,394/96 (Brazil, 1996) is one of the examples, as it establishes the guidelines and bases of national education, emphasizing the importance of ensuring access and retention of all students in school. It aims to promote inclusion and address the specific needs of each student. To contribute to this process, the National Policy on Special Education in the Perspective of Inclusive Education (Brazil, 2008) guides actions aimed at inclusive education in the school context. This policy encourages pedagogical practices that respect diversity, value human differences, and ensure the learning of all students, thus reinforcing Brazil's commitment to truly inclusive education. Furthermore, Law No.

13,146/15 (Brazil, 2015) strengthens the guarantee of the right to inclusive education, prohibiting discrimination. It also emphasizes the importance of developing accessibility, the use of assistive technology, and reasonable adaptations to enable the full participation of students with disabilities in the school environment. These measures reflect Brazil's commitment to ensuring equal opportunities in education, promoting the inclusion and joint learning of children, regardless of their individual characteristics. In light of the above, the country has been striving to improve pedagogical practices and materials that can facilitate school inclusion. In this scenario, the Dorina Nowill Foundation for the Blind (DNFB), a leading and pioneering entity in the rehabilitation of people with visual disabilities (VD), expresses its concern about the lack of use of the Braille System in the teaching and learning processes of children with VD, as this situation hampers the literacy process of these children.

The literacy process of these children involves successive techniques, comprising interdependent stages throughout the development of the process. These stages encompass the enhancement of specific cognitive, motor, and sensory skills, requiring a deep understanding and approach from the educator. Such a need arises from the fact that the Braille System transcends mere achievement of written and reading language, representing, therefore, more than a literacy process. In response to this concern, in 2016, the DNFB conceived the Lego Braille Bricks (LBB) kit, which consists of original LEGO pieces whose blocks correspond to letters, numbers, and mathematical symbols of the Braille system, as illustrated in Figure 1. Additionally, each piece features a printed representation of its corresponding Braille character on the bottom part, enabling all children to play and learn together, regardless of whether they have visual disabilities or not, and facilitating the development of inclusive school activities.

Figure 1. Example of pieces from the LBB.



Source: Personal collection of the third author (2024)

The kits, each comprising approximately 340 pieces, are manufactured by the Lego Foundation in Denmark (as of 2018) and distributed free of charge to 22 countries, including Brazil. In this country, the DNFB assumes the responsibility of receiving these kits and forwarding them to municipal public schools where children with VD are enrolled. Concurrently with the distribution of the LBB kit, the DNFB, in partnership with the Center for Promotion of Digital, School, and Social Inclusion (CPIDES) at São Paulo State University (UNESP), develops the Educators' Training Program for the use of LEGO Braille Brick (ETPLBB) for education professionals (school managers and education secretaries, mentors and pedagogical coordinators, teachers in regular classrooms and teachers of specialized educational services, and professionals from institutions supporting people with VD).

By the end of 2023, the DNFB distributed 8,131 LBB kits to 91 Brazilian municipalities, covering 12 Brazilian states (including 2,596 public schools and 18 institutions supporting people with VD). During this period, 5,500 education professionals were trained by the ETPLBB. Consequently, 3,328 students with VD and 64,480 students without VD gained access to the kits and the pedagogical practices implemented by participating professionals during and after the ETPLBB.

Considering its nationwide impact, this article subsequently describes the foundations underlying the training process for education professionals to use the LBB resource in school practices and the main contributions that emerge from this process.

2. Results and discussions: Contributions of the training program

The main objective of the ETPLBB is to train education professionals for the development of an inclusive literacy process, teaching the Braille System in a playful, creative, and inclusive manner, significantly contributing to the pre-literacy and literacy process of children with VD, using the LBB Kit, which is a toy designed to educate, entertain, and provide literacy instruction for children. To achieve this goal, the ETPLBB consists of two distinct phases. In the first phase, the DNFB selects Brazilian municipalities with the highest number of students with VD included in mainstream classes. Additionally, it contacts the educational managers of these municipalities, presents the program, and establishes a cooperation agreement. In turn, the municipality undertakes to identify public schools with enrolled students with VD, compile a list of educators interested in the training, and distribute the kits to the designated schools.

The second phase of the ETPLBB is coordinated by the CPIDES team and involves the training of educators from the municipalities previously selected in the preceding phase. This training is conducted via the Virtual Learning Environment (VLE) of the Moodle Platform. The participating educators are divided into groups of approximately 50 members, with each group supported by a pedagogical mediator responsible for assisting participants in their technical and pedagogical activities.

The training program consists of three modules: the first one aims to promote critical reflection among participants on inclusive education and VD, providing an in-depth understanding of the Constructionist, Contextualized, and Meaningful (CCM) approach and examining pedagogical practices for early stimulation; the second module intends to introduce the fundamentals of the Braille System, presenting its relevance in the literacy process of children with VD, and exploring strategies for adapting educational materials; the third module aims to address pertinent aspects of literacy for children with VD, explore audio description, discuss the importance of playing games in the educational context, and develop an Inclusive Strategic Intervention Plan. Each module comprises synchronous meetings for in-depth discussions and guidance on the topics covered with experts in the field, as well as individual and group activities to be carried out in the VLE.

The ETPLBB employs the CCM pedagogical approach (Schlünzen, 2000; 2015), drawing on the educational theories of Dewey, Ausubel, Papert, Vygotsky, and Freire. The CCM approach emphasizes the importance of solving real-world problems (Dewey, 1938) and constructing knowledge through the use of technology (Papert, 1985). Initially, a dialogue is conducted to assess participants' prior knowledge of inclusive education. Following this, the training activities offer detailed insights into VD, the Braille system, and other relevant disability-related topics. Simultaneously, participants are encouraged to reflect on their own circumstances, strategize for the integration of LBB within their educational contexts, and document all procedures within the VLE. This enables both the tutor and peers to engage in collaborative problem-solving (Vygotsky, 1998; 1993), fostering learner autonomy within their professional domains and, consequently, for their respective students (Freire, 1997). In this way, the tutor can assist each participant in appropriating the new concepts addressed in the training and applying them in their pedagogical practice based on their prior knowledge, which is defined by Ausubel as the foundation of meaningful learning (Ausubel, 1963).

The data selected to assess the effectiveness of the CCM approach in this training were collected from the final activity, in which participants conduct a self-assessment of their involvement and evaluate the training program. Since this excerpt is part of a doctoral research and a research productivity survey PQ, only data from the most recent edition, held in the second semester of 2023, will be analyzed. This edition received 1,113 responses, representing 90% of the total number of participants who completed the program.

The research is characterized as applied and of qualitative-quantitative nature, as data analysis was conducted by compiling the responses obtained from the evaluation form. The average percentages of "very satisfied" and "satisfied" participants were calculated for each assessed item. Table 1 summarizes the responses obtained.

Table 1. Responses obtained in the training program evaluation form carried out in the second semester of 2023.

Participant's opinion on:	Very satisfied		Satisfied		Indifferent		Dissatisfied		Very dissatisfied	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
Virtual learning environment	551	49.5	501	45.0	21	1.9	32	2.9	8	0.7
Available materials	721	64.8	368	33.1	11	1.0	9	0.8	4	0.4
LBB and its use in inclusive education	845	75.9	247	22.2	9	0.8	6	0.5	6	0.5
Web conferences	668	60.0	419	37.6	7	0.6	13	1.2	6	0.5
Support received from their tutor	818	73.5	256	23.0	24	2.2	9	0.8	6	0.5
Average	720.6	64.7	358.2	32.2	14.4	1.3	13.8	1.2	6	0.5

Source: Elaboration based on the responses obtained in the training program evaluation form carried out in the second semester of 2023.

The averages of the percentages corresponding to the "very satisfied" and "satisfied" options sum up to an average of 97%, indicating a high level of satisfaction among the participants regarding the analyzed aspects.

The participants reported a 99.4% rate of positive responses regarding the program's contributions to their professional growth within school environments aimed at fostering inclusion. The justifications for this response include: Enrichment of the Learning Process and Pedagogical Practice; Inclusion and Sensitization to Diversity and Special Needs; Professional Development and Preparation for Various Situations.

The findings demonstrate that, participants perceive the ETPLBB, underpinned by the CCM approach, contributes to creating a dynamic and constructive educational environment where participants can develop and reflect on their teaching methods, and their students can autonomously and actively engage in their learning process (Schlünzen, 2000; 2015).

This comprehensive approach to education is integral for the development of literacy skills in children with VD, promoting an inclusive and supportive learning environment that meets the needs of all students.

3. Final considerations

The professional development of educators, focused on enhancing the learning process and pedagogical practice, is a fundamental pillar for the enhancement of inclusive and effective education. The feedback from participants of the PFELBB reveals a significant impact in three main areas. Firstly, many participants highlighted the enrichment of their learning process through the acquisition of new knowledge and strategies. This aspect was crucial for revitalizing their pedagogical practices, making them more playful, creative, and inclusive. The incorporation of these new approaches not only renewed the dynamics in the classroom but also substantially improved the quality of teaching, highlighting the value of continuous education for educators.

Secondly, the training program proved to be crucial in promoting inclusion, with special attention to students with blindness and low vision. Participants reported significant development in their perceptions and approaches to inclusion. The learning acquired enabled them to overcome previous challenges and underscored the importance of careful attention to vision. This transformation in educators' beliefs and attitudes towards inclusion reflects the need for sensitive and adapted teaching to the diversity present in contemporary classrooms.

Lastly, the training program provided a significant advancement in the professional development of the participants. They expressed a sense of greater preparation and confidence to tackle various educational situations, including supporting students with VD. Furthermore, the willingness to continue learning and to share acquired knowledge with their peers demonstrates a commitment to continuous improvement in pedagogical practice. The training program, therefore, emerged as a valuable complement to educators' curricula, reinforcing their role in building a more inclusive and student-centered educational environment.

In conclusion, this training program has revealed its profound impact not only on the professional development of educators but also on the improvement of their pedagogical practices and the promotion of a more inclusive educational environment sensitive to diversity and special needs. These results underline the importance of continuous training programs that address emerging needs in dynamic and diverse educational settings.

The next phases of the research involve a broader quantitative and qualitative analysis that encompasses all the issues addressed in the forms completed by participants across the five editions of the PFELBB. The aim is to improve aspects identified as less positive, such as participants' opinions about the VLE, which, in the sample used for this article, received a response rate of 3.6%.

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WHAT MAKES A GOOD INSTRUCTIONAL VIDEO? THEORETICAL VS. EMPIRICAL APPROACH TO UNDERSTANDING WHAT STUDENTS AND TEACHERS LIKE ABOUT INSTRUCTIONAL VIDEOS

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Abstract

Although there is a heightened awareness of reading promotion in schools, the results of the IEA study PIRLS are not developing positively in Germany: The number of children who need to achieve sufficient reading competence in elementary school to transfer to secondary school is increasing. However, the popularity of reading in leisure time has slightly increased for primary school children since 2012. So, purely motivational issues are not driving the poor results. Instead, there is a significant increase in the use of online videos and their creation. If we ask what incentive videos offer, a connection to Comenius' and Pestalozzi's ideas of didactics that make everything accessible to all with all senses up to modern cognitive psychology becomes possible, which suggests based on the theory of dual coding to use different sensory channels for the provision of information simultaneously. Data from media use studies illustrate that students' reception practices and preferences have changed toward multimodality in convergent media. To understand the object of reading strategies, we conducted an exploratory study with a secondary school to ask how students and teachers evaluate the quality and effectiveness of instructional "explainer videos" on the *SQ5R* method. Therefore, we first evaluated the criteria of research for good educational videos and transferred them into a semi-standardized questionnaire on three selected explainer videos that were examined according to these criteria by content analysis. Afterward, the students evaluated the videos. Three qualitative interviews with German teachers about the teacher's criteria complement the view of the school perspective. The results of the explorative study show, that even serious, offered explainer videos by no means satisfy all relevant criteria themselves and that aesthetic categories and exemplary foundation seem to be essential for the students. Furthermore, it becomes clear that teachers need more theoretical knowledge to be responsible for the fact that freely available multimedia offers beyond those provided by textbook publishers can be insufficiently assessed from a professional point of view. Therefore, teachers tend to stick to written text-based formats or videos provided by textbook publishers. Given the increasing use of *Open Educational Resources* (OER), this theoretical deficit is glaring and reinforces the remoteness of schools from the real world, measured against the students' learning conditions.

Keywords: *Digital mediatization, open educational resources, educational videos, reading literacy, theoretical knowledge of teachers.*

1. Introduction and relevance of the topic

Even the current OECD PISA study on pupils' reading literacy performance in an international comparison cannot satisfy those responsible for education: The results still show significant educational disparities.

In 30 education systems, more than half of students performed below baseline proficiency level 2 in reading. In 21 countries and economies, at least 30% of students performed at proficiency Level 1a; in 9 countries and economies, at least 30% of students performed at proficiency Level 1b; and in 10 countries and economies, at least 10% of students performed at proficiency Level 1c. (OECD, 2023, p. 98)

That means these students have only rudimentary reading comprehension and need more contextual knowledge to appropriately classify and evaluate text statements. Pupils from educationally disadvantaged backgrounds, in particular, remain at a disadvantage. In addition to financial resources, there needs to be more official support services that can motivate and guide independent work outside of

school. Pupils from these social groups need not only the fundamental educational aspiration that allows them to recognize learning as meaningful and worthwhile but also comprehensible and attractive offers for a resumption of the content and tasks presented at school.

Although school materials promise seriousness, they are often of no help to lower-achieving pupils from socially disadvantaged social groups because they represent and reproduce the incomprehensible educational language milieu and are therefore bypassed (Schnoor, 2018). Digital media offerings, which are now available to all school groups, are more attractive in terms of youth culture and accessible in everyday language. For Germany, two current cohort surveys are available for the group of 12-year-olds of interest here (MPFS, 2023, 2022), the data used below.

Almost everyone (96%) – including pupils from educationally disadvantaged homes – has their private smartphone at secondary school (after grade 4), at least in Germany. Other digital devices can also be used at home. Moving image content, such as videos, attracts young people. YouTube usage increased by a further six percentage points to 82% in 2022 (MPFS, 2023, p. 12). On the other hand, written media, such as books, are only used by 35% or fewer young people outside of school (MPFS, 2022, p. 13).

Nevertheless, schools in Germany still need to be convinced to use digital media. The situation has improved somewhat with the problems of class attendance during the coronavirus pandemic, as digital online lessons have become necessary. However, this digitalization in the classroom needed to be more sustainable. Even in 2023, daily to multiple weekly internet use in the age group of pupils in this study is still only 47%. Moreover, they do not use digital media at school to offer such simplified media content. Only around 21% of this cohort do so at school (MPFS, 2022, p. 58) – but 38% use this medium at home (MPFS, 2022, p. 38).

The small study presented here combines two things: on the one hand, the content is about letter-supported literacy skills – namely, the acquisition of the *SQ5R* method (Pauk, 1984) – and, on the other hand, the selection and evaluation of YouTube instructional "explainer videos."

2. Justification for the object of research

Videos initially offer the incentive of primary youth cultural acceptance as a format of current mediatization. Simschek and Kia (2017, p. 17) speak of a "megatrend" of the current young generation. Didactically, a connection to Comenius' and later Pestalozzi's ideas of "teaching all things to all men" (Comenius, 1967, p. 5) is also possible. That also corresponds to the findings of modern cognitive psychology, which, based on the theory of dual coding, suggests using different sensory channels to provide information simultaneously. Data from media usage studies show that students' reception practices and preferences have changed toward multimodality in convergent media. Based on research on information processing and dual coding, the educational psychologist Mayer (2001) has developed his *cognitive theory of multimedia learning*, which suggests that the limited capacities of a sensory learning channel can be expanded by combining different channels when processing information. Multimodally coded video settings, such as the explainer videos currently available on YouTube, are suitable for translating complex contexts in educational language. They have an inclusive effect.

There is no uniform definition of what is meant by an "explainer video." Broad definitions define it as a short video production that explains content or facts (Brehmer & Becker, 2017, p. 1). Arnold and Zech (2019, p. 9) refer specifically to use in the education sector, a time frame of up to five minutes, and a target group-specific adaptation in form and content. According to Kulgemeyer (2020, p. 2449), this is also one of the seven core ideas for the effectiveness of explainer videos. Explainer videos, as they are understood in the present study, are publicly accessible free of charge (*Open Education Resources* OER). Their authors comment on the subject matter and justification of the topic ("what" and "why") and present a systematized support for the acquisition or application of a competence ("how") (Neumeister & Vogt, 2015, p. 568).

In contrast to professional instructional films (cf. Wolf, 2020, p. 18), laypersons in explainer videos convey information in a low-threshold manner for a broad audience and without direct curricular and didactic justification, but rather with a practical everyday orientation. On the other hand, they go beyond a video tutorial purely demonstrating the actions because the justification for acquiring the technology plays a vital role in the explainer video (cf. Wolf, 2020, p. 17). Technically, a variety of forms are possible: a demonstrative screencast, various laying techniques, stop-motion films, or a drawn whiteboard style were differentiated by Arnold and Zech (2019).

The 5-step reading method, also known internationally as *SQ5R*, serves as the object of the reception of the explainer videos examined here. It consists of *S* for Survey, *Q* for Question, *5R* for Read, Record, Recite, Review, and Reflect (Pauk, 1984). Systematic reading strategy support remains relevant for pupils throughout their school years, as reading comprehension is the basis for educational acquisition in all subjects. It is, therefore, particularly important for pupils in the general middle and lower ability

range. In the German curricula of the intermediate secondary school ("Realschule"), the systematic and reflective acquisition of reading skills in the national language up to the end of year ten is embedded (MSB, 2020, p. 20). The revision of the German curricula in 2022, in particular, attached greater importance to the reflection of learning processes among pupils:

The requirements for the skills for strategy application and the current state of research in this area were taken into account in the further development of the standards and the standard formulations. In the case of reading, for example, attention was paid to the fact that cognitive and metacognitive reading strategies should be mastered by pupils throughout the entire reading process (before, during, and after reading) with a view to the reading objectives. At the level of strategies, it was also considered that students must be increasingly familiarized with digital text production and reception. (KMK, 2022, pp. 17-18, own translation)

3. The study: What are good explainer videos? – Methodological considerations

Reading strategy development and digital selection skills were presented as relevant contents of the "Realschule." As central comparative and mandatory performance assessments in several subjects take place in grade 8 in Germany, which require reading skills, and the systematic teaching of reading strategies already takes place in grade 6, an evaluation already makes sense there following the corresponding national language lessons. Based on various scientific criteria catalogs for the evaluation of explainer videos (Kulgemeyer, 2020; Ebner & Schön, 2017; Marquardt, 2016), our study created its research instrument that should be understandable and easy to use for teachers and learners. The question was to what extent a connection can be recognized between the scientific criteria and assessments of good explainer videos and the reception impressions of the teachers and students concerned about three given explainer videos. The survey instrument created for the students is a standardized questionnaire consisting mainly of closed statements with predefined answers. The questionnaire is divided into five sections, which were formulated in a way that was understandable for the selected group of people: (1) personal details, (2) evaluation of explainer video 1 (EV 1), (3) evaluation of explainer video 2 (EV 2), (4) evaluation of explainer video 3 (EV 3), (5) conclusion. Reliable and interpreted items were used to record the impressions of reception, which were surveyed in the following subscales using a four-point Likert scale. The operationalization of the categories was primarily based on Nagel and Oppermann (2018) and Krämer and Böhrs (2017):

- First impressions of the explainer video (clarity of the topic, appropriateness of length and style)
- Content of the explainer video (understanding of content and terminology)
- Didactics and methodology of the explainer video (relation of topic, attention, and estimated relevance)
- Technique of the explainer video (evaluation of visual and auditory impressions)
- Assessment of the effectiveness of the explainer video (liking, novelty, understanding of the method presented, function of the video in the classroom)

In addition to 26 quoted student surveys as a mirror of three grade 6 classes in a secondary school, the three German teachers of these classes were interviewed in partially standardized focused individual interviews about their lessons using the three explainer videos. The three explainer videos selected for the student survey were evaluated according to the same categories. The interviews were transcribed and analyzed according to Mayring (2014) using the qualitative content analysis method. Three German explainer videos were selected for the German pupils and the teachers, which largely met the previously developed criteria, with scope and technical correctness being particularly important.

- EV 1: *Deutsch: 5-Schritt-Lesemethode* (kapiert.de, 2016)
- EV 2: *Texte lesen und verstehen. Lesen mit der Fünf-Schritt-Methode* (Vieweber, 2021)
- EV 3: *Die 5-Schritt-Lesemethode – Leseverständnis mit System* (Habenicht & Berkel, 2021)

All three videos are freely accessible as OER on YouTube, one video (EV 1) was created by a publishing house. EV 1 and the EV 3 have high five-digit reception figures on the Internet and are more professionally produced. EV 2 is more complex, narrative, and metacognitively reflective but produced much more amateurishly. This authenticity – including the green blackboard as a background in the school's style – makes it appear severe and appropriate for pupils.

4. Results

Overall, the students (n = 26) and teachers (n = 3) confirmed the scientifically described criteria in many respects. Even reputable explainer videos offered by publishers only meet some relevant criteria. However, the subjective reception impressions are particularly relevant in this study. That is because they

determine the acceptance and, therefore, the metacognitive and practical effectiveness of the offer. Aesthetic categories and exemplary substantiation, preferably embedded in a story ("storytelling"), play an important role, especially for the students. However, they did not choose based on the individual criteria. All three videos even received identical mean scores. Only when asked which video they would recommend, does EV 2 emerge as the favorite – even though there are also some points of criticism. Students criticized the music, length, and lack of color.

Although the three teachers interviewed (T 1 to T 3) also concluded that the video with the laying trick technique (EV 2) is the most attractive, they remain strongly oriented towards arguments for declarative knowledge transfer in their assessment. Where are terms used correctly? However, the argumentation shows that they also intuitively understand a continuous link between the presentation method and the skills and processes taught in student-friendly language as the main criterion. T 2 formulates this as follows:

T 2 – male (154-158): Yes, I think the fact that the subject matter was tied into a story is quite positive, as I just said, and I think that's definitely quite appealing for a sixth-grade class. And although it was, I think, seven or eight minutes long, it didn't seem that long to me, and I think my pupils will also find it entertaining because of the integration into the story.

5. Discussion

The comments from teachers and pupils show that the systematically surveyed criteria are not decisive when viewed individually but that the interplay of all characteristics creates a coherent picture, whereby the didactic design is more relevant than technical arguments. A fit with the media habits of the pupils, with their interests in narratives and conveying meaning, a direct, age-appropriate approach with an authentic voice makes minor deficits – such as the disturbing professionalism of the soundtrack and technical simplicity – fade into the background.

The students criticized the second video for its monotony of color and the background music, and the length of over 7 minutes was also a negative factor. Nevertheless, it was the video that most pupils would have recommended. It permanently linked the questions of "what," "how," and "why." It is also possible that the positive recommendation is identifiably linked to the male explainer voice – because most of the responding pupils in the quoted survey are boys (n = 20). The voices in the other videos should be read as female. However, it is still being determined whether humans or machines are providing the sound, especially in EV 1 from the publishing house Westermann (kapiert.de).

The teachers responded positively in principle to the explainer videos and are also developing ideas for integrating them into lessons. The criteria-based evaluation in the interview and the comparative analysis have helped them to favor a more authentic and layman-like video presentation, even though only low reception figures are recorded on the Internet, and no publisher claims any seriousness in the background.

More in-depth theoretical knowledge and experience with digital teaching materials as a subject of university education seems necessary to make teachers more confident in their independent assessment of the selection and use of videographic OER.

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THE METAPHOR OF THE POLYHEDRON: WHAT DO TEACHERS THINK ABOUT THE QUALITY OF EDUCATION IN COLOMBIAN RURALITY?

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Abstract

Quality education must be understood as a fundamental right that enables many other globally agreed goals to be achieved. In Colombia, measuring quality education through students' performance in standardized tests is a tradition. However, both the association of quality education with students' performance in tests and its implementation in the Colombian rural context is problematic. Since, from the actor's perspective, in this case the teachers, quality education is much more than a grade. Quality education beliefs of Colombian teachers in the rural context is explored in this qualitative study. As per grounded theory logic, the way in which quality education dimensions are shaped from the teachers' beliefs is identified, their scope scaffolding and the strategies for the social construction of the concept.

Keywords: *Quality education, rural education, teachers' beliefs, Colombia.*

1. Introduction

Throughout history, education has been recognized as one of the factors that contribute the most to both the individuals and the people's development. To a certain extent, we have been involved in educational processes as part of society. In some cases, revolutions have been conceived to ensure that right for everyone. At first, being part of the system was enough. However, this perspective changed and now having access to education is not enough, it being of quality is required (UNESCO, 2005). In Colombia, efforts have been made to broaden the system's coverage by ensuring access to basic education for all children and young people. Nonetheless, the concern to work towards quality education has grown in recent decades, since the country's participation in international tests.

Hence, the institutionalization of the country's tradition of associating quality education with standardized test results. This practice is problematic because it denies the concept's polysemic nature that alludes to too many things at once. And it does not consider the diverse nature of the territory in which, despite institutional efforts, access to the system is not assured for some inhabitants of the dispersed rurality. In addition, it does not consider the rural students lower retention rate in school, the disadvantageous conditions of their schooling, nor the country's historical learning gap between rural and urban students (MEN, 2018; DANE, 2016; ICFES, 2022).

In this regard, an approach that broadens, from other perspectives, the quality education's viewpoint is required. Focusing exclusively on standardized tests results, which predominate in the country and provides elements that contribute to its social construction. Consequently, the complex issue of quality education in the Colombian rural context to know and analyze teachers' beliefs of public basic education in the country is addressed by this research. It is also sought, to determine the consensuses and tensions associated with the phenomenon and the implications at a systemic level, to establish categories conducting to quality education monitoring from this perspective.

Research interest in teachers' beliefs has been growing at a regional level. However, in Colombia there are few studies on the subject (García Gutiérrez, 2016). The theoretical gap is more significant in relation to the beliefs of rural teachers in the country's formal approach. This has prevented the field from growing and contributing to the compilation of empirical evidence that favors the formulation of strategies for analysis and systemic improvement of education in the sector.

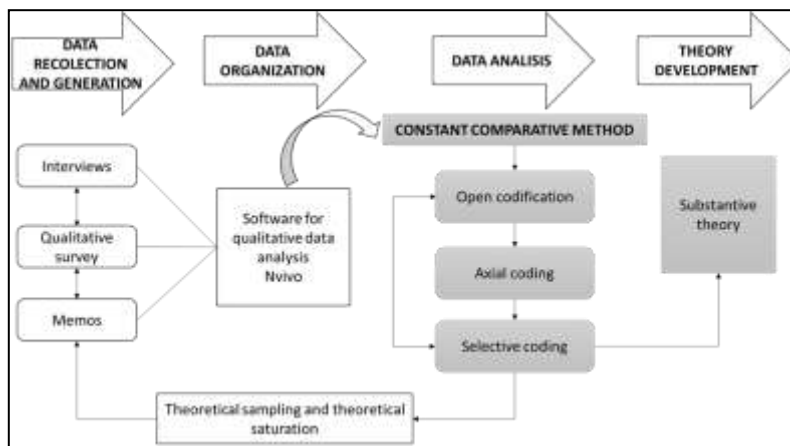
In this sense, the formulation of this study sought to analyze the beliefs about quality education on behalf of teachers of rural Colombia. In order to build a knowledge body that allows, by making explicit the rural teachers beliefs, the inclusion of their world view in concerted and inclusive public policies. This purpose has significant relevance because the convictions and beliefs of teachers affect their

way of processing educational demands. Teachers adopt convictions and beliefs about what it is to teach; about possibilities or factors that inhibit teaching; types of students and their abilities; didactic strategies; curricular contents and other related subjects. Furthermore, teacher’s beliefs are a powerful factor in determining the teacher’s behavior and their acceptance or rejection of innovative proposals (Vera Bachmann et al., 2012).

2. Methodology

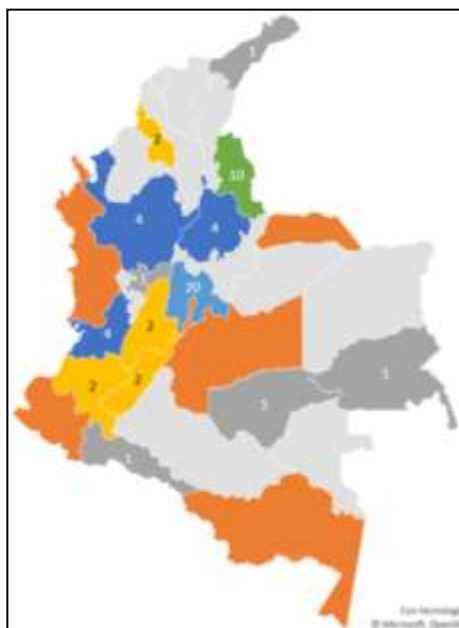
The phenomenon approach was based on the paradigm of qualitative research. And sought to make a comprehensive approach to the meaning of quality education in rural public educational institutions that teachers have. The main aspects that were considered for the methodological design, structured from grounded theory (Strauss & Corbin, 1994), and the principles that guided the analysis of the collected data are summarized in Figure 1.

Figure 1. Methodological Design of the Study.



A qualitative survey and in-depth semi-structured interviews with rural teachers from different regions of the country were used for the generation and collection of information, as specified in Figure 2: distribution of study participants in Colombia.

Figure 2. Distribution of study participants.



Note: the number above the geographical region indicates the number of participants in the sample collected.

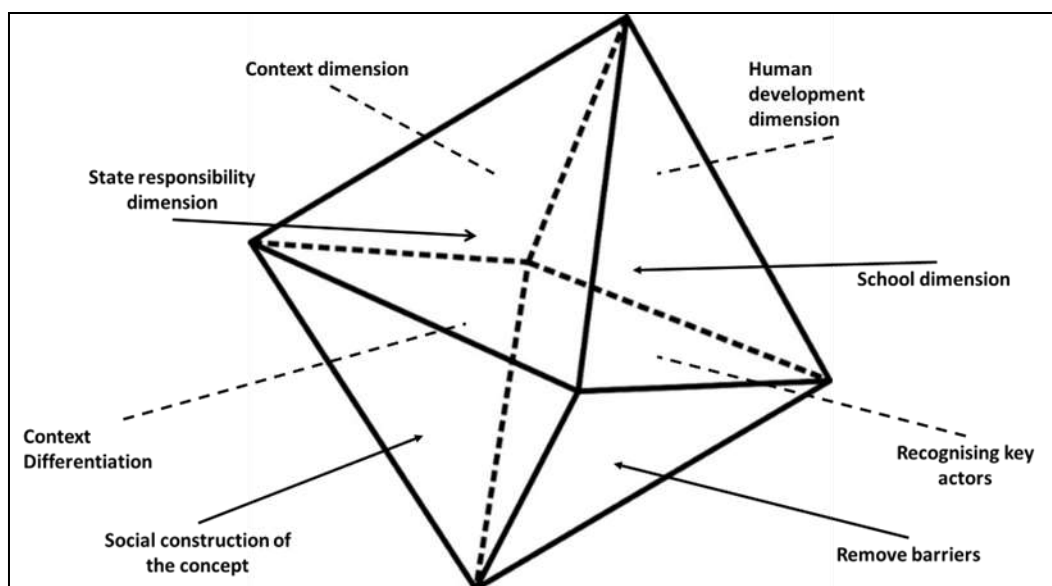
3. Results

From the data's inductive analysis, it is possible to conclude that rural teachers in Colombia believe that quality education is a multidimensional construct, based on the recognition of the rural context conditions, that requires the removal of barriers for its scope and must be socially constructed.

The belief held by Colombian teachers regarding quality education as a multidimensional construct confirms the empirical evidence provided by (UNESCO, 2005). In which it is appropriate to define it by considering the main elements that make up education systems, and how they interact. However, it is distant from the literature's proposal in which the dimensions are shaped to understand the quality of education.

The results of the research show that the beliefs held by rural teachers in Colombia are shaped in complex relationships which can be understood by using the polyhedron's metaphor. That is, the beliefs of rural teachers in Colombia can be understood if they are compared to a polyhedron in which its faces act as complex dimensions and their edges are common concepts that by complementing or contrasting are related (see figure 3). The four (4) upper faces correspond to the dimensions of quality education: human development, school, context, and state responsibility. And the four (4) lower faces correspond to the conditions for its materialization: to eliminate the barriers, differentiate the context, recognize the key actors, and build the concept through social participation.

Figure 3. Polyhedron of Educational Quality.



The four dimensions from the collected information, identified in an emergent way, evidence teachers' deep beliefs about their work. The student-centered human dimension development, in which describes the characteristics that rural education should have to contribute to the student's integral development. This dimension is aligned with the criterion of adaptability expressed by (Tomasevski, 2001), that is, that the educational system must adapt to the realities, expectations, interests, and possibilities of students.

Secondly, the school dimension, which centers on the school and corresponds to the conditions with which it must count for students to develop their potential. Bearing in mind that, from the beliefs of rural teachers, the school is conceived in relation to its impact on students and in context, the construction of this dimension approaches the criterion of curricular and pedagogical accessibility exposed by (Tomasevski, 2001). Since, it coincides with Colombian teachers in aspects related to curriculum development, evaluation strategies, and technologies used in teaching, among others.

The third dimension in which the context describes the conditions, characteristics and relations that must be generated from the school in relation to the context where it is. Finally, State responsibility dimension, which summarizes the main actions and processes that are the State's responsibility as administrator of the education system and guarantor of the right to education.

For teachers, these dimensions are developed in relation to conditions that operate as scaffolding and fulfill the function of being facilitators or barriers for quality education social construction. And that, in the polyhedron appear as the lower faces. These are: differentiate the context of rural education,

remove barriers to educational quality, recognize key actors and build the concept through social participation.

Regarding the context of rural education, teachers hold the belief that it is fundamental because it enables or prevents the attainment of quality education. According to the study findings, it is possible to affirm that the context is configured in a bidirectional relationship with the school and the teacher. Such is its relevance, from teachers' beliefs, that it can be considered as an actor of the quality education "perse". Now, as teachers describe it, at this historical moment, the Colombian rural context is configured as a factor that prevents quality education due to the state oblivion that characterizes it, the conditions of access to the territory, the perceived inequality, little or no family connection and the growing gap in relation to urban contexts.

Additionally, it is possible to conclude that teachers the Colombian rural context believe that quality education presents physical, human, and social factors that constitute obstacles to achieving it. These can be endogenous, directly related to the school and exogenous factors associated with external factors but directly influencing the educational process and the school. This belief is rooted in teachers and demonstrates a critical vision of quality education in rural schools. As teachers are conceived as critical actors that can contribute to the consolidation of quality education in relation to their community's social development, on one hand and with its pedagogical action on the other.

Since the study of teaching beliefs, this finding is very important because according to authors such as (Vera Bachmann et al., 2012) only reflection on the professional exercise itself allows the transformation of teaching in the classroom. This implies rethinking pedagogical practice, both in its meaning and in its effects. This could, in the long term, encourage all educational improvement initiatives aimed at ensuring the learning of children and young people in rural schools, reducing low achievement and dropout rates, that have characterized this context in our country for years.

On the other hand, Colombian rural teachers also believe that it is possible to achieve quality education if consensus is built through dialogue and community participation, the preservation of the country's cultural and ancestral wealth, the contextualization of the territory, the differential evaluation and the concerted public policies. The finding is important, while beliefs are a powerful factor in determining the teacher's behaviors and in their acceptance or rejection of innovative proposals (Vera Bachmann et al., p. 2)

4. Discussion

This vision of teachers presents a great fracture in relation to the official proposal of the focused public policy, almost exclusively, in standardized tests learning results measured and announces the state ignorance of its rural education duty and the teacher. In this sense, the beliefs of rural teachers in the country play an important role in the reformulation of plans, reforms, policies, or strategies focused on building quality education in the rural context at the country level. Considerably, as he describes it (Solis, 2015) "teachers elaborate their own reading of the proposals, of the educational reforms, from their beliefs that are built from their experiences as students and teachers. Ignoring teachers' ways of thinking could make it difficult to understand the proposals for change and limit their application, becoming a "self-sabotage" of any educational reform. On the contrary, delving into teaching beliefs will allow them to generate processes of reflection on their own pedagogical practice, their relationship with change and the consequent improvement of these" (p. 233).

In summary, popular wisdom says that when someone believes they can do something, they do it. Whereas, if you are convinced that it is not possible, no amount of effort will convince you otherwise. In this sense, there is a long way to go in the analysis of teachers' beliefs on quality education in the country and even more in the search for consensus that echo public policies focused on monitoring and supervises quality education. In this regard (Vera Bachmann et al 2012) clearly synthesizes the impact of teachers' beliefs in the education system, noting that "a professional does not change in a substantive way by only improving his knowledge and the quality of his know-how, if these two dimensions are not assumed and interpreted in a different professional "know-how", that gives meaning to the other two dimensions".

5. Conclusion

The way in which dimensions of quality education are constituted from rural Colombian teachers' beliefs can be presented through a polyhedron that considers the reality of the actors and their context. These ideas come into great tension with public policy that gives prevalence to results in standardized tests as a synonymous of quality. One cannot forget that standardized tests leave aside everything that is more difficult to measure: learn to think, learn to respect, learn to live with others, learn

to ask relevant questions and solve them, to determine what is important and valuable, to learn from the context. In conclusion, all that should remain at the heart of quality education.

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ETHICS OF GENERATIVE AI USE IN HIGHER EDUCATION: A FOCUS GROUP STUDY

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Abstract

Generative Artificial Intelligence (GenAI) tools like ChatGPT and DALL-E are increasingly impacting all aspects of our lives, including education. Educators and students are trying to adapt and learn with this disruptive technology. The objective of this study was to understand and critically evaluate the ethics behind GenAI when used in university settings. We conducted a focus group discussion at a public research university in the Netherlands to understand the challenges and concerns that arise with using GenAI in education. The topics for the focus group discussion were defined based on existing literature on ethical principles of AI in education. The use of GenAI was analyzed from five different perspectives: responsibility, trust, learning, inclusion, and its role in higher education. Participants could choose one of the topics based on their motivations and interests. This was also recorded in a template later to analyze their personal motivations and connection to the topics. Each group had an expert facilitator who helped guide the conversation and observed the discussions. The participants (n=31) were a mix of students, educators, and non-teaching staff. There were two methods through which data was collected. One was from the template that the participants filled in and the second was the notes recorded by the facilitators during the discussions. The study's findings can be categorized as challenges, opportunities, and solutions for better implementation of GenAI in higher education. The responses are currently being evaluated and will have concrete ideas that will be detailed in the final paper. The final paper will shed light on approaches to resolve and address ethical considerations in the use of GenAI.

Keywords: *Generative AI, ethics of AI, higher education, AI literacy.*

1. Introduction

Over the past few years, interest in Generative Artificial intelligence (GenAI) has increased. GenAI uses foundation models, including large language models (LLMs) trained on large amounts of data. Some examples of GenAI tools include ChatGPT, Dall-E, and Stable diffusion. These tools can handle complex data and provide solutions to various problems. They can be used to produce artificially generated content like text, audio, video, etc. GenAI tools have found a place in multiple industries such as healthcare, tourism, entertainment, and even education. Programs like ChatGPT have made GenAI easy to use and accessible to the general public. There have been many attempts globally to understand the impact these tools have on all aspects of education. Despite the numerous advantages these tools can provide to both students and teachers, there are also concerns and apprehensions. To map the landscape in education, several studies have tried to understand how students and teachers perceive GenAI within their institutions. This is a starting step to understand what the advantages and disadvantages are. Similarly, at Erasmus University Rotterdam, an internal study was conducted to understand how students at the university feel about ChatGPT. The results showed that most students were occasional or regular users of ChatGPT and very few had not heard of it before. Looking ahead, there are already some frameworks such as PAIR (Problem, AI, Interaction, Reflection) that support teachers to easily integrate GenAI tools in their curriculum (Acar, 2023). However, with all the advantages there are also concerns that the use of GenAI could lead to a decline in students' critical thinking skills (Civil, 2023) as they become more compliant and dependent on automated tools to complete their work. This fear and concern have led universities to limit the use of GenAI in academic contexts. In this study, we chose to focus on the ethics of GenAI. There are many ethical questions raised when using GenAI tools in academic contexts, some of which we are unaware of. This is a concern not just for students but also for educators working within the university.

The ethical aspects of AI, particularly GenAI, have been frequently discussed in the past. Frameworks and principles tailored to specific contexts have emerged to address these concerns. Adams et al. (2023) conducted a thorough qualitative analysis of current principles for the ethics of AI in K-12 education. The study showcased the need for some context-specific principles such as children's rights, AI literacy, and teacher well-being. Some universities such as UTS have defined principles for the effective and ethical use of GenAI (LX Team, 2024). The student-centric principles guide the usage of GenAI by equipping students to engage critically with it and helping them understand the legitimate use of GenAI in their studies. Teachers also need to be trained on how to use GenAI tools as a part of their curriculum. They should be able to understand how the applications work to effectively support classroom teaching and learning (Chiu, 2023). Several studies have been conducted to understand the ethical concerns of students and teachers when using tools like ChatGPT. Research has emphasized the importance of the sociotechnical context configured by educational practices in ethical considerations (Kitto & Knight, 2019). In addition, Nguyen et al. (2022) conducted a thematic analysis of relevant ethical guidelines and reports related to AI in education and arrived at seven principles. The principles covered a wide range of themes from inclusiveness to privacy. Based on the literature, five topics were defined for the focus groups. The topics were tailored to ensure in-depth discussions occurred in every group and were a starting point for facilitators to manage the discussions. The five topics were: Responsibility, Trust and Misinformation, Role in learning, Inclusion, and Role in Higher education.

2. Methodology

To investigate this research question, a cross-sectional and descriptive study design using the focus group technique was proposed. In this study, we used focus group discussions to collect data on the ethical challenges and concerns of GenAI when used in higher education. A focus group is a qualitative research method that brings together a small group of people to answer questions in a facilitated setting. The goal of the focus group was to create space for participants to share their opinions, attitudes, and concerns. The focus group discussions were held as a part of a larger event called Explore, held at Erasmus University Rotterdam in March 2024. The focus of the event and thereby the focus groups was the ethics of GenAI. The focus group was semi-structured and lasted an hour. Templates were given to both participants and facilitators to help structure the discussion. The goal of the template for participants was to understand their motivation, goals, and concerns when discussing the ethics of GenAI. Once participants filled in their worksheets, an open discussion followed which was hosted by the facilitator. The worksheet for the facilitator was to help make the note-taking process easier.

Table 1. The template for participants and facilitators.

Prompts for Participants	Prompts for Facilitators
<p>Q1: What was your motivation for picking this topic? What are the stakes for you?</p> <p>Q2: On your own, articulate a specific question (or questions) on the topic, focusing on ethical implications/aspects.</p>	<p>Challenge(s)</p> <p>Opportunity(ies)</p> <p>Solutions</p> <p>Big idea(s)</p>

2.1. Topics of discussions

After the literature reviews, five themes were defined as the topics of discussion for the focus groups. Experts from all across the university were chosen to facilitate these focus groups based on their expertise.

- Responsibility: GenAI's role in education raises questions on ownership and accountability. In this context, it could entail mastering prompting, evaluating generated responses and foreseeing implications.
- Trust (Misinformation): GenAI's reliance on diverse data sources and potential misinterpretation emphasizes the critical role of information literacy in higher education.

- Role in Learning (incl. research & student-teacher collaboration): GenAI's integration in education challenges the traditional teacher-student dynamic, potentially fostering new collaborative learning models and reshaping roles in the classroom.
- Inclusion: GenAI's dual role in education can both bridge and widen disparities, through enhancing accessibility while also amplifying biases and inequalities in affordability and inclusivity.
- Role in higher education: GenAI's impact on professional sectors and higher education demands ethical consideration due to evolving roles and expectations, shaping both learning practices and outcomes.

2.2. Participants

Thirty-one participants attended the focus group discussions and were allowed to select a group based on their interests. The topic and a short description were presented to assist their decision-making process. This approach was chosen to give participants autonomy and facilitate in-depth conversations. The group consisted of students, teachers, and university staff members occupying roles such as educational specialists, policy advisors, and information specialists. Five facilitators facilitated the discussions and were experts in a variety of fields from law to research.

Table 2. The participant distribution.

Participant profile	Number of participants
Student	12
Teachers	3
University staff	16

2.3. Limitation

The study had a few limitations. The distribution of participants across groups was unequal which resulted in some groups having fewer members. This was a direct outcome of some topics receiving more attention than others. The sample was relatively small and thus represented a limited number of perspectives from the overall university.

3. Results

The data from the focus groups was analyzed in two levels. Initially, the discussions within each group were analyzed to extract insights on the specific topics. Subsequently, a secondary analysis was conducted based on participants' profiles (students, educators, university staff) to identify overlaps in concerns and proposed solutions. This approach aimed to observe common themes and patterns across the diverse participant groups. The takeaways from each group are listed below.

Responsibility: All participants had a shared concern about the lack of critical perspective regarding responsibility in the use of GenAI. Apart from challenges, there was also discussion about opportunities for improvement. The key focus was on equipping students to prompt and reference correctly. One actionable idea was for students and educators to co-create regulations for the use of GenAI within the university.

Trust: Participants had specific questions about how to measure trust and inform students about the risk of misinformation. Some participants were skeptical about GenAI usage questioning its utility. A very diverse range of definitions emerged regarding the concept of trust. Concerns arose about what is right and wrong when using GenAI. In terms of potential solutions, increasing awareness and implementing policies were suggested. Participants also discussed the notion of validating and accrediting sources.

Learning: Some participants had clear questions about understanding what needs to change in the current curriculum to support students better. Others wanted to know what a healthy balance between working on their own and using GenAI could be. Discussions revolved around the possibility of a universal approach to implementing GenAI in learning. Students were also concerned with the gray area between using GenAI to support their own work and the likelihood of the assignment becoming a creation of the tool itself.

Inclusion: Participants wanted to address concerns about how GenAI could aggravate existing inequalities. Strategies to mitigate these biases and prevent them from impacting academic work were discussed. A common agreement was the necessity of AI literacy in universities, stressing the importance of its implications for both students and educators. Some participants were skeptical about the feasibility of achieving a fully unbiased GenAI model, because of biases in the real world that impact the training data.

Role in Higher Education: Participants raised overarching questions regarding how developments in GenAI impact current learning and testing practices. The idea of a balance between creativity and cheating was discussed to address concerns from students. Looking ahead, the possibilities of using GenAI in university work were explored. The group noted that there is a lack of critical thinking among students when utilizing such tools, emphasizing the necessity for guidance and reflection.

4. Discussion

Aside from insights from each of the groups, patterns emerged across the groups as well. When analyzing the data based on the participant profiles, it was clear that students across all groups expressed concerns about the impact of GenAI on their education. They expressed the need for guidance and support from faculty and educators to help navigate this new reality. University staff expressed role-specific concerns and shared a common objective of enhancing awareness of GenAI usage. Teachers and educators expressed a desire to support students in utilizing GenAI and understanding its implications. There was an overlapping theme of wanting a structured framework for integrating GenAI tools into the existing curriculum.

While analyzing the data we also realized that a lot of insights and findings focused on GenAI usage in higher education and less so on the ethical concerns behind them, one reason behind this could be the lack of AI literacy which needs to be established before discussing ethical considerations. Another reason could be the lack of clarity on what ethics entail. There is a general agreement on terminology to describe ethics and ethical issues, but there are different interpretations and understandings (Ryan et al., 2021). Conversations were also limited by the topics defined for the focus groups. Three main themes emerged from the discussions. Two of them are more relevant to the initial proposed study of the ethics of GenAI. The third theme of AI literacy sheds light on a bigger challenge with the adoption of GenAI.

1. The need for ethical frameworks and guidance: Participants across the group expressed concern over the responsible use of GenAI. The takeaway from the focus group discussions was that it is important to equip students and educators with the skills to prompt and reference correctly. This could be guided by a framework created within the university by students and teachers working together. To support this finding, research also suggests that while there are many theoretical frameworks investigating the ethics of AI in general, there is no universal consensus on the best ethical theory concerning the field of (higher) education (Nguyen et al., 2022).
2. Ensuring creativity while maintaining integrity: There was concern about the boundaries of using GenAI as a tool. Educators wanted to find a balance between promoting GenAI-driven creativity and preventing cheating. Students need increased critical thinking skills to reflect on using the GenAI tools. Existing research also suggests the need for critical reasoning and thinking skills when learning with ChatGPT (Chiu, 2023). The discussion highlighted the importance of generic skill development and how students should still be trained in certain basic skills before using GenAI to support them in their tasks.
3. AI Literacy and Awareness: The necessity for AI literacy was highlighted across the different groups. The participants emphasized the lack of clear understanding of the implications GenAI has for both students and educators. There was also skepticism regarding the existence of fully unbiased AI models.

5. Conclusion

The study aimed to understand the ethical challenges and concerns with using GenAI in higher education contexts. The participants involved educators, students, and university staff; hence a variety of perspectives was represented. This study helped elucidate some concrete steps for the future to support the ethical use of GenAI in the university. There is an evident need for more AI literacy and more critical conversations around the use of GenAI. A majority of the participants were open to adopting their work/learning to use GenAI but were lacking guidance and support for the same. There was also a consensus that this shift to new technologies can only be productive if educators and students work together and co-create a regulatory framework for its use. Future studies can test more actionable steps and the

impact they will have on curriculum and interactions at the university. There is also scope to create more concrete ethical principles for the use of GenAI in higher education.

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CHATGPT AS TUTOR? A CASE STUDY ON COMPETITIVE PROGRAMMING

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Abstract

In this paper, we present a case study on how students utilize ChatGPT as a tutor for a short competitive programming course. The students were divided into two groups, one led by a teacher, and the other tutored by ChatGPT. The course was an intensive five-day course and both groups studied concurrently. Students could freely choose which group they participated in. The ChatGPT group was provided a guide on the basics of prompting, including approaches on how to generate the study material. Both groups were allowed to use any learning material, and only the teacher-led group excluded the use of generative AI tools. *Research questions:* In this study, we focus on the following questions: (1) How did students approach using ChatGPT as a tutor?; (2) Are there significant differences between students led by a teacher or by ChatGPT?; (3) How did students in both groups experience the teaching and did it correlate to the achieved learning results (exam)?

Methodology: The data consists of survey data, and final exam given to students (N=11). We also collected the discussion history of the ChatGPT group. The discussion history was divided into prompt-message pairs (N=340) and analyzed. The data was analyzed using mixed methods. The discussion history was analyzed using grounded theory. Statistical methods were used to find any correlation between initial skill level and learning as well as the tag distribution of the ChatGPT discussions.

Results: Differences were found between the two groups. Those with a higher initial skill level seemed to favor the ChatGPT group, whereas the less experienced chose the in-person teaching. Analysis of the ChatGPT discussion history showed mostly similar usage patterns across students. We present the distribution of tags used by the ChatGPT group. Additionally, we give insight on how to approach similar research settings in the future.

Impact: All around the world, students are already utilizing ChatGPT as a substitute for a teacher or a tutor. Our pilot study provides insight into how students approach utilizing ChatGPT as a tutor in a programming teaching setting. These preliminary results can be used to guide future research settings.

Keywords: ChatGPT, programming education, case study, AI in education.

1. Introduction

ChatGPT and other large language models (LLMs) have in a relatively short period grown in capabilities and are being used across different industries. Additionally, the good availability and performance of these tools have led students across the world to start using ChatGPT (and other LLMs) to aid them in their schoolwork. Although some of the potential use cases are nefarious, such as using ChatGPT to generate full answers to introductory programming courses, there are valid use cases as well. Students might use ChatGPT to help them understand a hard-to-grasp topic or try to replace incompetent tutors. They also might be studying independently or they might try to update outdated material with the help of these now easily available tools. This creates a need to understand how well ChatGPT can act as a tutor, tutorial, or substitute a tutor. This begs the question: can students identify potential caveats related to these approaches and what is the performance of the publicly available models related to in-person interactive learning experiences?

2. Related work

ChatGPT is a LLM published by OpenAI. LLMs models that have been trained with massive amounts of data. It can perform a variety of different tasks across multiple domains from code generation, and translation to text classification (Liu et al., 2023, Achiam et al., 2023). OpenAI has published GPT-3.5

and GPT-4-based ChatGPT models. GPT-4 performs better than GPT-3.5 in almost all tasks (Achiam et al., 2023). There are potential downsides. LLMs can and also will generate convincing-sounding false text, known as hallucinations (Maynez, Narayan, Bohnet, and McDonald 2020). It might also generate text that reinforces stereotypes. These potential risks should be kept in mind when using ChatGPT or other LLMs.

One of the challenges is also the art of prompting (prompt engineering). A prompt is the user's input to the model. Aligning the large language model to give relevant answers has always been a challenge, and prompts can greatly affect the performance of these models (Reynolds & McDonnell, 2021). On the other hand, utilizing specific prompting techniques such as chain-of-thoughts (Wei et al. 2022) can improve the performance of the models. Chain-of-thoughts is a prompting technique where the model breaks down the problem into smaller separate steps, often increasing the model's performance on tasks requiring reasoning. Yilmaz and Yilmaz (2023) note that providing instructions for students on prompting is important because a prompt can greatly affect the quality of the output of the model. This can concretely be seen, for example, in some of the prompts written by the students in Qureshi (2023), where some of the provided example prompts of students lack clear instructions and do not give enough context for the model to provide a correct answer.

Yilmaz and Yilmaz (2023) noted in their conducted study that incorporating ChatGPT into programming courses seems beneficial and that incorporating it seems to enhance "students' self-confidence, learning motivation, and code-writing skills".

Qureshi (2023) conducted a quite similar study to ours. The study setting was that students were given programming tasks to solve within a strict time limit. In the study student students (N=24) were into two groups. The groups were composed of six pairs of students. The first group had no access to the internet (Group A) but they had access to the textbooks and notes of programming courses while the students in the second group (Group B) were given access to ChatGPT and were encouraged to use it. The ChatGPT group also had access to ChatGPT in the exam. Group B had a better overall score than group A. However, in group B the submitted code lowered the score due to its lack (to some degree) of accuracy and consistency.

3. Methodology

The setting in this study was a 5-day intensive course themed "Introduction to Competitive Programming" (3 ECTS). The course was held as an alternative to a voluntary "custom project" course. Students were free to choose their tutor (human or ChatGPT) freely. The ChatGPT group were asked to use GPT-3.5, but were allowed to use GPT-4 if they already had paid the required subscription fee themselves. The students in the contact person group were prohibited from using any LLMs on the course. The curriculum included four days of studying and a final exam on the fifth (final) day. The exam was supervised and neither group was allowed to use any LLM during the exam. The exam was the same for both groups and held for both groups at the same time.

Data collection: At the end of each the students answered the survey. At the end of the course, students were asked to e-mail the links to their chats with ChatGPT. These prompts were then collected and analyzed using grounded theory. After the exam, a small feedback session was held where students could discuss.

The ChatGPT group was given a small guide constructed by us that contained information about ChatGPT and prompting. The guide also contained instructions to generate study materials related to the course content. Students were instructed to generate materials following the workflow displayed in Table 1. The ChatGPT group could also use other freely available materials across the internet. The ChatGPT group was not given any other external materials besides the guide and the course description (learning objectives).

Table 1. Suggested workflow for study material generation in the guide given to students.

Workflow suggested to students	Additional notes for students
1. Generating a modular curriculum based on the course's description and learning goals.	Check that all of the learning goals are mentioned in the generated plan and that the plan is realistic.
2. Generating individual modules (study material) in a separate thread(s).	Remember the context limit.
3. Create exercises in a separate thread and include enough context (generated course material) to improve the exercise quality and align the ChatGPT with the set learning goals.	Remember to create programming exercises and essays.

4. Results

The more experienced students seemed to prefer to study independently using ChatGPT, as a one-tailed T-test showed a statistically significant difference ($p=0.002$) in the mean between the starting skill: .03 and 1.0 respectively as measured by evaluating the coding question in the pre-course survey.

A one-tailed T-test revealed a statistical significance in the mean final test scores (maximum points 100) between the ChatGPT and non-ChatGPT groups: 65.4 and 79.1, with the ChatGPT-group performing better ($p=.041$). This result corroborates the fact that the more experienced students chose to study with ChatGPT.

The generated course syllabi were similar across the board. The in-person course syllabus developed by the teacher began with a day of introduction to competitive programming and revision of common data structures. The second day focused on problem-solving strategies, such as dynamic programming and divide-and-conquer. The third day was about recursion. The fourth day focused on graphs and graph problems. The syllabi created by ChatGPT for students always followed the same general structure as above, except for leaving out recursion and replacing it with coding practice.

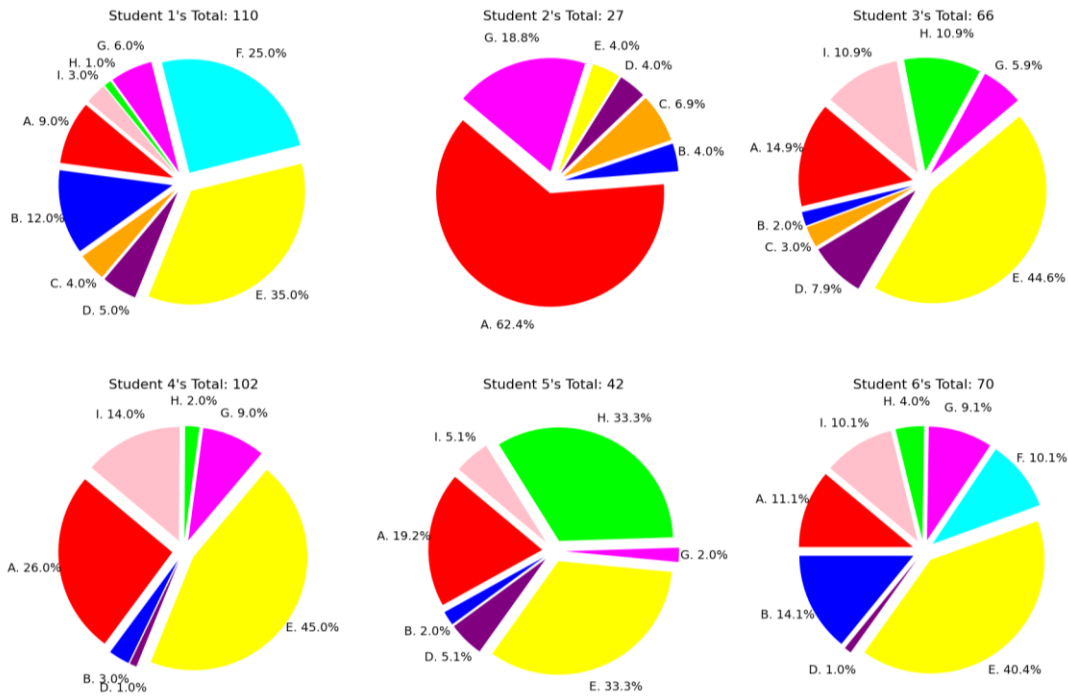
The distribution of the prompt-answer pairs can be seen in Figure 1. Due to a technical error, 39% (40 total) message pairs from student 1 were left untagged. As seen in the figure, there is quite a big difference in the number of question-answer pairs depending on the student. One prompt-answer pair could include multiple tags (although most of them had only 1 tag). Unfortunately, our number of students in the ChatGPT-led group ($N=6$) was too small to make solid assumptions based on this. The explanation of the tags can be seen in Table 2. The “ChatGPT explains” and “Information search” are partly aligned, and one could argue to present them together. However, we decided to separate them because the more complex questions can be answered directly by ChatGPT or other LLMs but searching using traditional search engines (e.g. Google) would not have yielded as good results.

In the feedback session after the exam, students noted that sometimes ChatGPT explained terms with wrong definitions. Also, students mentioned that exercises generated by ChatGPT were sometimes too easy. During that students confirmed that topics were mainly the same as the teacher-led group.

Table 2. Tag explanations with corresponding letter and color.

	A	Exercise generation	Generation of exercises, e.g., coding questions, multiple choice questions or essays.
	B	Exercise evaluation	Evaluation of the answers provided by students.
	C	Exercise variation	Generating a variation, often asking for more harder exercises of already generated ones.
	D	Other	Not fitting to any other category (e.g. thanking ChatGPT).
	E	ChatGPT Explains	ChatGPT explains a complex topic.
	F	Continue prompt	Asking ChatGPT to continue generating more material. (often used with study material generation, tag “ChatGPT explains”).
	G	Study planning	Often the creating the modular curriculum.
	H	Information search	A simpler question, often the answer could have been gained with a simple Google search.
	I	Example answer	ChatGPT produced an example answer to an exercise.

Figure 1. The distribution of the tags. Label explanations can be seen in Table 2. The distributions of 0 have been excluded from the figure for increased readability. Total is the total tag count.



5. Discussion

Students, especially students learning programming are already learning on courses that are held fully remote and which require or even have very little input from the course personnel. However, students can complete these courses and achieve the required learning goals. So active teacher-student interaction is not necessarily an obligatory requirement, although having that interaction is almost always beneficial. In certain scenarios, ChatGPT can be, although not perfect, maybe an adequate substitute for a tutor. This of course requires that students remain vigilant and are aware of the limitations and risks of the technology.

This naturally raises the question of the quality of the generated materials and to which degree we need human intervention in the programming courses. The biggest challenge and limiting factor of LLMs is hallucination. Students need to be actively reminded that LLMs sometimes will generate convincing-sounding answers that are completely fabricated. This also sets requirements for which topics this kind of study setting can be utilized. Learning competitive programming is almost the perfect subject for this setting because it requires students to use their logical thinking and it's more about applying skills than learning blindly theoretical background. This forces students to actively challenge the answers generated by ChatGPT instead of relying on them as the ground truth.

ChatGPT's capability to act as a tutor is limited both by students too novice to validate the output as well as the model's inability to produce correct answers reliably. For more novice students the teachers should give more strict guidelines, defining the allowed and prohibited use cases clearly to students, along with the information about why restrictions were set. However, if students have enough base knowledge of the topic and the tool (LLM), students can be given more freedom. Students should be actively reminded that ChatGPT behaves more akin to a more experienced classmate than an expert in the field.

We noticed that the students who were working full- or part-time (presumably in programming-related jobs) or had the highest skill tended to select the ChatGPT group. We suspect this was due to the flexibility that independent learning can offer. It might also be that those unsure of their abilities tended to favor the possibility of interaction with real teachers. Additionally, at least in these early stages of technology, utilizing ChatGPT to its full potential requires a lot from the student, especially in terms of willingness to learn a new tool, its proficient use and restrictions.

However, the potential of the technology is still quite large. If the hallucination problem is ever solved (or students learn to double-check information), and LLM context sizes keep increasing, many possibilities could emerge. For example, teachers could focus on defining learning goals and selecting source materials, while the LLM could adapt the provided source material to best fit the learning goals of the course's teacher set. However the current technology still clearly lacks the capabilities to achieve this.

We deem that giving students an alternative to ChatGPT (or other LLM) is also important. In our study, this was also emphasized in the guide given to students, in the very first sentence of the first chapter of the guide. This gives students agency and freedom to find the most efficient way to study. Although this study setting was a bit extreme, it's important to remember that students are already doing similar activities across the world.

6. Conclusion

The limitations and threats associated with ChatGPT limit the possibilities of its usage. However, we can fairly confidently say that students across the world will use ChatGPT as a tutor or teacher's substitute. The 39% (40 total) of message pairs left untagged from student 1 due to a technical error changed the distribution of tags of student 1 but did not otherwise affect our result.

Using it as an autonomous tutor should be considered carefully. The risks associated with using ChatGPT as a tutor should be recognized and carefully considered. The selected topics should, at least in this early stage of the said technology, aim to mitigate the risk of causing potential knowledge gaps in students' knowledge caused by hallucinations of the LLM. This means that students should have enough knowledge of the taught topic, as well as exclude topics where undetected hallucinations can cause harm. This also means that ChatGPT should be utilized in courses where students mainly do not try to gain new theoretical background, but instead try to apply already learned skills with possibly minor additions to their base knowledge. In a programming context, this could be e.g., course about competitive programming or amplifying the student's productivity on a final project on a programming course therefore increasing the possible scope of the project.

For future research on similar settings, we recommend dividing students with a pre-test, similar to Qureshi (2023), to avoid skewing more proficient students in the ChatGPT group. We also concur with Yilmaz and Yilmaz (2023) that students should also be given guidance on prompting and basic knowledge of LLMs before giving students access to using them in a teaching setting. In addition, we propose that separating students into three different groups could provide interesting results: a fully independent that can utilize LLMs, a fully independent without access to LLMs, and an in-person held contact group. Also, we noticed that students might be unsure about whether the content generated by ChatGPT is good enough, so confirming that the model is producing good quality content with students at regular intervals would probably be beneficial. Keeping in mind the potential and challenges related to LLMs, as mentioned in the discussion, is vital to producing good, ethical research on this topic.

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IS HOMESCHOOLING DETRIMENTAL TO SOCIOEMOTIONAL DEVELOPMENT? AN EXPLORATORY STUDY WITH SPANISH SCHOOL-AGE CHILDREN

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Abstract

In recent decades families that decide to homeschool their children have increased significantly. The situation of these families is very different depending on the country of residence. For instance, in Europe, most countries recognize homeschooling (HS) as a legal right. However, existing regulations vary in a wide range of situations, ranging from rather lax regulations (Austria, France, Belgium) to quite restrictive ones (Italy, Norway, Portugal) (Blok et al., 2017). These differences in regulation highlight the lack of consensus about the benefits and consequences of HS. The issue of social and emotional adjustment is closely associated with socialization, which is a key issue in HS. The HS advocates appeal to the authoritarian, uncritical and competitive environment of the educational system, to the possible situations of mistreatment and/or discrimination between peers or to the difficulty in maintaining social status as variables of the school context that can harm the social development of children (Dalaimo, 1996; Farris & Woodfrud, 2000; Medlin, 2000; Meighan, 1995; Murphy, 2014; Taylor, 1986). Detractors of HS consider that the school context is critical in learning social norms, values, and social interaction skills and that, therefore, reducing it to the family context can result in isolation and poor social and emotional development (Farris & Woodfrud, 2000; Medlin, 2000; Murphy, 2014; Romanowsky, 2001; Shyers, 1992). The objective of this work is to analyze the impact that homeschooling has on the socioemotional development of school-age children. The participants were 205 families with children between 6 and 11 years old. 124 of these families school their children in public schools and 84 are homeschooled. An ex post facto design has been used in which the psychological adjustment of the participants has been compared through two measures: on the one hand, self-report of the Child and Adolescent Evaluation System Questionnaire (SENA, Fernández-Pinto et al., 2015) and, on the other hand, hetero-report of the same instrument completed by the family. Preliminary results suggest that there are no significant differences in the socioemotional development of school-age children depending on the type of schooling. The implications of these findings will be discussed.

Keywords: *Homeschooling, socioemotional development, school-age children, social adjustment.*

1. Introduction

Families that decide to homeschool their children have increased significantly in recent decades. It has been estimated that approximately 3% of school-age children in the United States currently are homeschooled (HS) (Ray, 2023). Most European countries recognize HS as a legal right. In some cases, they are governed by rather lax regulations (Austria, France, Belgium) and in others they are quite restrictive (Italy, Norway, Portugal) (Blok et al., 2017). In Spain, for instance, according to national legislation full-time compulsory education cannot be provided at home.

Previous studies don't clarify about benefits of homeschooling due to some methodological and ideological issues (Kunzman & Gaither, 2020; Valiente et al., 2022). Many authors pointed out the following methodological problems found in these studies (Kunzman & Gaither, 2020; Murphy, 2014; Valiente et al., 2022): samples are usually convenience samples and are not representative, many studies do not take into account variables that could explain some of the differences (such as socioeconomic status, parental involvement, the time of onset, and years of homeschooling or specific contexts of children's social relationships) and most studies only use parents as informants. In terms of ideological issues, some authors have found that many parents who homeschool their children have had bad

experiences at school during their childhood, and this experience contributes to develop a negative perception of the school context (Arai, 2000; Neuman, 2019; Wyatt, 2008). McQuiggan et al. (2017) in the United States found that 51% of families decided to homeschool their children to provide religious instruction and 67% to offer moral education. Moreover, 80% of families were dissatisfied with the school environment and 61% were also dissatisfied for academic reasons. These results show that, in many cases, the families' main motivations go beyond academic issues and are related to ideological, religious, and contextual aspects.

Socioemotional adjustment in homeschooled children

In one hand, the homeschooling advocates refers to the authoritarian, uncritical and competitive environment of the educational system, the potential situations of peer mistreatment and/or discrimination or the difficulty maintaining social status as variables of the school context that may be detrimental to children's social development (Dalaimo, 1996; Farris & Woodfrud, 2000; Medlin, 2000; Meighan, 1995; Murphy, 2014; Taylor, 1986). In the other hand, detractors of homeschooling point out that the school context is critical in learning social norms, values, and social interaction skills, and that, therefore reducing it to the family context can lead to isolation and poor social and emotional development (Farris & Woodfrud, 2000; Medlin, 2000; Murphy, 2014; Romanowsky, 2001; Shyers, 1992).

Present Study

The objective of this paper is to contribute to the knowledge of the impact that homeschooling has on the adjustment and socioemotional development of school-aged children in a Spanish sample. There are no previous studies in Spain that evaluate the psychological state of children who are homeschooled. It is important to note that in Spain, homeschoolers can be considered a hidden sample.

2. Methods

An *ex post facto* design has been used in which the psychological adjustment of the participants has been compared through two measures: on the one hand, self-report of the Child and Adolescent Evaluation System Questionnaire (SENA, Fernández-Pinto et al., 2015) and, on the other hand, hetero-report of the same instrument completed by the family.

2.1. Participants

The participants were 205 families with children between 6 and 11 years old. 124 of these families opt for school their children in public schools and 84 are homeschoolers. There is some particularity regarding the samples as the measures were taken at different times. Depending on the variable, the sample was different. In this sense, for the measurement of anxiety the sample is the following:

Table 1. Composition of the sample according to gender and type of schooling for anxiety.

		Schoolers		Homeschoolers		Total
		Boys	Girls	Boys	Girls	
Self-report	6-7 years old	40	33	14	15	102
	8-11 years old	75	63	22	7(4*)	171
Hetero-report	Families	124		79		205

Note: *participants didn't inform about gender

The sample for the rest of variables is the following:

Table 2. Composition of the sample according to gender and type of schooling for the others variables.

		Schoolers		Homeschoolers		Total
		Boys	Girls	Boys	Girls	
Self-report	8-11 years old	46	36	22	7(2*)	113
Hetero-report	Families	31	44	50	26 (8*)	159

Note: *participants didn't inform about gender

2.2. Instruments

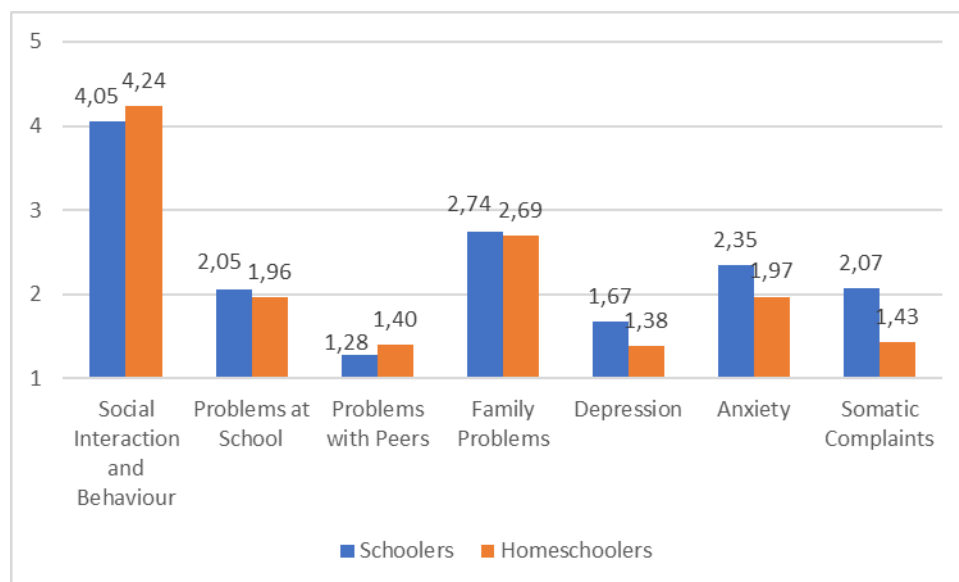
The Child and Adolescent Assessment System Questionnaire (Cuestionario Sistema de Evaluación de Niños y Adolescentes - SENA, Fernández-Pinto et al., 2015), scaled for the Spanish population in its self-report and hetero-report version, was used. This questionnaire allows a broad exploration of child psychological adjustment, covering ages from 3 to 18 years.

In this study we chose the scales that measure aspects more related to adjustment and social skills, such as Anxiety, Depression, Problems with Peers, Family Problems, Problems at School, Interaction and Social Behaviour, and Somatic Complaints for the self-report version. For the hetero-report answered by the parents, the scales Anxiety, Depression, Emotion Regulation, Willingness to Study, Attentional Problems, Hyperactivity and Challenging Behaviour scales were chosen. The instrument is scored on a Likert scale where 1 means "Never or almost never", 2 "Rarely", 3 "Sometimes", 4 "Very often" and 5 "Always or almost always". For the authors of the test, scores of 3 and above are indicative of problems.

3. Results

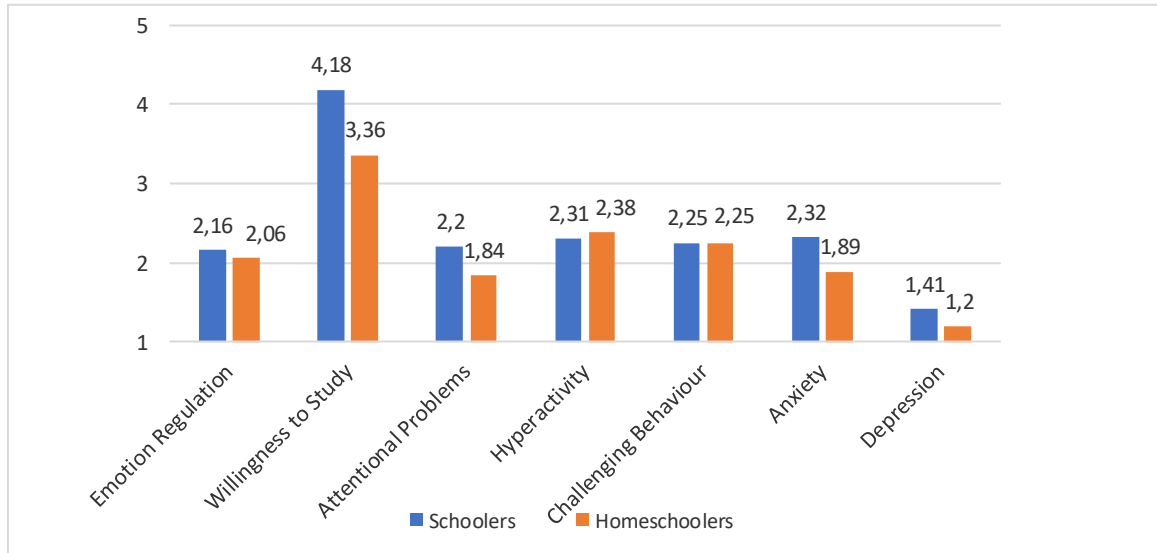
The normality of the data was tested using the Kolmogorov-Smirnov (K-S) test. Mann-Whitney U test was applied for the variables that showed a non-normal distribution and T-Student test was applied for the variables that showed a normal distribution. Mean scores for self and hetero-report can be seen in figures 1 and 2. In the self-report significant differences were observed only for the Depression ($U=851$, $z=-2.079$, $p=.007$, $r=-.25$), Anxiety ($t(155)=-2.366$, $p=.019$; $d=.66$) and Somatic Complaints ($U=463.5$, $z=-5.205$, $p=.000$, $r=-.49$) scales. In all cases, the HS children obtained lower scores than the school children.

Figure 1. Mean scores for self-report.



In the hetero-report significant differences were found in the Attentional Problems ($U=2371.5$, $z=-2.69$, $p=.01$, $r=-.21$), Depression ($U=2362.5$, $z=-2.76$, $p=.01$, $r=-.22$), Anxiety ($U=3622.0$, $p=.001$, $z=-3.38$, $r=-.02$) and Willingness to Study ($U=1427.5$, $z=-5.97$, $p=.00$, $r=-.47$) scales. In all the scales mentioned, the score of the homeschoolers was lower than that of the schoolers.

Figure 2. Mean scores for hetero-report.



4. Discussion

The objective of the present study was to compare the socioemotional adjustment of students who are homeschoolers and those schooled in educational centers. Multi-informant measures (self and hetero-reports) were used. Our results showed that, in the self-reports, the homeschoolers scored significantly lower in Depression, Anxiety and Somatic Complaints. No differences were found in any of the other measures of socioemotional adjustment. Likewise, the parents' view through the hetero-reports also showed that the homeschoolers scored significantly lower in Depression, Attentional Problems, Anxiety and Willingness to Study than schooled children.

Probably the most interesting found of this study was the consistency between parents' and the children's scores for the measure of depression and anxiety. These results are in line with those of other Guterman and Neuman (2017), who found that homeschoolers between the ages of 9 and 12 show significantly lower levels of depression.

Another interesting result has to do with the Somatic Complaint scores. The Somatic Complaint Scale asks children to rate the frequency of certain physical complaints that are considered indicative of psychological manifestations. As some previous studies have shown, stomach aches, headaches, backaches, or fatigue in preschool children have been found to be predictive of depression and anxiety in childhood and adolescence (Lien et al., 2011; Shelby et al., 2013; Woods, 2020). It is important to note that children's assessment of this symptomatology could be especially revealing, as it is a physical experience that can be much easier for children to assess than other issues more linked to emotions or thoughts. In this sense, it is feasible that the differences between the two groups support and add coherence to those found in the Depression and Anxiety scale.

One surprising result was found in the so-called Willingness to Study. In this case, school children obtain higher scores than homeschoolers. Analyzing a bit more in detail this scale, it seems that it refers to issues that can be important in the school context but not necessarily in the context of homeschoolers.

Taken together, our results suggest not only that homeschoolers present similar levels of psychological adjustment compared to school children, but also that they score higher, on some scales. It is important to point out that the measures of social adjustment, one of the main concerns of the studies that have evaluated the well-being of homeschoolers, do not reveal social interaction difficulties. In the same sense, no differences were found in family interactions (neither in the Family Problems scale nor in the Challenging Behavior scale) compared to school children.

This study presents some limitations: the size of the sample and the lack of certain relevant information for the correct interpretation of the results (such as socioeconomic characteristics, the reasons that led to the decision of homeschooling - religious issues, disagreement with the educational system, negative experiences in educational institutions -, the methodology of teaching used in the family context or the time they have been homeschooling, etc.)

Besides those limitations, one of the most important strengths of this study was to access a sample of homeschoolers in Spain. The non-regularized situation of homeschooling in Spain makes it

difficult to access this type of participants for research, thus our results could contribute towards modifying the image that, at least in Spain, is usually held of families that educate their children at home. Likewise, in line with the few previous works carried out (Guterman & Neuman, 2017), our results suggest the need for more studies to better understand the impact that this type of schooling has on children's development.

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ARTIFICIAL INTELLIGENCE REVOLUTIONIZING ONLINE EDUCATION

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Abstract

The recent COVID-19 pandemic forced universities to move to online education, many of which would not have considered online courses without that impetus. Subsequently there has been a surge in online courses. Online courses take a long time to prepare and frequently the delivery and execution is of low quality. One way to overcome both limitations is to use the powerful paradigm of Artificial Intelligence, especially Large Language Models, to develop and deliver online courses. In this paper, we introduce “AI Lecturer”, an innovative solution powered by a Large Language Model that is designed to improve the quality and delivery of lessons in educational institutions. The paper discusses related work in online course delivery and locates our solution in this space. The AI Lecturer functionality is presented and includes AI-powered automated lesson preparation, interactive teaching through AI avatars, and personalized homework generation and evaluation. A survey was carried out to evaluate student satisfaction and learning using AI Lecturer. The survey results will be presented. Respondents expressed a high degree of satisfaction with the user interface and overall experience, found the lifelike avatars engaging, and indicated they would recommend the platform to others. Finally, we will discuss the advantages and disadvantages of our platform and the challenges students faced when using it.

Keywords: *AI lecturer, online education, interactive teaching avatars, automated personalized homework.*

1. Introduction

In recent years, the world of education has witnessed a profound transformation, driven by artificial intelligence (AI) and technological innovation. As technology continues to evolve, it is no longer confined to mere facilitation but now plays a central role in the pedagogical process. In this dynamic and ever-changing context, we introduce AI Lecturer, AIL, an innovative solution that leverages the power of AI for online learning (<https://myai-edu.com/>). Online education, once considered a niche alternative, has surged in popularity and relevance (Papadakis, 2023). Recent pandemics have changed the way we think, how knowledge is produced, and how education is perceived. This has led to the popularity of Massive Open Online Courses (MOOC) - based learning (Shah, 2021). Recent reports indicate that millions of new users have registered on popular MOOC platforms (Gomez et al., 2022), though many do not complete the courses.

An additional impact on online education is the revolution of AI and Large Language Models (LLM), (OpenAI, 2022). With the advent of AI and machine learning, online learning has not only become more accessible but is evolving into a personalized educational experience.

UNESCO (2021, p. 27) offers this advice to educational managers and policymakers: “...as AI functionalities improve, they will inevitably relieve teachers of increasing numbers of burdens. Accordingly, as the AI tools take over the knowledge transmission tasks, facilitating students’ lower order thinking, teachers will play a reduced role. Theoretically, this will allow teachers to focus more on the design and facilitation of learning activities that require higher-order thinking, creativity, interpersonal collaboration, and social values – although, no doubt, AI developers are already working to automate these tasks too. Accordingly, to ensure that teachers continue their critical role in the education of young people policy makers must review strategically how AI might transform teachers’ roles, and how teachers might prepare to work in AI-rich education environments.”

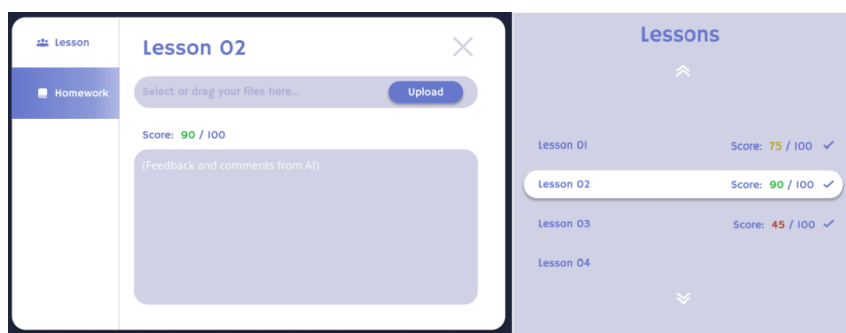
Three features are deemed important for effective online education: motivation, engagement, and personalized learning. Chazan and Ball (1999) say that classroom interaction needs to be intellectually motivated in order to be productive for learning. It seems critical that teachers monitor and manage classroom disagreement in order to support and sustain intellectual ferment. Our solution offers an AI clone of the lecturer image, lip synchronization, and state-of-the-art text-to-speech technology. The avatar

conducts lectures and delivers content with an authenticity that captures the students' attention and elevates their engagement with the material. The AI clone serves as a catalyst for questions and discussions.

Senthamarai (2018) states that interactive teaching approaches should be designed to help students engage with the material and meet the objectives. Educators need to create, or select, the instructional activities to engage students. AIL allows the teacher to create online questions and activities to meet the learning objectives.

According to Makhambetova, Zhiyenbayeva, and Ergesheva (2021) personalized learning is a major factor in improving academic achievement and motivation in education. In our proposed AIL solution, personalisation takes centre stage by offering personalized homework assignment generation, personalized discussion with the student and a personalized approach to lesson delivery. Leveraging the capabilities of AI, the platform assesses each student's understanding through their interactions with the AI clone and tailors homework assignments accordingly. This forward-thinking approach ensures that students receive tasks that align with their learning pace and specific needs, coupled with automatic grading (Figure 1.).

Figure 1. Automated grading system.



2. Related work

In this Section we will discuss latest developments in the field of online education and compare the most popular online learning platforms with our proposed solution.

Coursera (<http://coursera.org>) and edX (<https://www.edx.org>) are popular online education platforms that offer a wide range of courses from top universities and institutions. While they provide access to quality education, they rely on traditional video lectures and lack the personalized features of AIL.

Khan Academy (<https://www.khanacademy.org/>) is known for its adaptive learning platform, that adjusts content based on a student's progress. However, it lacks the real-time interactivity and AI-driven lesson delivery of AIL. Carnegie Learning (<https://www.carnegielrning.com>) is an AI-driven educational technology company that provides personalized math instruction. It uses AI to adapt lessons based on student performance. It is restrictive to math instruction only whereas AIL is comprehensive. IBM Watson Education (<https://www.ibm.com>) offers AI-powered tools for educators and institutions. It focuses on analytics, cognitive tutors, and chatbots for administrative tasks. It is an assist tool compared to AIL that has a defined process for creating and delivering online content. Zyrobotics (<https://www.kidscodingapp.com/>) is known for its use of AI-driven avatars to teach children with special needs. This demonstrates the potential of avatars in enhancing engagement, but it does not cover the breadth of subjects or advanced features found in AIL. Virtual Reality (VR) and Augmented Reality (AR) platforms like Google Expeditions (<https://sites.google.com/tcsnc.org/tcs-g-expeditions/google-expeditions-app>) and Oculus for Education (<https://unimersiv.com/review/deep-space-vr/>) have been used for immersive learning experiences. They offer unique interactivity but require specialized hardware and are not as widely accessible as web-based platforms like AIL.

Knewton (<https://www.knewton.com>) is an adaptive learning platform that uses AI to personalize course materials. It offers personalized recommendations and assessments but lacks the real-time interactive features of AIL. DreamBox (<https://www.dreambox.com/>) is an adaptive math program for K-8 students. It provides personalized lessons but does not offer the comprehensive suite of features provided by AIL.

Turnitin (<https://www.turnitin.com/>) is widely used for plagiarism detection and feedback. It simplifies the grading process but does not provide lesson delivery. There are learning analytic tools like Blackboard (<https://www.blackboard.com/group/136>) and Canvas

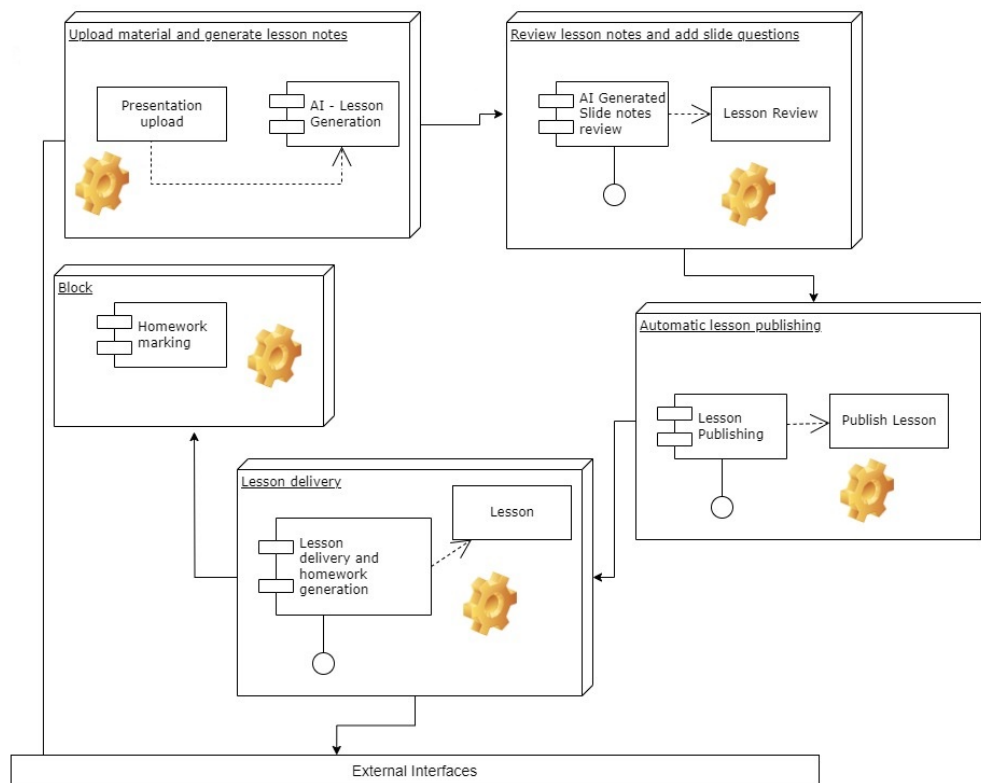
(<https://www.instructure.com/canvas>) are learning management systems for managing the learning process. Plugins can be included to aid lesson preparation and delivery. But there are no automatic features for generating lesson content from slides nor to deliver the content.

3. Component architecture

The component architecture is shown in Figure 2 and consists of:

- AI-Powered Automated Lesson Preparation. AIL simplifies lesson preparation for educators, leveraging AI algorithms to generate textual notes and questions based on uploaded presentations.
- Interactive Lesson Delivery. The platform employs AI avatars to deliver lessons, enhancing student engagement and learning.
- Interactive Teaching Approach. Two-way communication between students and AI avatars fosters active participation and dynamic learning. This is achieved through a Chatbot based on the topic given in the lesson name.
- Personalized Homework Assignment Generation. Assignments are based on individual student interactions, ensuring tailored learning experiences. They are created through variables that include the lesson topic and student questions and answers.
- Efficient Homework Evaluation. Student submissions are graded automatically.

Figure 2. Component Architecture.



4. Advantages and disadvantages

AIL is a prototype. It has been tested on a group of students in the Faculty of AI and Robotics at Raffles University (RU). 20 students were surveyed to evaluate their learning through AIL. The Student Satisfaction and Learning Quality Questionnaire was designed following the methodology recommended by Vanderleeuw, Keim, and Moore (2023). It was divided into four sections. The first was to gain feedback on student engagement and satisfaction with AIL. In the second section students were asked to compare learning quality between AIL and the traditional face to face approach. The third section asked the students to describe their learning experience and challenges faced using the platform. The fourth section asked for feedback on how to improve the platform. The questions are:

Section 1: Platform Satisfaction and Engagement

1. On a scale of 1 to 5 (1 being strongly dissatisfied, 5 being extremely satisfied), how satisfied are you with the platform's user interface and overall experience?
2. How often do you engage in interactive activities (e.g., asking questions, participating in discussions) on the platform during lessons?
3. Do you find the lifelike avatars engaging and effective in delivering content? (Yes/No)
4. Rate the platform's responsiveness to your queries and interactions (1 - Very slow to 5 - Very fast).

Section 2: Learning Quality Comparison

5. How likely are you to recommend our platform to a fellow student? (1 - Not likely to 5 - Very likely)
6. Have you experienced other online learning platforms? (Yes/No)
7. If yes, please indicate which learning mode you find more engaging and conducive to your learning (Face-to-face / Online using our platform). [Face-to-face means online live face-to-face online learning.]
8. On a scale of 1 to 5, please rate the level of personalized attention and assistance you receive through our platform compared to face-to-face learning.
9. Do you believe our platform helps you retain and understand course material more effectively than traditional methods? (Yes/No)
10. How confident are you in your ability to apply the concepts learned through our platform to real-world situations? (1 - Not confident to 5 - Very confident)

Section 3: Learning Experience and Challenges

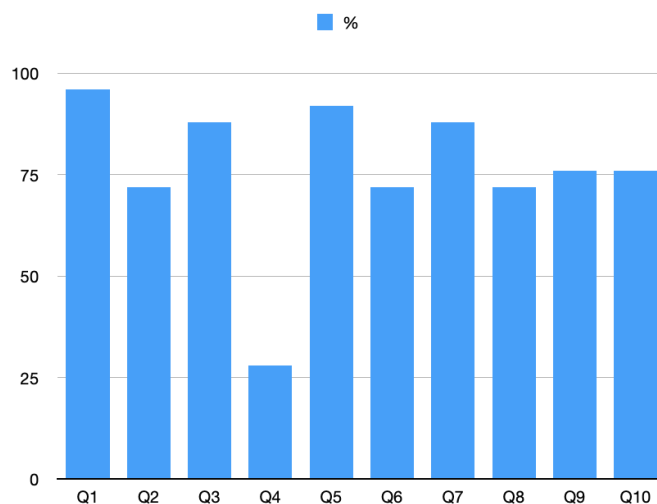
11. Describe a specific instance when the interactive features of the platform enhanced your understanding of a topic.
12. Have you faced any challenges while using the platform? If yes, please elaborate.
13. How has the availability of recorded lessons for later review impacted your learning experience?

Section 4: Additional Comments

14. What aspects of the platform do you find most beneficial for your learning experience?
15. Are there any areas of improvement you would suggest for the platform to enhance learning quality and engagement?
16. Any additional comments or suggestions for enhancing your learning journey?

The selective sampling method means statistical analysis does not apply, only descriptive statistics. The survey responses are summarized in Figure 3 for Sections 1 & 2 (Questions 1-10). For questions with a rating scale, the frequencies shown are the counts for 4 & 5 combined. For yes/no questions the frequencies shown are for Yes.

Figure 3. Student survey results.



Responses above 50% are positive and below 50% are negative. As can be seen, all but one response is above 50%. The rating for responsiveness was low (28%). This is because there is bad internet connectivity in parts of Johor and limited capacity in some student homes. 96% of the students were satisfied with the platform and 88% liked the avatars. The students liked the question and answers through the Chatbot and being able to learn at their own pace. Their major challenge was slowness of

response due to poor internet connectivity, as noted above. For improvement the students recommended including the slide number and total number of slides. These results are indicative only, but they do show the potential of the platform to improve online learning.

4.1. Advantages

AIL provides a platform that automatically generates teaching content, an audio-visual file with avatars to deliver the content that is interactive and marking of student homework. This saves the lecturer time and effort. It is also good for new lecturers or those not comfortable speaking in front of a class. The AI generated avatar provides consistency in the speaking voice.

AIL architecture supports student motivation, engagement, and personalized learning, three features deemed essential for effective online learning.

4.2. Disadvantages

There are several limitations regarding content generation from the uploaded PowerPoint slides. First, no content will be generated if the slide solely contains a picture. There must be some key words on the slide for the AI generator to work from. Second, the amount and accuracy of the content depends on the subject matter. Topics where there are a wide variety of resources available on the internet will generate better content, e.g., a course on statistics. Esoteric subjects, such as the philosophy of E.A. Singer, Jr., may generate no, little, or wrong content. In these situations, you will have to write your own content. The image must be square when uploading your own image to create an avatar of yourself otherwise part of your head will be cut off. It is best not to smile. If you smile and show your teeth the avatar will show your teeth as it speaks, which is not realistic. You should have your lips closed for better authenticity. The avatars may not appear to be authentic or realistic for some users and they may see this as a disadvantage. This is a controversial topic. Some researchers argue that avatars should not be human-like, others that they should be. We have adopted the first position.

Lastly, the Chatbot and homework generation are generated by AI. The Chatbot replies and homework marking may not agree with what you have written during content generation.

5. Conclusion

This paper has presented an AI platform for online lesson generation and delivery. The AIL functionality was presented and includes AI-powered automated lesson preparation, interactive teaching through AI avatars, and personalized homework generation and evaluation. An informal student survey, using selective sampling, indicated the majority of students found the platform engaging and liked the avatars. The advantages and disadvantages of AIL were discussed.

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BETTER THAN BEFORE: BUILDING ON EXPERIENCES REGARDING SCHOOL TO HOME ENGAGEMENT IN A POST COVID-19 PANDEMIC WORLD

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Abstract

Working with pre and inservice teachers, one can see an ongoing disconnect between stated beliefs and actions regarding the significance of families and caregivers in a child's academic development. Teacher beliefs regarding the importance of school-home engagement were often limited to what teachers knew from a few school-based encounters. These were typically teacher led, such as parent-teacher conferences, meetings regarding behavior and academic concerns, and other discussions regarding school issues. Home-visits and other more personal encounters were not common-place or expected in many schools. While teachers might voice the adage "parents are the child's first teachers", methods to engage with parents to build on these practices were often neglected. Much of this could be attributed to a deficit perspective, as languages and cultures unknown to the teacher could be undervalued and misunderstood. Globally, the COVID-19 pandemic's effect on public spaces caused the rapid pivot to alternative forms of teaching. A much more home-based approach to schooling was embraced by school administrations. This included virtual teaching across ages, geographic regions, and economic levels. Teachers worked with children virtually in kitchens, living rooms, and other personal spaces. Teachers were often dependent on parents and siblings to initiate and even interpret the content of lessons in the home context. With an insider's view, teachers taught across a screen, with windows into sometimes more than 20 homes—thus families-- at a time. Did a more positive belief and understanding about parent engagement develop or did misconceptions regarding parenting—including language and cultural deficits--persist? This paper presents findings regarding teachers' beliefs about working with parents in 2023, the third year of the COVID-19 pandemic's effect on schools. Information from studies in six countries will be presented, with findings and emerging trends in parent engagement examined. Traditional school-based programs are explored, such as Family Math and "shared book experiences," made new with technology and electronic communication. Implications for how teachers and families can acknowledge and make use of practices in both settings will be presented.

Keywords: *Technology, school-home engagement, family literacies.*

1. Introduction

On average school age children spend six hours in a somewhat homogenously designed space—the classroom. Grade level standards are expectations for all children. The one-to-two teachers a child sees each day are ultimately responsible for design, interpretation, and implementation of the regulated curriculum.

In a quick transition from school to home, the child arrives at their living space. The diverse households receive each child as their own; the child is now a member of a group different from the classroom community. The child's "membership" into the family group, regardless of age, contributes to the home. No longer is the child seen as a student, identified by a reading level or sorted into a group academically. The intimate relationship begins—nicknames, relationships and responsibilities to siblings take precedence; routine household tasks are the norm and taken in stride. The student is replaced by the child. In many cases both in the US and around the globe, the child is now a part of a collective.

This bi-directional *dis*-connection of school-to-home cultures can impede a supportive relationship between the two. From school to home, expectations may be lost. Likewise, the parents' and caregivers' expectations for the child may be misinterpreted, misused, and misconstrued by the school.

The abruptness of the COVID-19 pandemic school pivot to virtual instruction revealed how deeply this misunderstanding or disconnect ran through. For many, school closures were mandated for all. Together teachers and families problem solved to provide some form of instruction. Some parents

provided Wi-Fi access and set up mini-classrooms in the home. Other parents worked collectively to provide a shared classroom — in a home, outdoor or community space. Other parents requested instruction to be more asynchronous, where children worked from their homes and submitted work electronically to the teacher. Still other families used what Wi-Fi was available, catching it in snippets. A study conducted in early 2020, found that parents drove to Wi-Fi free access spaces, such as a McDonald’s parking lot, a public school, or a church after services ended. Other parents requested traditional hard copies of schoolwork—in these cases teachers created paper-pencil packets for weekly work. Parents drove to the school parking lot to pick up and/or submit the packets at a specified time of day. Still if that wasn’t feasible, teachers drove packets to individual homes. This long list of measures to meet the needs of children, families and school is evidence of the efforts the multiple stakeholders made to maintain connections on behalf of the child (Fox, Roney, & Hargrove, 2022).

2. Objectives of this paper

As teacher educators, we work to prepare pre-service and inservice teachers with the knowledge and skills to help all children reach their potential. We know that with parent and caregiver engagement, classrooms can become culturally responsive settings that value both self and others. What gains were made in the bi-directional problem solving that occurred between schools and homes during the COVID-19 pandemic? What did teachers learn about the home languacultures, or rich linguistic and cultural intersections (Agar, 1996), that could positively impact their relationships with parents and caregivers post-pandemic? This study, conducted in the third year after the initial widespread school closure period of 2020, captured teachers’ perceptions of working with parents whose culture, home language, and ethnicity often differed from their own. During the COVID-19 pandemic the teachers’ working relationship with parents and caregivers went through periods of change, from independently working in two settings to co-dependently working to the home’s virtual classroom, to a return to independently working. The period when schools were closed to face-to-face instruction forced teachers to depend on parents and caregivers to invite them into the home, albeit virtually. Children’s instruction was mediated by Wi-Fi access, space, timing, others in the space, and understanding of the role of education. What was previously practiced as “homework,” was now schoolwork, although situated in the home. What was teacher-assigned schoolwork to be done in the home and submitted to the teacher for check and review, was now dependent on a parent/caregiver to have the technology and wherewithal to support the child’s electronic submission. The work that was previously assumed to be conducted independently in the home setting was now assumed to be collectively conducted during the day and evening, with others around.

The research question then is, what experiences from these virtual home visits have impacted instruction and school-home relationships as schools reopened and children returned to traditional face-to-face instruction? This paper presents findings from a study of teacher beliefs about working with parents in 2023, the third year of the COVID-19 pandemic’s effect on schools.

3. Theoretical framework and literature review

According to Creswell & Poth (2018), of the five most common types of qualitative designs, phenomenology provides the clearest framework for describing a particular phenomenon from first-hand reports. Because of the rapid pivot in settings, instructional methods, and expectations, teachers were put on the front line of change. Their firsthand experiences were important to examine, including the lessons learned as they reflected on the experience. Furthermore, as described by Neubauer, Wiktop, and Varpio (2019), the researcher played an active role in the interpretive phenomenological analysis of data as it evolved in real time.

Previous studies examining gaps in teacher training suggested that the types of knowledge and skills-based learning in education methods courses addressed only a small subset of learning experiences (Hughes, 2013; Moore-Adams, Jones & Monty, 2016). Working with parents and caregivers was one area often neglected beyond surface level acknowledgement. Therefore, teachers were often unprepared to design lessons that would bridge school to in-home instruction (Duncan & Barnett, 2009). In a report to the National Education Policy Center, published just prior to the pandemic, a meta-analysis on virtual schools identified barriers to successful academic gains in virtual schooling (Molnar, Miron, Elgeberi, Barbour, Huerta, Shafer & Rice, 2019). As reported, a lack of attention to cultural differences in homes and communities was evident in virtual schooling design and delivery, even those specifically targeting underserved communities. Pre- and inservice teachers’ use of technology for differentiation across cultures, languages, socio-economic differences, and technology ability was likewise neglected. Resta and

Leferrier (2015) suggested a focus on intercultural training for teachers, researchers, and policy makers to address the logistical challenges of a digitally networked world across cultures and diverse demographics.

At the advent of the COVID-19 pandemic and school closings, an initial study was conducted with a similar group of teachers in the same geographic areas. Questions focused on teachers' emotions regarding the pivot to virtual instruction. Responses revealed frustration with school expectations and feelings of exhaustion, fear and vulnerability. When referring to parents and caregivers, teachers described a partnership, where parents were invited to share across the screen. Concerns with parents were more about lack of WIFI and the training it took to support children academically. Teachers described methods of communication that had emerged during the pandemic that they would maintain when school returned to what they described as "normal" face-to-face instruction (Fox, et. al, 2022).

4. Methods

As a teacher educator in language and literacy studies, I work with both pre-and inservice teachers. Interested in school and family engagement, I pay attention to my students' comments regarding their communication and involvement with families. As children returned to the classroom in the 2nd and 3rd years after the COVID-19 closing of schools in our area, inservice teachers in graduate level classes used phrases such as "back to normal" when describing their school setting. To get at what they meant with this phrase, particularly when describing school to home engagement, I conducted an anonymous survey of 11 students currently teaching grades Pre-K through 9th grades. The three question survey asked if there were changes in their relationships with families, if so, what these changes were, and what they would like to see in the upcoming year. In a quick turnaround my students described disappointment in their engagement, concern that parents either would not or could not help their children and that parents were more disengaged than ever. Although this informal study with a convenience group of only eleven participants, was short and questions were generalized, the findings struck me as worth investigating further.

Building on the informal pilot study of classroom teachers' beliefs about school-to-home engagement a survey was sent to a convenience sample of 77 inservice teachers asking about their current relationship with parents and caregivers. The teachers were identified through a master distribution list created for the university professional development system (PDS). To be a partnership teacher implied mentoring and modeling for a student intern in their final year of teacher training. To serve in this role a teacher is required to hold a teaching license, have taught a minimum of 3 years teaching in the public school system, and agree to both training and ongoing professional development offered by the university. This group of teachers is seen as having achieved a level of mastery. Invitations to participate in the study were distributed through the university email system and sent from the PDS office email. Participants were assured their responses were voluntary and anonymous. The survey was sent to the 77 partnership teachers across the state, with 22 completing the survey, or 29% return rate.

Questions were designed to give participants open-ended response regarding what they learned about working with parents and caregivers during the period of virtual instruction and the following months. Questions were framed from an additive stance, i.e. What new ways of engaging with parents and caregivers have been maintained since the COVID-19 pandemic's school closures? Had their communication style changed and if so, in what ways? Had parents and caregivers become more or less engaged in the curriculum and/or instruction? Had parent and caregiver visibility at school or the classroom changed and if so, in what ways? For a complete list of survey questions, see Table 1: Survey Questions for Partnership Teachers Regarding Parent-Caregiver Engagement.

5. Findings

During the early period of the COVID-19 pandemic, initial reports from local anecdotal evidence and media showed an openness from teachers to include parents in the virtual instruction. Parents too showed appreciation as well as a willingness to participate in the virtual instruction set-up and delivery (Fox, et.al, 2022). In the current survey results, however, teacher respondents showed increased frustration towards parents and caregivers. During the first months of the COVID-19 Pandemic school shutdown, the relationship was described as mutually supportive, but was now negative, even accusatory in some cases. Teachers described parents as holding unreal expectations but "falling short when it comes to parenting." Others described parents as "really busy and less engaged in their student's academics and more concerned with their social life." Still other teachers described feeling undervalued, i.e. "They [*parents*] do not value teachers beyond being babysitters." Complete survey responses are available upon request.

6. Discussion

Despite the success of the collaborative work that occurred during the pivot to virtual instruction brought on by the COVID-19 pandemic, participants in this study expressed gratitude of “going back to normal.” Rather than building a sustained partnership with parents, teachers seem to disrespect parents’ involvement in education. Perhaps the responses to the survey echoed what was being reported broadly by school officials and government statistics. The youngest children’s entry into the school was plagued with lack of school readiness. Test scores across all areas fell, but particularly in the earliest grades. Most recently, the 2022 Program for International Student Assessment (PISA) scores across 77 countries showed a decline in math scores for 15-year-olds in the year 2022 (PISA, 2023; Schliecher, 2023). Parents turning to home schooling in 2023 showed disturbing trends. Home school numbers soared from 2.65 million in 2020, to 3.7 million and grew to 4.3 million in 2022. The need for teachers has not lessened, however. In the state in which the study took place 16% of teachers left after 2022, compared with less than 12% in the three years before the pandemic (Barnum, 2023). This was the same population that expressed their stress, feelings of exhaustion and being overwhelmed in the larger study of teachers in the first month of the pandemic. Unfortunately, rather than building a sustained partnership with parents and the community as an outcome of their earlier co-dependency, teachers seem to have an increased disrespect for parents’ involvement in education. This too, was reflected in worldwide PISA findings, which found that fewer conversations happened between teachers and parents and caregivers in 2022 (Schliecher, 2023). The “learning across the kitchen table” opportunities (Ginsburg, 2007) have fallen short of providing a window to the home as a learning space. Lessons learned seemed to reaffirm old beliefs rather than build on additive events that helped sustain schooling during some of our most challenging times as educators.

7. Conclusion

Octavia Butler (1993) states: “All that you touch, you change. All that you change, changes you.” We recognize that all are touched and changed when distrust, oppression and exclusion are made visible. The classroom is a starting point with a far reach. Connecting Butler (1993) with Walt Whitman, on my undergraduate and graduate teacher education courses I start the semester with the poem, “There was a Child Went Forth.” As Whitman said, more than one hundred years prior to Butler,

*There was a child went forth every day,
And the first object he looked upon and received with wonder or pity or love or dread, that object he became, many
years or stretching cycles of years...*

(<https://poets.org/poem/there-was-child-went-forth-every-day>)

Just as research into children’s literature has shown that books can provide a gateway to mirror one’s identity, they can also provide windows into others’ contexts. When viewing the classroom as a text, an open classroom is a text not only for the child but for the parent and others. Likewise, “reading the world” of the home, can provide valuable information to the teacher and other children for promoting a truly bi-directional cultural understanding. To better address the question, “*What kind of world [school, community, home] do we want to live in?*” schools of education must operationalize the response. Beginning with pre-service teachers, teacher education programs can require both a critical analysis and a subsequent action plan for addressing the disconnect between the classroom and the home. More than providing lip-service to culturally relevant pedagogy, the relationship between the two most influential and consistent entities in a child’s life—the home and school—can be explored, addressed, and put into practice in teacher training. Whether through interactive newsletters and discussion groups with parents, invitations to parents to participate in cultural activities across the electronic classroom, or simply holding virtual home visits, pre-and inservice teachers can open the school to the home in a truly bi-directional and additive partnership.

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NAVIGATING POLYCRISIS: THE ROLE OF SCHOOL PEDAGOGUES IN CROATIA

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Abstract

In the present era, there is increased awareness that we are navigating a time of *polycrisis*, which refers to the simultaneous interaction of different crises (e.g., the Covid-19 pandemic, war crisis, climate crisis, weakening democracy, inflation, social inequality, etc.). All these issues intertwine, generating instability, complexity, and uncertainty in entirely unpredictable ways (O'Regan, 2023). A state like this notably shapes the dynamics of the education system and all individuals participating in it (educational workers, students, parents, etc.). This research is initiated with the aim of gaining insights into whether schools are prepared, and in what manner, for operating in such complex circumstances and confronting various crisis situations. More precisely, the research is focused on the experiences of school pedagogues, as educational specialists in Croatian schools. The main objective is to examine their experiences in dealing with different crisis situations at schools, as well as their resilience and preparedness for effectively coping with potential crises that may arise in the future. In this paper, the intention is to present the results of the qualitative survey, which aims to examine school pedagogues' experiences regarding their resilience and preparedness in various crisis situations within elementary and secondary schools. This paper aims to present preliminary research findings based on a review of relevant literature in the field and focus groups with school pedagogues. Understanding of this topic can contribute to establishing an empirical foundation for the development of a more resilient educational environment.

Keywords: *Croatian educational system, polycrisis, school pedagogues, qualitative study.*

1. Introduction

Polycrisis refer to situations where multiple crises occur simultaneously, creating a complex environment of uncertainty. In these situations, the combined impact of these crises is greater than the sum of their individual effects (O'Regan, 2023). The Covid-19 pandemic, wars, the climate crisis, the collapse of cryptocurrency prices, the weakening of democracy, inflation, social inequality, austerity measures, rising energy costs and the global mental health crisis all are deepening society's sense of existential uncertainty (O'Regan, 2023). The European Committee of the Regions (CoR) (2023) emphasizes that we cannot predict which crises will affect Europe, its cities, provinces, and regions in the future, but we can predict that vulnerable groups will suffer the most from the consequences of the crises. This is also confirmed by the opinion of the European Economic and Social Committee (EESC) (2024), which emphasizes that the climate crisis is expected to have a profound negative impact on all countries and social classes, with a particular focus on vulnerable groups such as women, children, persons of low socioeconomic status, the unemployed, minorities, immigrants, and people with disabilities. It predicts that the realization of their fundamental rights will be seriously jeopardized due to unsuccessful policies at national, European, and global level and that social equality in Europe will be at risk if urgent action is not taken. It also emphasizes that crises do not stop at administrative borders. It is therefore important to cultivate a culture of risk and crisis management and to work on social preparedness in the interests of citizens' safety, health, and well-being (European Economic and Social Committee, 2024). The European Union's role in crisis management should aim to develop a systematic approach to crisis management to increase the resilience of society, enable rapid and flexible responses across different sectors and consider short-term and long-term perspectives in crisis management. Solidarity should be a key principle in crisis management, with a focus on sharing limited resources according to the principles of human dignity and non-discrimination (European Commission et al., 2022). The global Sustainable Development Goals (The 2030 Agenda for Sustainable Development) also address the above issues and advocate reducing

exposure and vulnerability to extreme climate events and other economic, social, or environmental disasters (United Nations General Assembly, 2015).

In this paper, special attention is paid to the potential of education systems to cope with crisis situations. It is estimated that around 65 million children between the ages of 3 and 15 are directly affected by emergencies and protracted crises worldwide, meaning that they are at risk of lack of protection, disruption of education and displacement, as well as other psychosocial problems (Nicolai et al., 2015). In recent years, interest in researching crisis situations in the education system in the Republic of Croatia has significantly increased, especially during and after the pandemic (e.g., Ristić Dedić & Jokić, 2021; Ćurković et al., 2021; Zovko et al., 2022; Ristić Dedić et al., 2023). In Croatia, coinciding with the outbreak of COVID-19 in March 2020, there were a series of earthquakes that disrupted daily school operations and affected general safety. The Government of the Republic of Croatia recognized the consequences of these crises and adopted the National Recovery and Resilience Plan 2021-2026 (NPOO), which was approved by the European Commission in July 2021. In addition, the Croatian school system was also affected by the Ukraine crisis, as evidenced by the rapid enrolment of Ukrainian students, especially at schools near the Hungarian border. Croatia also felt the repercussions of a mass shooting incident in neighbouring Serbia in May 2023. This event caused fear among students and teachers at all levels.

Regardless of the type or its scope, crisis situations can make it considerably more difficult to achieve educational goals and threaten normal educational processes and the well-being of students. In order to manage the crisis effectively, it is important that experts from different fields, including pedagogues, psychologists and experts in the educational-rehabilitation profile, play a key role in providing immediate measures and support adapted to the specific needs of students and teachers in times of crisis to ensure the continuity of teaching and the well-being of all involved. This study will focus specifically on school pedagogues working in Croatian elementary and secondary schools, exploring their work experience in the context of *polycrisis*.

2. Methodology

2.1. Aims of the study

This study was conducted with the aim of investigating school pedagogues' assessments of their resilience and competence in different crisis situations within the elementary and secondary schools. The specific research questions are as follows: (1) *what a "crisis situation" at school represents for school pedagogues*, (2) *what are the experiences of school pedagogues in dealing with different crisis situations at schools*; and (3) *how school pedagogues assess their resilience and preparedness for effectively coping with crisis situations at schools*. Regarding the defined research questions, a qualitative research approach was chosen and focus groups were conducted with school pedagogues. The main aim of the qualitative analysis was to construct themes and to interpret and discuss the themes in the crisis context presented in the introduction. This study presents the preliminary results of the research.

2.2. Sample and procedures

Five focus-groups were conducted with school pedagogues. In the Croatian school context, a pedagogue is a professional associate who is most commonly employed in formal education institutions (preschools, elementary and secondary schools). His/her role is broadly profiled, but basically involves collaboration with students, teachers and parents in various tasks and forms. Core activities for pedagogues are planning, programming, and evaluating educational work in diverse institutions; organizing and enhancing educational processes; ensuring ongoing improvement of educational quality; etc. (Croatian Qualifications Framework, 2023). The study involved a total of 24 participants, including 21 women and 3 men. Of these, 15 were employed in elementary schools, while 9 worked in secondary schools and/or student dormitories. The schools represented in the study were located in 9 different Croatian counties and differ in terms of size and number of employees and students.

Data collection took place between May and November 2023. Careful attention was paid to ethical procedures when conducting this study. The participants were provided with informed consent for their participation in the study and it was ensured that the anonymity and confidentiality of the data were guaranteed. The results of the focus groups were analyzed in a six-step thematic analysis following the framework outlined by Braun and Clarke (2013). MAXQDA software was used for qualitative data analysis. In this study, selected topics and verbatims of the participants are presented. Verbatims also contain information on gender (F = female, M = male), the type of school where research participants work at (ES = elementary school; SS = secondary school; SD = student dormitory).

3. Results

The presentation of the research results follows three defined specific research questions. In the search for an answer to the question of *what a "crisis situation" at school represents for school pedagogues*, the thematic analysis of the focus groups revealed three key themes. When pedagogues talk about crisis situations at school, they most commonly categorize them in these three categories, which differ depending on where the source of the crisis is. Firstly, they recognize crises that occur outside the school but affect the daily life and work of the school (for example: global/national crises such as pandemics, wars, natural disasters (earthquakes, floods)). For illustration, here is an example of how a global (war) crisis manifests itself in a school: *"Changes began to happen. Now more and more children are coming, more and more differences are coming, more and more difficulties are coming. We now have a Ukrainian boy who came to the second grade, who has ADHD and does not know the language. (...) He is vulnerable."* (F_ES). Secondly, there are crises that occur within the school, and which also have a significant impact on the functioning of the school (for example: crises in the school collective such as loss of a teacher or crises in the classroom such as bullying). Below follows the experience of a school pedagogue who talks about the crisis within the school collective: *"In my collective, crisis situations arise when relationships between teachers are severely damaged, and it even happens that colleagues sue each other in court. This is a situation that affects the whole school."* (F_ES). The third and most common are individual/personal crises, usually affecting a particular student (or their parents) (for example: self-harm, sudden death, serious illness, family violence, conflicts with demanding parents such as threats, verbal conflicts, etc.). In the experience of the participants in this study, the third category is the most common. To illustrate the seriousness of this crisis, two situations are shown: *"It was awful when one of our graduating students died on the day of the school "noriade" (final celebration). He died in a car accident. It was the first terrible situation, a real crisis. It left a deep impact, and every and each passing year we remember it, still asking why and how."* (F_SS); *"In my former school, I had a situation where a little boy was beaten up - his father rammed his head on the floor. After some of the things the boy told me, it took me two weeks to come to my senses. The things that child said to me are unimaginable things to do as a human being, let alone as a father. (...) Dad ended up in pre-trial detention, from which he was released after two days with a ban on accessing his children. A few months later, I saw them walking around the town."* (M_ES).

The second question raised in this research is *what are experiences of school pedagogues in dealing with different crisis situations at schools*. Here we looked for descriptions of how pedagogues describe their dealing with crises at school and found two key themes. When analysing the way pedagogues deal with crisis situations and what experiences they have, the first thing that stands out is that in every crisis they consistently focus on the well-being of the children (or the other people most affected by the crisis). Their mission is to ensure that children are safe, healthy, and supported. Here are some examples of their experiences that illustrate this description: *"In any case, when (an emergency situation) arises, we have to adapt to it and we have to be able to keep the basic things, that in the elementary school the children are taken care of, safe and that they can continue playing in some form."* (F_ES). Secondly, when they reflect on their own role in crisis situations, they will say that crisis situations are extremely emotionally demanding, stressful and exhausting for them, especially for the pedagogues at the beginning of their career (with fewer years of professional experience). To illustrate this, the experience of a pedagogue with less than 5 years of professional experience is shown, who describes a crisis with a student who has serious problems with drug addiction: *"I was very scared, I had never been in such a situation before, and I felt lost because I hadn't learnt about such things at university or anywhere else. This situation needed to be resolved, but I didn't know how to approach these parents. (...) Honestly, I could not sleep at night because of it and it was really awful. (...) These are the situations where I just wonder if I am doing a good job."* (F_SS). On the other hand, the experiences of pedagogue with more years of professional experience also point to the problem of demanding (emotional) work in crisis situations: *"It's a job where you have to take a certain distance at a certain time, otherwise you burn out."* (M_ES)

The third question that this research aims to answer is *how school pedagogues assess their resilience and preparedness for effectively coping with crisis situations at schools*. Analysis of focus-groups conducted with school pedagogues in the context of this issue reveals three key themes. First, it is visible that resilience and preparedness for effectively coping with crises grow with experience. According to our research participants: *"Work experience is perhaps even more important than education. Just when they throw you into something, that's when you learn best."* (M_SD). Second crucial point is that pedagogues feel empowered (resilient and prepared) to deal with crisis situations when they work in an environment where teamwork and collegial support are recognised. According to one participant: *"...it is important for pedagogues to be well, to take care of their mental health and to listen*

to their colleagues. (...) When we meet, we prefer to tell what happened to us, and listen to what happened to someone.” (F_ES). On the other hand, when there is no such support, pedagogues feel frustrated and overloaded: “I personally feel very overloaded, really, really overloaded. (...) I think we have learnt to deal with different situations and we deal with them as we know and can, but, yes, I am missing..., that's exactly what's missing here, I am missing one or two more people where we can act together.” (F_SS). In their statements, they also often point out that they lack systematic support in their work. Thirdly, pedagogues feel more resilient and more prepared for navigating crisis when they have the opportunity to learn and improve their knowledge and skills. They often mention the importance of continuous professional development, working on their personal growth and self-improvement (especially in the context of psychotherapeutic work), participating in supervision processes in which they feel empowered and confident to share their experiences. This can be recognized in the following statements of research participants: “Organized supervision and psychotherapy that I personally use and would highly recommend to everyone, reflective meetings at school - maybe there will be some kind of group support.” (F_ES). There is also recognized need to integrate the topic of crisis management into the initial education of pedagogues. They often point out that they did not have the opportunity to learn about crisis management as part of their formal education, but they believe that this knowledge would be very useful and necessary for them today.

4. Discussion and conclusions

According to the experiences of Croatian school pedagogues, there are three main types of crises that affect schools: external (global) crises such as pandemics or wars, internal school crises such as conflicts between teachers or conflicts in the classroom, and personal crises, especially among vulnerable students. It is important to note that school pedagogues have also recognized that vulnerable groups are particularly affected by crises, which is often discussed in the context of European policy level. This study also examines how pedagogues deal with these crises and finds that they prioritise children's wellbeing and recognise the emotional strain. Their professional experience strengthens their resilience, and a supportive environment helps pedagogues cope with crises. However, many express frustrations at the lack of systematic support and training in crisis management. It is evident that pedagogues have a strong need for ongoing professional development and self-improvement, supervision, peer support and collaboration with their colleagues to share the responsibility in such a difficult situation.

In conclusion, the question arises as to how school pedagogues can successfully navigate through the *polycrisis*, i.e., how effectively they can deal with various challenges and crises that may overlap. In the Croatian education context, this has become particularly visible in recent years, as schools have had to work effectively under the conditions of a pandemic, earthquakes, the consequences of the refugee crisis and general uncertainty at the same time. Part of the answer to this question certainly lies in continuous professional development. Ongoing professional development is crucial to enable school pedagogues (and other educational workers as well) to recognise signs of trauma, provide support to students and teachers and take appropriate action during and after crises. In addition, it is important to raise awareness of the demands placed on school pedagogues and to recognise the emotional strain and potential for professional burnout and provide appropriate support. Maximising opportunities for pedagogues to engage in supervision processes and collaborative teamwork in multidisciplinary environments can significantly enhance their potential to successfully deal with crises. Overall, it can be concluded that greater attention must be paid to crisis management. It is also necessary to carry out systematic monitoring and research to understand the impact of crisis situations on the individual as well as on the education system in general.

At the end, given the qualitative nature of the research and the preliminary results presented, it is important to recognize some limitations of this study. This study was conducted in the Croatian educational context, so the transferability of the results to other settings or contexts may be limited. Furthermore, since this study provides a first insight into the results, no analyses were conducted to identify differences in participants' experiences in terms of the length of their professional experience in school, or the type of school at which they are employed. The preliminary nature of the findings implies that further research and analyses may uncover additional layers of themes and complexities that are not recognized by this study. Despite the recognised limitations, the findings of this research can contribute to the discussion on how to create a more resilient educational environment that is better equipped to cope with and respond effectively to crises that we may face in the future.

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GENERATIVE AI-CHATBOTS IN HIGHER EDUCATION: CHALLENGES AND OPPORTUNITIES IN STUDENT MOTIVATION AND AUTHENTIC ASSESSMENTS

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Abstract

The rapid pace of development in generative artificial intelligence (AI) has resulted in the introduction of extremely advanced chatbots, such as ChatGPT, Google Bard and Copilot. These chatbots are capable of simulating human behavior quite successfully, because they have been trained on huge data sets with large language models (LLM). New avenues for application of generative AI-chatbots have arisen not only in industry, science and medicine, but also in education. The consideration of social and ethical consequences of this new technology has not kept pace with the speed of its development. This paper explores challenges and opportunities which have arisen in higher education with the emergence of generative AI-chatbots. For university students, the temptation to use chatbots to complete their assignments may seem like a good way to save time and effort. The disadvantage is that they may not learn anything by simply copying answers from a chatbot. Inexperienced students may trust the validity of answers which are incorrect, especially if they do not have prerequisite knowledge to evaluate the output of a chatbot. For educators, however, it can be extremely difficult to determine whether students have completed their assignments themselves, or whether they have submitted the output from a chatbot. Instructors have the responsibility to teach university students to avoid plagiarism by judiciously citing the sources used. Furthermore, competencies taught at the university level should go beyond mere reproduction of facts. The development of analytical capabilities and critical thinking often require hard work to learn from mistakes, so-called “productive failure”. Creative teaching methods, such as gamification, may help to motivate students to engage with learning materials. A number of questions which have arisen from these challenges will be addressed in this paper. (1) Can educators determine whether student submissions are original or were written by a chatbot?; (2) Should students be allowed to use generative AI-chatbots to work on assessments? If so, how?; (3) Can creative teaching methods, such as gamification, motivate students to engage in learning?; (4) What kinds of assessments can help to evaluate whether students have achieved learning goals? Challenges encountered in exploring these questions when teaching undergraduate university courses will be presented. Opportunities to increase student engagement and design of authentic assessments will be discussed.

Keywords: *Artificial intelligence, chatbots, motivation, gamification, assessment.*

1. Introduction

Chatbots have come a long way since the original “chatter-bots”, which were only able to answer the simplest of user questions (Mauldin, 1994). Because artificial intelligence itself was not yet as advanced as today, these early chatbots had to be explicitly pre-programmed to answer a limited number of pre-defined questions. Although they could only respond with simple, predetermined answers, they were considered useful to answer typical, rote questions, such as in customer service.

Recently, a quantum leap in chatbot technology was achieved by advances in deep learning methods, such as generative large-language models (LLM) (Floridi & Chiriatti, 2020). This new generation of chatbots, such as Chat-GPT (OpenAI, 2023) and Gemini (Google, 2023), can mimic human intelligence so convincingly, that it can be quite difficult to differentiate whether output has been produced by the chatbot or by a human. Generative AI chatbots have achieved a level of sophistication which enables their application in industry, science and medicine. Critical examination of social and ethical consequences of this new technology has not kept pace with the speed of its development.

The use and misuse of chatbots gives rise to a number of challenges in higher education. Answers to typical homework assignments, essays and even computer code can be generated by a

generative AI chatbot with comparatively little effort. The temptation to misuse chatbots to copy answers and thus avoid the effort necessary to actually learn a subject can be hard to resist. Especially inexperienced students may be more likely to trust incorrect answers output by a chatbot, because they lack the prerequisite knowledge to judge their validity. Educators often have difficulty determining whether assignments have been completed by students or have simply been copied from a chatbot.

An initial investigation of research questions is conducted, primarily using literature sources.

R1: Can educators determine whether student submissions are original or were written by a chatbot?

R2: Should students be allowed to use generative AI-chatbots to work on assessments? If so, how?

R3: Can creative teaching methods, such as gamification, motivate students to engage in learning?

R4: What kinds of assessments can help to evaluate whether students have achieved learning goals?

First, generative AI chatbots are described. Next, challenges experienced with AI chatbots in education are discussed. Possible solutions to these challenges, such as gamification and authentic assessments are considered. Finally, conclusions and plans for future work are presented.

2. Generative AI chatbots

Large language models (LLM) implemented as artificial neural networks possess advanced capabilities to generate natural language. Deep learning methods employ statistical pattern recognition methods to train these models on unstructured, unlabeled datasets, such as Wikipedia or the huge amount of text and books available on the internet (Floridi & Chiriatti, 2020). Generative artificial intelligence can go further than simply mimicking human-like behavior. Intelligent searches, summarization of text, generation of essays and computer code can be achieved with simple prompts (Tamkin et al., 2021). ChatGPT, first released as a free version in November of 2022, is the most widely known generative AI chatbot (OpenAI, 2023). Recently, Microsoft announced a major investment and cooperation with OpenAI. The intention is to integrate this technology into its Office software (Microsoft, 2023).

The increased use of generative AI chatbots in all aspects of life gives rise to a diverse range of opportunities for industry, science and society in general. Pividori and Green (2023) argued that large language models can improve productivity in writing and revising scientific papers. They demonstrated that a large language model was capable of suggesting appropriate revisions to academic papers. In their view, generative AI has the potential to revolutionize productivity in areas of knowledge work.

A major weakness in the validity of the results delivered by generative AI chatbots was discussed by Stokel-Walker and Van Noorden (2023). Because large language models are trained on content currently available on the internet, this also includes false, outdated and inherently biased information. Errors or misleading information are most often generated on topics with a low amount of training data. The editors of a major scientific journal stated that ChatGPT “cannot be trusted to get facts right or produce reliable references”. For this reason, a number of scientific journals have forbidden the use of any text produced by generative AI (Thorpe, 2023).

The consideration of ethical aspects has failed to keep pace with the rapid development of generative AI. According to Brynjolfsson (2022), this is due to the sole focus on mimicking human intelligence to automate processes. Instead, technology should be used to find new ways to help humans enhance their productivity, to improve the well-being of employees and to create new business models. Farina et al. (2024) proposes two interventions to combat the negative effects of generative AI. To minimize factual errors, they suggest that LLMs should be supervised by humans, especially in sensitive areas, such as medicine, law and journalism. Second, they stress the importance of ensuring transparency and pluralism. Instead of relying on the “black box” of LLMs trained stochastically on an average spectrum of answers, cultural, political and value pluralism need to be maintained.

3. Challenges to education

3.1. Empirical experiences in education

The impact of generative AI chatbots on education was examined soon after the release of ChatGPT by Zhai (2022). He demonstrated the ease with which an apparently coherent-sounding, research paper could be generated within 2-3 hours, without any prior professional knowledge. The only problem was that the information used was not completely accurate. He concludes that while the use of generative AI can greatly increase the speed in conducting subject domain tasks, instructors need to adjust their learning goals for students. Creativity and critical thinking skills should be the focus of learning. Advantages and pitfalls when using ChatGPT in education was reported by Qadir (2023). He successfully used chatbots as intelligent virtual tutors to provide students with personalized, adaptive learning. One problem encountered was the lack of reliability of results and a tendency to output “hallucinatory”

misinformation. The differentiation between acceptable vs. non-acceptable use of chatbots in completing assignments was difficult to define.

The effects of AI chatbots were investigated for an undergraduate course in databases (Brockmann, 2023). Before the semester, the instructor entered the semester assignments as prompts into ChatGPT Version 3. This output was graded using the same grading scale as for students. ChatGPT achieved a grade almost an entire point higher than the students (B- vs. C-). At the end of the semester, students were assigned to test ChatGPT themselves by entering their assignments as prompts. They first expressed frustration that they had “wasted their time” solving the assignments themselves. During a detailed class discussion, however, they noticed that many of the chatbot answers which sounded correct were actually erroneous. Students realized that without first solving the assignments themselves, they would not have had the necessary knowledge to critically evaluate output to identify wrong answers.

This subsection shows that AI chatbots can aid in learning, if they are used carefully (R2: mixed).

3.2. Plagiarism

Plagiarism poses one of the major challenges when using chatbots in higher education. A study which tested 20 essays created by ChatGPT was analyzed using a popular plagiarism-checking software. They found that 16 of the 20 essays were judged to exhibit a high level of originality and less than 10% were flagged as possible plagiarism (Wadhwa & Joshi 2024). An opinion published by Liang et al. (2023) cautions that GPT detectors frequently misclassify non-native English writing as AI-generated. They raise serious ethical concerns that the inherent bias in training data can lead to the marginalization of non-native speakers of English. King (2023) prompted ChatGPT itself to write an editorial about the danger of students abusing ChatGPT to cheat on assignments. ChatGPT judged this behavior as unethical. It recommended that instructors should employ a wider variety of assessment methods, not just traditional essays. Oral presentations, group projects and other hands-on activities which give students the opportunity to demonstrate their skills may be more interactive and engaging and may reduce cheating.

This subsection shows that it is not possible to determine whether students have cheated (R1: negative).

4. Possible solutions

4.1. Gamification

One possible teaching method to increase motivation of students to learn a subject is gamification. The term “gamification” is defined by Deterding et al. (2011) as the “use of game mechanics in non-gaming contexts”. Positive, intrinsically motivating psychological reward systems, similar to those experienced when playing games, can help to strengthen engagement and encourage behavioral patterns (Huotari & Hamari, 2012). Gamification has been successfully implemented in a variety of different contexts, such as commerce, health, intra-organizational systems, sustainable consumption, human resources, innovation, data gathering and education (Hamari et al., 2014).

Caponetto et al. (2014) conducted an extensive review on gamification in education. They found that gamification makes learning more attractive, captivating and thus more effective. Gamification can encourage behaviors such as collaboration, creativity and self-guided study. An empirical study conducted Chapman & Rich (2018) found that a majority of their students reported increased motivation when taking part in a gamified course. The most motivating game elements (as rated by students) were the opportunity to earn points for assignments, due date bonuses and penalties, due date flexibility, a current grade indicator, a course map and a leaderboard. A systematic literature review by Popp & Schuhbauer (2023) conducted a meta-analysis on the effectiveness of gaming elements on e-learning platforms. They investigated which gamification elements should be used to increase learning motivation in asynchronous e-learning. Badges, leaderboards, level up systems and progress bars showed the most promise. A further increase in users’ motivation could be achieved by combining badges with leaderboards or level up systems.

In contrast to these mostly positive results, negative effects associated with gamification in education were identified in a systematic mapping study conducted by Toda et al. (2018). Four negative effects associated with gamification were identified: indifference, loss of performance, undesired behavior and declining effects. Loss of performance, where gamification hinders the students’ learning process, was the most commonly reported issue. Students who were most active in the gamified activity focused more on the game itself and scored lower than their peers on the transfer skills test. Undesired behavior was the second most common negative aspect found. This was often caused by demotivation due to excessive competition. Leaderboards were strongly associated with negative effects, such as loss of performance and undesired behavior. They postulate that this finding correlates with psychological

literature showing the negative effects of ranking systems within learning environments. When designing a gamification component to increase student motivation, possible negative effects should be considered.

This subsection demonstrates that gamification can be used to motivate students (R3: positive).

4.2. Authentic assessments

Instead of adapting a policing approach to generative AI chatbots, Rudolph et al. (2023) advocates a student-centric approach to pedagogy and assessments to support learning. They postulate that digital literacy in education should include AI tools. Memorization of information does not teach students the type of problem-solving skills required in our modern society. The role of faculty is to engage and motivate students to learn. Assessments should encourage students' creative and critical thinking abilities. Especially during the pandemic, many educators turned to online exams to reduce infection risk. Since then, the increasing use of AI chatbots threatens the legitimacy of online exams, due to the potential for cheating. A reevaluation of testing methods is necessary in the era of AI chatbots. The need for authentic assessments, which concentrate on higher cognitive skills, problem-solving and creative thinking coincides with evolving pedagogical learning goals of the 21st century (Ifelebuegu, 2024).

Wiggins (1990) was one of the first authors to make the case for authentic assessments. In contrast to traditional tests, students should not simply recall acquired knowledge. Instead, higher competencies on worthy intellectual tasks should be demonstrated: collaborating with others, writing, revising and discussing papers and even conducting research. Murphy et al. (2017) conducted a literature review on authentic assessments in higher education. They found that authentic assessments can encourage active student learning, improved achievement and greater retention. Students benefit from real-world experiences in safe, supportive environments. Although there was some resistance when working in large groups with time and resource constraints, careful planning and inclusive student consultation helped.

The subsection shows that authentic assessments can evaluate achievement of learning outcomes (R4: positive).

5. Conclusions and future work

This initial exploration of the research literature delivers first insights to the research questions.

R1: Can educators determine whether student submissions are original or were written by a chatbot?

Negative. It is extremely difficult to determine whether students have completed their own work.

R2: Should students be allowed to use generative AI-chatbots to work on assessments? If so, how?

Mixed. Activities which require critical thinking and adequate citation can aid learning.

R3: Can creative teaching methods, such as gamification, motivate students to engage in learning?

Positive. Gamification can motivate students to learn, if the activity is designed carefully.

R4: What kinds of assessments can help to evaluate whether students have achieved learning goals?

Positive. Authentic assessments can aid in evaluating achievement of higher order learning goals, especially real-world problem solving, creativity, critical thinking and collaboration.

Future work will include the development of a learning game for first semester students. As a capstone project, final year students participate in each phase of a research project to develop a learning game about a startup company. This research project starts with requirements analysis, continues through the development and testing phases to determine which elements of gamification can increase student motivation. As an authentic assessment, the goal of this project is to write and publish a conference paper.

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ADAPTING A BUSINESS PLAN IMPLEMENTATION AS AN INSTRUCTIONAL METHOD

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Abstract

This paper addresses the disconnect between classroom learning and real-life applicability, particularly in the context of master's degree programs. It explores the effectiveness of using business plans developed collaboratively with professors and local government branches or businesses as case studies in graduate business school courses to bridge this gap and enhance student learning outcomes. In order to test this a business plan was developed by university teachers working together with a local government branch, afterwards that business plan was turned into a case study for a business graduate course. The student feedback as well as their performance on assignments indicated a higher degree of satisfaction with this type of case study, it also improved the actual business plan, allowing students to impact on the case study in real time.

Keywords: Business plan, case study, instructional method.

1. Introduction

Education as a discipline is constantly evolving, this is usually achieved by either adapting methods or materials, or both, depending on the needs of society at the time. These changes are different depending on the subject, more practical disciplines may experience changes more rapidly while the more theoretical subjects may adapt more slowly to changes. There are, however, innovations that can impact several disciplines at roughly the same time, one of these innovations was the introduction of the case study in the late 1800's (Argandoña, Persico, & Visic, 2018).

The case study has been widely adopted as a way to introduce students into real life situations in order for them to apply the theory in practical situations, while in a controlled environment. The potential downside to this method is that it's entirely dependent on the information chosen by the instructor and how well it actually applies to their specific context. This can turn problematic, especially in developing countries that may not have enough materials for specific subjects so they tend to import textbooks and other materials from developed countries.

One of the main problems when importing course materials from other countries, (especially if it needs to be translated) is that the context from where it originates can be vastly different from the context where it will be applied, and even though a good translation can try to account for regional differences (Jandová, 2017) and is more an adaptation than a word-for-word translation, it can still feel very foreign to both the students and the teacher.

Another issue with adapting case studies from other places, is that the teacher must assume some of the details pertaining the case, regardless of how well documented the case is, it's really difficult to actually know why some decisions were taken and all of the surrounding specifics. While this does not reduce the efficacy of the case study method, it does leave some room for improvement in some specific scenarios.

In this paper we'll describe first the case study as an instructional method, followed by an introduction of the business plan and its importance in the business discipline. The next section proposes the use of a business plan, where teachers are involved in developing it, as an improved case study for teaching in a master program and the proposed advantages over a regular case study.

2. Case study as an instructional method

Christopher Columbus Lang-dell introduced the idea of using actual cases as a way to add more realism into the classrooms in 1879 (Argandoña et al., 2018), since its inception it has progressed to being used in several disciplines and being adapted to suit the needs of the schools where is taught. However, in

order to be an actual case study, instead of another method, it must follow some basic rules, namely following a case, having additional information like technical reports, information on all parties, context surrounding the case, etc. (Wassermann, 1999).

The importance of case studies is that they bring a certain degree of authenticity into classrooms, is not just hypothetical situations being discussed, but actual events with real people that happened some time ago. This can make students feel more involved, since its an event in which they may have participated had they been in the right moment and place.

In business studies, especially for graduate students, using these types of methods is fairly common, Harvard is notoriously famous for using the case study methodology in its MBA program, however this can result in the unintended consequence that other schools, in other countries will use these same examples trying to follow this standard even if those cases are not an ideal fit for their specific contexts.

That's not to say importing case studies can't be useful, a lot can be learned from this type of cases but it will be harder for the students to relate and for the teachers to make it relatable, there needs to be more context added to the specific cases, in order to fill the gaps of knowledge and it will be more time consuming.

3. Defining a business plan

A business plan, at its core, is a document that defines the objectives of the business and how said objectives should be met (CEPAL-ONU, 2016), it establishes the roadmap to follow while giving a clear picture of the available resources and potential obstacles (Osorio & Murillo, 2010). A good business plan should be useful not just to kickstart a business or attract initial investors, but also as a way to track progress, verify which goals are being achieved and which ones should be adapted (Arias, Portilla, & Acevedo, 2008). The business plan becomes an essential tool for anyone trying to start a business, especially those who are trying to become entrepreneurs.

Around the world there has been a trend to incentivize entrepreneurship among the population, there seems to be a correlation in both the entrepreneurial education and entrepreneurship activities, and these activities promoting the economic development of a certain region (He, Zheng, Sharma, & Leung, 2024). It follows logic that some governments are interested in collaborating with universities in order to give the students tools to start their own businesses.

Some critics argue that a business plan may not be suitable for entrepreneurs since startups move at a rapid pace, however there are studies that show an increased performance of businesses who use business plans (Ferreira, Loiola, & Gondim, 2017), furthermore, a business plan does not have to be static, it can be a living document, constantly evolving and adapting to the needs of the organization and the market, in order to do so, it would need to be constantly reviewed and analyzed.

There are several methodologies on how to write a proper business plan, and it's not uncommon to make students work on a mock-up version of a business plan, specially at business graduate levels, these mock-ups however can be limited on their impact since they're merely theoretical and often judged just by classmates and faculty.

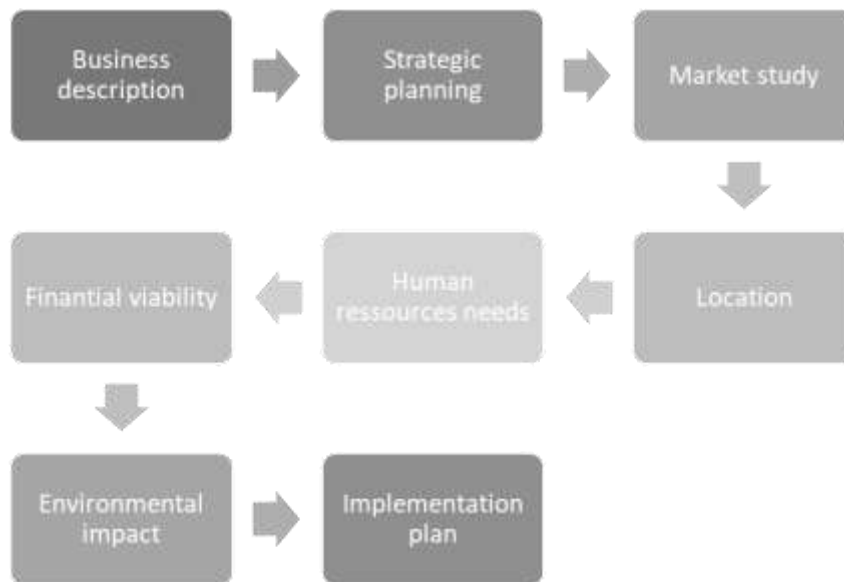
Another way of trying to teach how to work on a business plan consists on using real business plans and analyzing their structure and success, as in a case study, the problem with this approach is that not all companies will release their business plans to a general audience, and those that do, won't necessarily relate to the context of the students.

4. Collaborative business plan development and impact on student learning

A proposed solution to address the challenge previously described is to involve professors in the development of business plans tailored to the specific regional context. Collaborating with local government branches or businesses, professors contribute their expertise to create business plans that reflect current industry trends and address local economic needs. This collaborative process ensures that the resulting case studies are relevant, up-to-date, and aligned with the learning objectives of business school courses.

To assess the effectiveness of this approach, a project was initiated to develop a business plan in collaboration with teachers at both undergraduate and graduate levels, as well as a local government branch. The structure for the business plan is presented in the figure below. The idea was to analyze the viability of a project the local government branch was trying to get funding for.

Figure 1. Business plan elaboration.

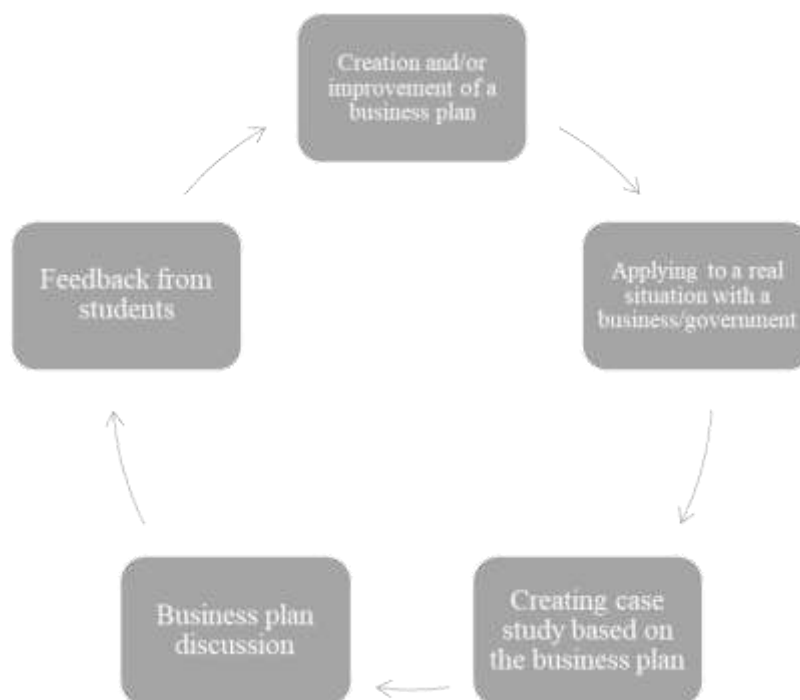


The developed business plan served as an instructional method for a master's level course, allowing students to apply theoretical concepts to a real-world scenario. Outcome measures included student feedback, performance on assignments and exams, and qualitative assessments of learning outcomes.

5. Results and conclusion

The results of the project indicated a positive response from master's level students, who found the instructional method using the collaborative business plan to be useful and relevant to their learning experience. The integration of real-world business planning into the curriculum enhanced student engagement, critical thinking, and problem-solving skills, demonstrating the effectiveness of the collaborative approach in bridging the gap between classroom learning and real-life application.

Figure 2. Improvement of a business plan by a feedback loop.



By creating a case study, based on the actual business plan where the teachers were involved in the making, teachers felt more confident while introducing the case to the students, if additional information was required during the course, it was easy to obtain. An added bonus of this dynamic was the creation of a positive feedback loop, since the business plan is not a static document and can be modified and evolve, the discussions during the course about the case lead to improvements to the business plan in real time, which could then result in an updated case study, that could lead to further improvements.

The collaborative development of business plans with professors and local government branches or businesses offers a promising approach to enhance the relevance and applicability of case studies in business school courses. By incorporating real-world scenarios into the curriculum, educators can better prepare students for success in the dynamic and competitive business environment. Further research and implementation of this approach at the undergraduate level are recommended to expand its impact on student learning across diverse educational contexts and how to best adapt this method to larger groups.

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THE MATHEMATICS THAT THE SEA CONCEALS - CONNECTIONS FOR THE TEACHING OF MATHEMATICS

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Abstract

Exploring mathematical connections with relevant current issues is an important support for learning in a world where reality and its problems are becoming increasingly global, multidimensional and complex. The first author of this paper has developed, from scratch, a set of 17 worksheets relating mathematics with the sea, driven by the cause of ocean sustainability. The tasks are intended for middle school mathematics, grades 7 to 9, and address all the main topics of the syllabus (algebra, geometry, statistics, computational thinking). Most of the tasks are contextualised in the history and livelihood of Cascais, the Portuguese municipality where the author teaches, focusing on aspects such as marine pollution, fishing, oceanographic exploration, surfing, navigation, lighthouses, among others. During the academic year 2022-23, a didactic experiment was carried out, by assigning some of the tasks to middle school students, collecting data and conducting a survey afterwards. From the results of the didactic experiment, the following aspects stand out: the established connections enabled the students to recognise the relevance of mathematics, thus leading them to understand it is part of reality and not merely an isolated school subject; the students got involved with curiosity and commitment in carrying out the tasks; they detected incorrect resolution strategies and self-corrected them; they developed transversal mathematical skills and deepened other areas of knowledge, going beyond learning specific mathematical contents. The tasks provided the students moments for reflection and the sharing of experiences of active citizenship in favour of the ocean, proving that mathematics classes can contribute to raising awareness of the importance of ocean sustainability and benefit from this connection. This work culminates with the challenge of putting into practice or adapting these tasks in other Portuguese schools and municipalities, thus reinforcing the students' learning process in a country with a maritime dimension such as Portugal.

Keywords: *Middle school mathematics, mathematical connections, sea, ocean sustainability, Cascais.*

1. Introduction

The ocean constitutes 70% of the planet, and its sustainability is currently a global concern. Its protection is a Sustainable Development Goal (SDG 14). It is essential to prevent and reduce marine pollution to address challenges such as climate change and the availability of sufficient, safe, and nutritious food. For this, the cooperation and action of everyone is necessary. Young people are not detached from this struggle; on the contrary, when informed, they easily join the cause and can be potential agents of change. In what way, can mathematics classes contribute to the cause of ocean sustainability? Can the topic of the sea contribute to achieving the learning outcomes of mathematics at school? The search for answers to this dual question guided the work presented in this article.

1.1. Mathematical connections in the curriculum

As Edgar Morin emphasises in the epistemology of complexity (Morin, 2002, pp. 39-50), to address the complex and global problems that the current world faces, compartmentalised knowledge is insufficient; it is necessary to reconnect the various areas of knowledge, recognising the relationship of the part to the whole and the whole to the part.

The *Aprendizagens Essenciais de Matemática* (AEM), Portuguese official mathematics syllabus and guidelines, approved in 2021 for years 1 to 9, acknowledge the importance of the ability to establish internal and external mathematical connections (Ministry of Education, 2021a, pp. 17-18). This mathematical ability is considered cross-cutting and should be addressed in an integrated manner with other subjects.

The relevance of external mathematical connections in learning is grounded in the “principles of relevant knowledge” advocated by Edgar Morin (Morin, 2002, pp. 39-50). In his opinion, for the construction of relevant knowledge, education must make evident the context, the global perspective, the multidimensionality, and the complexity of knowledge.

The purpose of mathematical connections is to support learning, facilitating the understanding and expansion of ideas, concepts, representations, and problem-solving strategies in specific contexts. Consequently, it presents mathematics as a cohesive whole, articulated and related to other areas of knowledge. Additionally, it is essential to consider the potential that the context of school tasks has in motivating students. When students are able to establish mathematical connections, their understanding becomes deeper and more enduring (National Council of Teachers of Mathematics, 2008, p. 71).

1.2. The sea as a motivating theme for establishing connections in mathematics classes

With the aim of engaging students and promoting their learning, based on the curriculum guidelines of the Ministry of Education (ME) and inspired by the SDG 14, the first author of this article developed seventeen tasks for mathematics classes from scratch. These tasks establish connections between the sea and the learning objectives of the subject. They are intended for students in the 7th, 8th, and 9th years of basic education, covering various topics defined in the AEM (Ministry of Education, 2021a, 2021b, 2021c). The goal was to diversify the types of exercises, ranging from direct and simple questions to others with a higher level of cognitive demand, including problem-solving and geometric constructions.

Contextualised mainly in the history and characteristics of Cascais, a coastal town near Lisbon, the tasks address topics such as tides, ocean exploration, marine animals, sustainable fishing, surfing, lighthouses, marine pollution, art inspired by the sea, among others. Each task is divided into two sections: the statement for students and a pedagogical framework for teachers. Both parts contain an introductory section with relevant historical/cultural/environmental information about the context. Obtaining all the information required visiting many interesting places (museums, lighthouses, Cascais tide gauge, fish markets, etc.) and interviewing people from many different occupations (fishermen, museum staff, photographers, surfers, etc.) All the problems/questions presented along the task seek to be meaningful within the context and not just a transposition of a mathematics exercise into a forced context. As an illustrative example, one of these tasks is described in section 3. The complete set of tasks is available in Frade (2023).

2. Methodology

This study aimed to analyse how mathematical connections with the topic of the sea, including the issue of ocean sustainability, affect the learning of mathematical content. The case study (Yin, 1994) was the research method used to assess the potential of the created tasks. Three tasks were selected and implemented in 7th-year groups, according to the learning objectives intended to be achieved in each year group at a specific moment.

Inquiry techniques, direct observation, and document analysis were used, employing the following instruments: field notes, questionnaires, and written productions by students. During the task implementation, the teacher (first author of this article) adopted the participant observation technique. Written productions were photographed and sent by students through Google Classroom, and questionnaires were filled out on Google Forms. The questionnaires aimed to understand how the tasks were perceived by the students. The data collected throughout the survey were later analysed, and the results were presented using graphs created with Excel. Stacked bar graphs were constructed according to the five-point Likert scale used in the questionnaires (1 - Total disagreement, 5 - Total agreement), centring and colouring the bars to facilitate the reading.

2.1. Participants

The case study was conducted at a school in the municipality of Cascais and took place between February and June 2023. The participants were students from three 7th-year groups, totalling 85 students.

2.2. Description of the study

The selection of the tasks and the choice of when to apply them were based on the learning objectives planned for the year groups. The first task selected, “Boat speed,” was applied in all groups and addresses functions. The second and third tasks, “The oceanographer king” and “The poem,” were applied in two of the year groups and address scale factors and equations, respectively.

The students worked in pairs, as we believe that this methodology allows students to express their ideas, listen to other opinions, discuss solution strategies, argue and critique, contributing positively to learning. Moreover, this is a methodology regularly used in mathematics classes that is clearly appreciated by the majority of students involved in the study. After the pair work, a collective discussion of each task was conducted, using the projection of students' answers. The objectives were to analyse the different strategies used to answer the same question, correct any errors, systematise the mathematical learnings emerging from the task, and in some situations, discuss the issue of ocean sustainability.

In the next section, as mentioned earlier, we present one of the tasks applied to the students, as well as an analysis of the questionnaire answered by the students at the end of the completion of this task.

3. Results

3.1. The oceanographer king

“The oceanographer king” is a task intended for 7th year students and explores the geometry topic of similarity and scale factors. It unfolds around a set of four fish drawings by one of the last Portuguese kings, D. Carlos, who reigned from 1889 until his assassination in 1908 (Portugal became a republic in 1910). He was known as the “diplomat” king due to his multiple diplomatic endeavours, but also as the “father of Portuguese oceanography” due to his interest in oceanography. He is also known for his talent as a painter and among his works there are several scientific illustrations. D. Carlos conducted twelve exploratory campaigns in the Portuguese sea aboard his yachts adapted for oceanographic research and built an oceanographic laboratory to study marine organisms collected during the expeditions (Girard, 1908).

Two of the forementioned scientific fish drawings made by the king have a scale factor indication (see Figure 1). This is a fertile setting for mathematical activities related to the topic of similarity and scale factors. Among the learning objectives for the 7th year related to this topic, one stands out: “identify similar figures in everyday situations,” with the recommended teaching strategy to “confront the meaning of similarity in real life with that of mathematics, in order to provide understanding for students” (Ministry of Education, 2021a, p. 40). “The oceanographer king” complies to this goal connecting mathematics with the areas of scientific illustration and naval modelling. The study of scale factors, more commonly applied in the interpretation of maps, is thus extended to other areas.

The task is enriched by the issue arising from the fact that only photographs of the king's drawings are available, with the scale factor unknown. Having identified and contacted the author of the photographs, Pedro Aboim Borges, it was possible to determine the actual dimensions of the drawings created by D. Carlos. Using this information, it was found that at least two of the fish captured and drawn in 1904 by the king had dimensions larger than those of the same species currently inhabiting the ocean, an aspect proposed to be explored through connections with the field of Biology and fishing sustainability, in particular.

Figure 1. Drawings of two fish by King D. Carlos in 1904, watercolour on paper.
Left: a *Macrurus* fish, scale factor 0,5:10; Right: a *Alepocephalus bairdii* fish, scale factor 1:10.



The task contains three parts. In the first one, students are led to discuss the meaning and importance of scale factors and asked to determine some real fish measures using the two drawings of Figure 1. Students are also asked to discuss how can one of the fish lengths to be so much larger than

what is now expected for that species (the fish on the right in Figure 1 measured 1,45m and nowadays this species grows up to 1m.). The second part of the task is related to planning a wooden model of one of the king’s yachts, based on a photograph of the yacht and knowing some of its real measurements. Finally, the third part of the task explores the issue arising from the fact that we only have access to photos of the king’s drawings without mention of the scale factor. By accessing the photographer’s archives, the original photos showed a colour bar next to a ruler in centimetres which allows the determination of the original measures.

3.2. Analysis of questionnaires

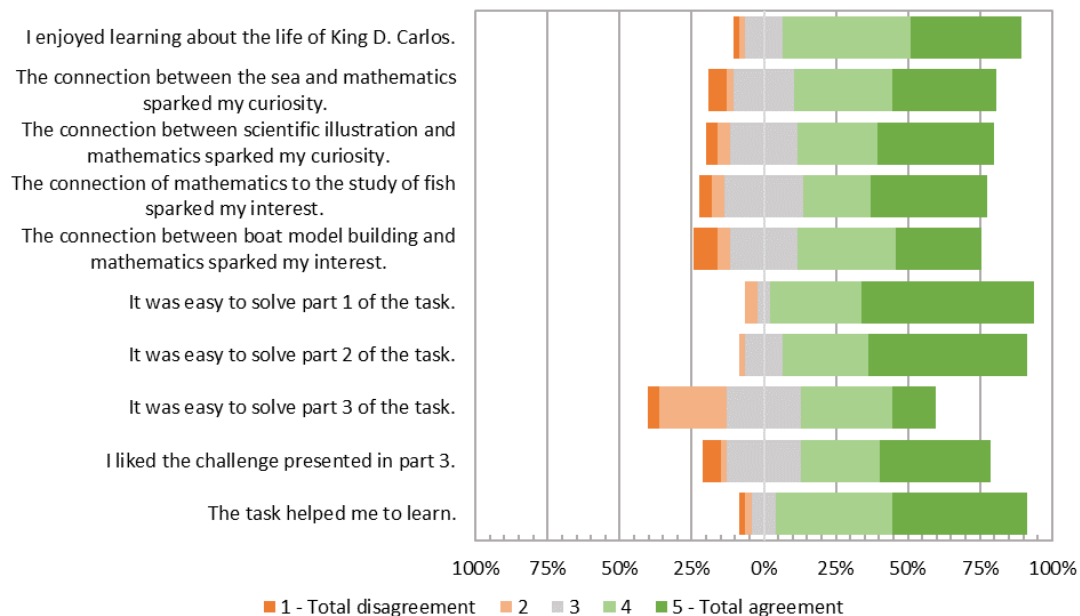
At the beginning of the experiment, students were asked about their interest in the theme of the sea. The answers given by 69 students revealed that 68% of them showed interest, 9% lacked interest, and 23% had a neutral opinion. It should be noted that living in the municipality of Cascais, a seafront territory, may have influenced the expressed interest.

After the completion of the task “The oceanographer king,” students expressed their opinions about it by responding to a questionnaire. Forty-seven responses were obtained.

On a five-point Likert scale, where 1 corresponds to “Total disagreement” and 5 corresponds to “Total agreement,” students indicated their level of agreement with various statements (see Figure 2). A vast majority of the students, 83%, enjoyed learning about the life of King D. Carlos, expressing levels 4 and 5 of agreement with this statement (green coloured bars in Figure 2). Likewise, the various connections established in the task sparked the curiosity of most students: the connection between the sea and mathematics (70%); the connection between scientific illustration and mathematics (68%); the connection of mathematics to the study of fish (64%); and the connection between the construction of boat models and mathematics (64%).

The majority of the students found it easy to solve part 1 (91%) and part 2 (85%) of the task, while the difficulty level of part 3 divided opinions, with the majority enjoying the challenge posed by that part (47% positive opinions vs 28% negative opinions). Except for this statement, the percentage of negative opinions (orange-coloured bars in Figure 2) was always relatively small. A vast majority of the students, 87%, considered that the task helped them to learn.

Figure 2. Results of the questionnaire about the task “The oceanographer king”.



Upon requesting an overall evaluation of the task “The oceanographer king,” 47% of the students rated it as Very Good, 40% as Good, 11% as Fair, no students as Poor and only one student, 2%, as Very Poor. Among the comments written by the students in the open-ended question of the questionnaire, the following stand out as representative:

- “The connection between King D. Carlos, the illustrations, and the subject matter we had to cover was quite creative.”
- “I enjoyed completing the activity and the combination of mathematics with oceanographic study.”

- “Very good, I had fun during the learning process.”
- “The activity was great, and I learned a lot.”

The analysis of the results described so far aligns with the direct observations made by the teacher.

4. Conclusions

Along the survey, the vast majority of students acknowledged that “the tasks helped them to learn”, corroborating the conclusions drawn by the teacher from the analysis of field notes and written productions by the students. Additionally, it became evident that framing mathematics problems in real-world contexts related to the sea had a positive effect on student motivation.

The majority noted that “the connection between the sea and mathematics sparked curiosity” and emphasised enjoying learning about the subject that contextualised each task.

From the analysis of the implementation of the tasks proposed in “Mathematics and the sea” (Frade, 2023, pp. 145-182), the following aspects stand out:

- The established connections enabled students to recognise the relevance of mathematics, understanding that it is part of reality and not just an isolated discipline.
- Students engaged with curiosity and dedication in task completion.
- They identified incorrect resolution strategies and self-corrected.
- Transversal mathematical skills were developed, and other areas of knowledge were deepened, going beyond the learning of specific mathematical content.
- The tasks provided moments of reflection and sharing experiences of active citizenship in support of the ocean.

Finally, the authors express their wish to share and disseminate the tasks proposed in Frade (2023), hoping they can be implemented and/or adapted in other schools throughout the world, for the benefit of students' mathematical learning and the sustainability of the ocean.

Acknowledgments

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COLLABORATIVE NETWORKS OF KNOWLEDGE

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Abstract

Numerous learning systems have emerged over the past two decades promising novel approaches to improve education and training. However, they use a learning process based on exposure to information and practice, which does not guarantee the internalization of the concepts and changes in behavior required to improve education and training. This paper proposes a learning process that aims to address this concern. It consists of five steps: modeling the learner, motivating, guiding, assessing, and attesting the learner. We present each of these steps and discuss how leveraging innovative knowledge structures from network science and existing and emerging technology and AI can support the proposed learning process in a learning system that engages learners in their learning journey. Our discussion is supported by a theoretical framework developed based on data on student learning and on student and faculty experiences with two learning systems where we piloted steps of the proposed learning process. Each learning system has endured the scrutiny of student and faculty usage over several years and their feedback has shaped our goals and expectations.

Keywords: *Network of knowledge, individual learning pathways, personalized education, micro-learning.*

1. Introduction and motivation

Learning is shaped by how a person receives, internalizes, and then uses information (Huitt & Hummel, 2003). Learners' experiences, biases, environments, cognition, as well as other factors, impact the way they engage in the learning process. Traditional education systems are structured to push knowledge at students through compulsory or comprehensive university curricula, not necessarily designed to ensure such content has relevance to each student's current needs and competencies, but instead communicating a payoff after a multi-year process, demotivating the learners. Instead, learning should be seen as productive and attractive in its ability to meet each student's current needs and interests. Thus, the design of a personalized Learning and Development System (LDS) must support the recognition of relevant learning traits from each learner to support the necessary customization of personalized learning strategies.

We propose and exemplify the creation of a personalized Learning and Development System (LDS) that must adapt learning content with appropriate instructional design principles and address the following about each learner: 1) learner competency, to address personal cognitive load and working memory limitations; 2) required structuring and organization of learning activities; and 3) personal agency within a collaborative learning model. We focus on how information technology enhances the learning process as a tailored experience that includes modeling the learner, guiding the learner, motivating the learner, assessing the learner, and attesting the learner. Specifically, we discuss how a network of knowledge captures a nonlinear foundational construct supporting these learning process activities, so that the LDS creates learning-centered pathways through the network to support a personalized learning experience.

To understand how network science can support the learning process, we leverage motivating and guiding the learner through self-directed and self-paced learning opportunities in an educational environment conducive to meeting the learners' needs through facilitating a participatory environment. Such efforts push the limits of the current educational systems, tools, and a learning system's capabilities. Our contribution includes an examination of a dynamic network of knowledge as a foundational construct

to create a personalized educational experience that meets the set learning outcomes of each learner individually.

2. Theoretical grounding

In this section, we synthesize the learning science and network science components addressing the extrinsic and intrinsic motivation of learners.

2.1. Learning science

Learning occurs when a person processes, organizes, and connects new information to preexisting ideas to create new meaning (Bransford et al., 2000). The learner's ability to receive, reflect, and internalize information, within the limitations of working and long-term memory, is an important consideration when designing an LDS. Learning requires effort, and if working memory is overloaded, a person will be unable to continue to receive new information, thus degrading the learning process (Cook & McDonald, 2008). Learning content design—the design of activities, their structure, and the scaffolding and segmentation of content—is an important aspect of managing cognitive load. Technology can support a design that presents learners with the necessary expert guidance utilizing instruction and micro-modules, also known as chunks, with opportunities for checks for understanding. Self-contained micro-modules allow the user to pause the learning process in a natural way, reducing strain on the learner and restoring a learner's capacity for taking in new information. Additionally, as a learner progresses through assessment activities, the incorporation of adaptive learning tools can provide learners with critical feedback tailored to their specific challenges.

Chang et al. present a model for how a learning system can automatically identify a learner's working memory capacity by analyzing the learner's behavior (Chang et al., 2015). Through the monitoring of students' activity log information within a learning system, mechanisms are introduced. Thus, a personalized LDS would capture learning data, update learner characteristics, and adapt the recommendations presented to the learner from a repository of resources which should naturally and easily be curatable for the learner. So, the LDS filters and suggests content that is most relevant to each learner, mitigating the risk of overwhelming the learner while also supporting the curator of content (Reith & Dever, 2021). Additionally, learner agency within the personalized LDS supports the understanding, ability, and opportunity for the learner to take an active role in the learning process, thus the LDS design empowers the learner while mitigating the excessive demand for working memory. Bartlett introduced the idea of learning schemas as a necessary component of cognitivist learning theory which is the basis for this research (Gholson & Craig, 2006). Therefore, the formation of mental representations of interconnected content is important for learners to establish connections between existing knowledge and new complex knowledge supporting improved retention and storage in long-term memory (Van Merriënboer & Sweller, 2010).

2.2. Collaborative environments: Network of knowledge

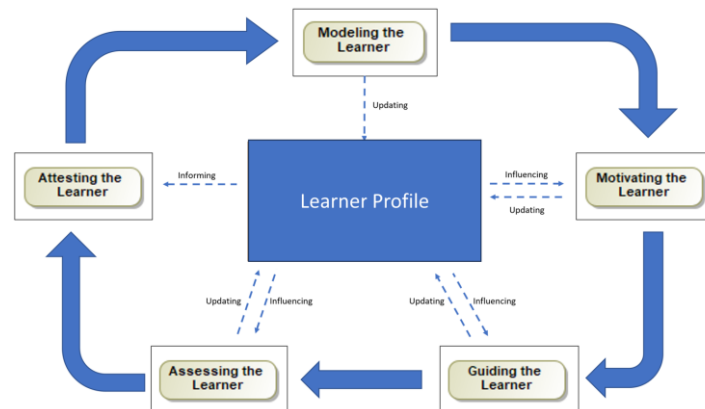
In creating a student-centered learning environment within higher education, we seek to facilitate learner knowledge creation through experience rather than just transmission from the subject matter expert to the learner. A networked environment can support experiential learning, cognitive learning, participatory learning, case studies, discussions, and other problem-solving methods leveraging pre-existing resources available on the Internet to populate learning pathways (Feldman et al., 2000). Learners are guided through this networked environment as self-directed and self-paced users, supported by asynchronous or synchronous engagements.

The Network of Knowledge is an environment to which subject matter experts (SME) can collaboratively contribute and tag content based on their area of expertise, and then connect it based on pre-requisites or dependency in a non-linear way (Cleven, 2018). Existing prototypes provide a real-time adaptive micro-learning method for enhanced and personalized education (Gera et al., 2019). A Network Science approach for learning focuses students through networked learning pathways recommendations in the presence of information overload. Self-paced learning has been practiced and empirically analyzed using intentional and meaningful networked content and activities through a network approach (Gera et al., 2019). An interconnected model of education brings an interconnected (non-linear) view of knowledge and its users. That is, we also model the learning support as the users' social network comprised of content creators, instructors, instructional support staff, stakeholders, sponsors, and learners.

3. Context of the research

We now introduce our model for the personalized learning process proposed in a networked environment inspired by existing models. Figure 1 depicts the learning components into the learning cycle, whose information is retrieved into a learner profile and used to personalize learning.

Figure 1. The Learning Cycle shows activities associated with learning and their interaction with the learner profile.



The learner profile is automatically built on data collected from the learner, such as employment, education, interest, personality, preferences, and accessibility of resources. In formal courses, instructors attempt to elicit some details through student introductions, discussions, and engagement over time and use the data to scaffold material as they teach, a difficult practice due to large class sizes and diversity. An LDS can easily collect and use the data to personalize the learning experience and content. This may manifest in at least three ways. First, some learners may start at an advanced point in the curriculum based on their existing knowledge. Second, teaching examples and analogies may be customized to align with familiar experiences. Finally, understanding the learner's attitude toward a topic may help the LDS choose an appropriate teaching strategy. These learner profile categories can be leveraged in the five components displayed around it in Figure 1, and detailed next.

Modeling the learner has often been associated with understanding prior knowledge. Formal pre-tests and baseline assessments as well as queries on background experiences are common as instructors interact with learners including related experiences and attitudes. This knowledge can be used by the instructor to adapt examples to build off this information. The learner profile is a set of goals, a set of competencies, and a set of constraints. Chief among these competencies is the learning competency that models the proficiency of the learner to acquire competency. Crafting adaptable micro-modules to personalize learning as well as cultivating them into a personalized pathway requires background information on the learner stored in a learner profile. The ubiquity of data opens the opportunity to shape customized learning experiences by tailoring the curriculum making it efficient compared to commonly observed approaches in today's education, such as one-size-fits-all or differentiated by group level.

Motivating the learner includes motivation to start learning a topic and motivation to endure the process to completion. The former may involve such intrinsic motivators as a need to address an immediate issue, seek out a better quality of life, or the pure joy of learning and satisfying curiosity. The latter may involve extrinsic motivators such as grades or demonstration of competency, improved by personalization of learning and supporting learner's meta-cognition. First, to support dual encoding of information through exposure to diverse modalities of interacting with the content, we envision leveraging the learner profile's tags to match appropriate content from the network of knowledge. This supports each learner individually by providing content that motivates each learner based on the tags in the learner profile. Second, to support meta-cognition, the LDS provides immediate and specific feedback to each user to have the opportunity to improve self-learning based on the reporting that the environment captures.

Guiding the learner is the process of presenting and sequencing learning materials, achieved by using best practices such as spaced repetition, elaboration, visuals, concrete examples, and concept maps. For the directed learners, we guide them individually through learning paths throughout the network of knowledge, by ranked ordering choices of content that meet the same learning outcomes, offering scenic routes, thus empowering the learner in selecting the depth and breadth for topics. As the motivation for learning changes for more mature learners, to progress towards exploratory learning, the LDS provides choices of micro-modules, driven by keyword matching to the learner's profile based on an updated list of

keywords from the learned content, based on social networks of the learners (Andriulli et al., 2019).

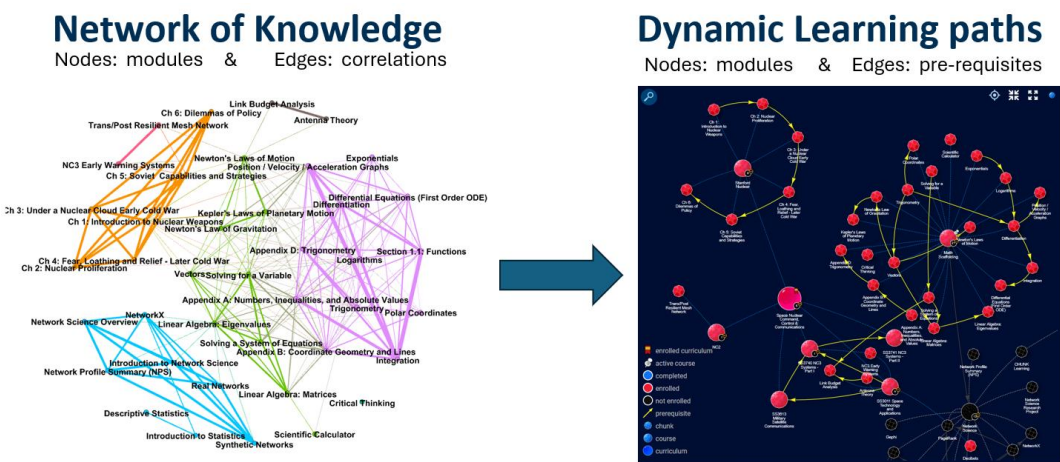
Assessing the learner often involves measuring competency, such as adaptive knowledge, skill, ability, behaviors, and characteristics. Personalized learning depends on granular data for successful agile scaffolding from micro-modules, determining the learner’s current state of knowledge and gaps to meet the goals. Such assessments not only provide feedback to a learner’s end state at the completion of a learning, but the learner’s starting state when engaging in the next activity guaranteeing relevant learning. As such, student-centered assessments that establish evidence about the learning process and validate the competencies achieved, such as formative assessments, support understanding of learning at different instances continuously monitoring the ability to relate new information to previously acquired principles. Additionally, they provide critical feedback to the learner and to the LDS on the effectiveness of the learning pathway and help uncover weaknesses or gaps in understanding.

Attesting the learner involves witnessing evidence of competency and certifying the learner to others. Whether it manifests as a degree, certificate, testimonial, reference, or digital badge, a record of competency helps the community efficiently understand a person’s proficiency in a topic. The LDS tracks and provides immediate attestation of the learner’s progress to inform his decisions, while the learner progresses through the learning path. Consequently, the educational ecosystem must be dynamic, flexible, and a rich cognitive environment supported by adaptable micro-modules based on the LDS’ reporting.

4. Experimentation

We piloted this methodology in entry, survey-courses and advanced courses in statistics, modeling and simulation, advance math courses at the Naval Postgraduate School starting in 2018. We created a network of knowledge for these courses, with students able to get personalized content based on the information in their learner profile, with additional options to suggested content. A visual of the network of knowledge is depicted on the left of Figure 2 where nodes represent content modules, and the edges capture similarity based on the tags associated with the content (thicker edges represent more tags in common). The right picture of Figure 2 shows learning paths through the network of knowledge, as displayed to the learners.

Figure 2. A Learning Path is displayed on the right in red, based on the Network of Knowledge environment.



We assessed the pilots using data on prior knowledge, cognitive competencies, perception of the learning system and instructors, and cognitive processes using pre-, and post-course questionnaires, augmented with focus groups. We consistently found that students in all level courses valued the flexibility in the choice of content in LDS environments. While all students responded they preferred some interaction with the instructor, students in introductory-level courses were more likely to state the choice and visualization of the learning paths through the network of knowledge that supported their learning by preparing them to engage in meaningful learning through interactions with their instructor. For advanced, complex topics, only about half of the students preferred the piloted LDS learning environments. The recommendation asks for a larger amount and variety of content choices to increase the students’ engagement and better support their learning. The assessment of the pilots points to the exciting possibilities in using an LDS system and demonstrates the need to continue to expand our understanding of the art of the possible that ensures students are exposed to relevant and meaningful learning.

5. Conclusions

In this paper, we ask whether personalized and individualized learning can occur effectively and efficiently in a learning environment that benefits from advances in technology. We introduce an environment where learners are guided by personalized learning paths through a network of knowledge composed of interchangeable content, provided by different authors and in multiple modalities of engagement to support dual encoding. Learning in a digital age of abundant content enables opportunities for each learner to make personal choices based on available content alternatives. We present the learning science motivation of why this is needed and introduces our vision of a network science approach to personalized education provided by learning paths of micro-modules from a network of knowledge.

We identify that recommendations for the learning paths can be personalized based on the learner's profile, placing the learner at learning-appropriate location in the Network of Knowledge, and choosing between the learning paths based on each learner's interest. We conclude with an experiment testing such a personalized LDS prototype, alluding to the exciting possibilities that the approach brings. This work presents the vision and is an open call to academics and practitioners to join in the effort to fill in gaps, push the frontier, test what & where works, continuously improve such an educational system and find valuable solutions.

Future explorations should leverage the ability of Artificial Intelligence (AI) to leverage emerging technologies in education design to support both the network curators and learners, since knowledge identification, curation, and uploading is time-consuming.

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INTERNATIONAL COOPERATION ACTIONS FOR THE SYSTEMATIZATION OF A SIGN LANGUAGE GENERATOR AND PUBLISHER

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Abstract

This text describes the process of systematizing a study and developing a pilot technology aimed at the Brazilian Sign Language (Libras), a result of a collaboration between Brazil and Costa Rica. The Technological Institute of Costa Rica created the International Platform for Sign Language Editing (PIELS) to support the editing and learning of Costa Rican Sign Language (LESCO). PIELS emerged with the goal of finding technological solutions for the graphic representation of content in Sign Language, utilizing graphic and interaction libraries, programming languages, and a web server, with data stored locally in a lightweight and accessible format. The study in question involved creating 60 signs in Libras, starting from signs already existing in PIELS, which initially only included LESCO. Indicators for the tool's use were also analyzed, aiming to promote effective communication and mutual understanding between the teams from both countries. The process included meetings with a multidisciplinary team, composed of Libras interpreters, deaf individuals invited for the validation of the signs, and experts in programming and information technology. Topics covered in the meetings included: introduction to PIELS technology, technology studies in Sign Language, deaf culture in Costa Rica, morphology, phonology, syntax, and discourse in PIELS, dictionary and proximity, and Libras grammar. For the creation of the pilot systematization, six main categories of signs were selected, covering days of the week, months, colors, numbers from 1 to 10, greetings, and family context, chosen for their relevance and frequency of use in everyday life. The result was a library of common signs in LESCO and Libras. Regarding PIELS, the proposal is to include technologies that allow an avatar to reproduce Libras signs stored in a database. The signs, created and stored based on Libras grammar, are facilitated by an editor that optimizes the creation of complex signs. The signs consist of Libras parameters and their transitions, trained in the avatar, with hand movements such as linear, curved, circular, sinusoidal, and spiral, configurable for different directions.

Keywords: *Brazilian sign language, platform for sign language, digital technology in education.*

1. Introduction

In recent years, we have witnessed a notable increase in the development of technologies aimed at accessibility and inclusion for people with disabilities. One area of emphasis is the enhancement of Sign Language technologies, essential for the communication of the deaf community. This text describes the process of systematizing a study and developing a pilot technology for Brazilian Sign Language (Libras), resulting from a collaboration between Brazil and Costa Rica.

Chacón-Rivas (Naranjo-Zeledón et al., 2020) highlights the importance of technology in development and interaction processes, especially for deaf people, who often face social barriers due to a lack of awareness or information. For the author, technology is vital in education, and its inclusion has been more evident recently, with efforts to avoid the marginalization of vulnerable groups, such as the deaf community (Espinach, et al., 2021)

In this text, we report an ongoing study that involved the creation of 60 signs in Libras, categorized into six groups, based on signs already present in PIELS, previously restricted to Costa Rican Sign Language (LESCO). The efficacy of the tool and its potential to facilitate communication and mutual understanding between Brazilian and Costa Rican teams were evaluated.

Multidisciplinary teams from both countries, including Libras interpreters, members of the deaf community, information technology experts, and education professionals, participated in online meetings.

These meetings covered from the introduction to the International Platform for Editing Sign Language (PIELS), involving the cultural aspects of the deaf in Costa Rica and Brazil, culminating in the creation of a library of common signs between LESCO and Libras.

PIELS was developed by the Costa Rican Institute of Technology. PIELS seeks to provide technological solutions for the graphical representation of signs, starting with the Costa Rican Sign Language (LESCO), aiming to improve access and understanding of Sign Language. In this sense, this study collaborates to expand the library considering the Brazilian context.

The Costa Rican Institute of Technology, recognizing the importance of inclusion and accessibility, developed the International Platform for Editing Sign Language (PIELS). This platform was created with the aim of providing an innovative technological approach to facilitate the editing and learning of Costa Rican Sign Language (LESCO). The project began in 2016 and has evolved significantly, benefiting from strategic collaborations, mainly with the National Center for Resources for Inclusive Education (CENAREC), linked to the Ministry of Public Education of Costa Rica.

Zamora-Mora and Chacon-Rivas (2022) highlight the importance of recognizing sign language through computational means as a topic of international interest, as it helps to reduce the gap between deaf people and the society that communicates through verbal means, regardless of ethnicity, location, or origin of the sign language.

Over time, the PIELS project evolved to include a dictionary of LESCO signs, developed in close collaboration with the deaf community and based on the signs compiled by CENAREC. This dictionary, enriched by the active participation of the deaf community and the support of private entities, now houses a vast collection of over 2,200 signs, covering a wide range of knowledge areas.

The Brazil-Costa Rica collaboration aims to enable a greater understanding and identification of the technological advancements achieved, as well as to ponder future possibilities of technological development that facilitate communication and promote the inclusion of deaf people, adopting an inclusive perspective.

2. Results and discussions: Contributions of the training program

This international cooperation between the involved educational institutions presents a promising opportunity to further expand this technology and its impact and usefulness through a collaborative project aimed at expanding the sign repertoire on the platform. This expansion will meet the growing needs associated with LESCO, as well as contemplate the inclusion of Brazilian Sign Language (LIBRAS). With this, PIELS can broaden its reach, serving a more diverse and international user base, reinforcing its role as an essential tool for education and communication in the deaf community.

The main objective of the project is to establish the theoretical and practical foundations for the generation of Libras signs, using a digital avatar in PIELS. The specific objectives include: presenting the scope and limitations of PIELS as a Sign Language editing platform; analyzing previous versions of PIELS, focusing on the technological complexities and grammatical characteristics of Costa Rican Sign Language (LESCO); exploring the cultural experiences of the deaf community that influenced the development of PIELS; providing insights into Brazilian deaf culture and the grammatical aspects of LIBRAS.

As an initial step for the development of the project, eight meetings were held via Google Meet (Table 1), involving multidisciplinary teams from Brazil and Costa Rica. These teams included Libras and LESCO interpreters, programming specialists, and members of the Study Group from the Center for the Promotion of Digital School and Social Inclusion (CPIDES).

Table 1. Meetings via Google Meet.

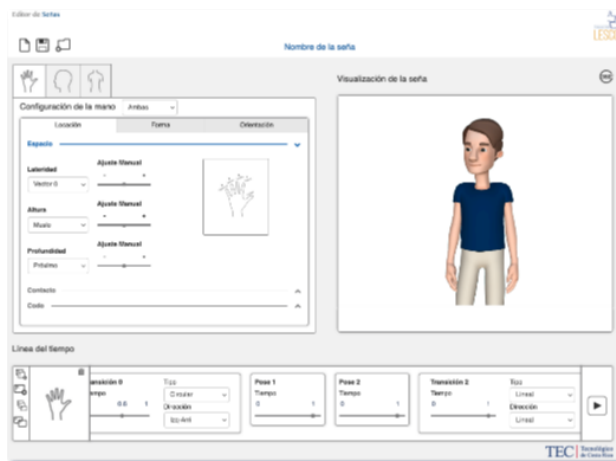
07/02/2023	1st Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 1
14/02/2023	2nd Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 2
28/02/2023	3rd Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 3
28/02/2023	Support material for the meeting: True or False LESCO
07/03/2023	4th Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 4

14/03/2023	5th Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 5
04/04/2023	6th Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 6
11/04/2023	7th Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 7
25/04/2023	8th Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 8
02/05/2023	9th Meeting - PIELS - International Platform for Sign Language Publishing - Lesson 9

In these meetings, various topics were discussed, ranging from technical issues of implementing signs on the platform to linguistic aspects of sign languages. A space was dedicated to sharing experiences and perspectives on deaf culture and the needs of the deaf communities in both countries. The contribution of Libras and LESCO interpreters was crucial to ensure the accuracy and understanding of the topics. The participation of deaf people was equally important, providing insights into linguistic and cultural issues. These asynchronous meetings fostered a collaborative environment, where various areas of knowledge came together to achieve the project's objectives. Interdisciplinarity was a key element for the successful development of the pilot technology for Libras.

One of the tangible results was the creation of a Portuguese language prototype for the production of LIBRAS signs, using a digital avatar. Comparing the 2018 (Figure 1) and 2023 (Figure 2) versions of PIELS, one can observe the evolution of the editing interface and the inclusion of a more sophisticated avatar.

Figure 1. 2018 version.



source: PIELS

Figure 2. 2023 version.



Source: PIELS

According to Espinach and colleagues (2021), the project began in 2015, focused on animating a digital avatar for Costa Rican Sign Language (LESCO). Between 2016 and 2018, the project included more than 2150 signs, with the collaboration of LESCO editors and deaf graphic designers. Validation sessions, called Señatón, were held in 2016 and 2018 to verify the comprehension of signs by the avatar. These events provided valuable information and raised awareness of the urgent needs of the deaf community.

For the creation of the pilot systematization with the partnership between Brazil and Costa Rica institutions, six main categories of signage were selected, covering days of the week, months, colors, numbers from 1 to 10, greetings, and family context, chosen for their relevance and frequency of use in daily life. The result was a library of common signs in LESCO and Libras. Regarding PIELS, the proposal is to include technologies that allow an avatar to reproduce Libras signs stored in a database. The signs, created and stored based on the grammar of Libras, are facilitated by an editor that optimizes the creation of complex signs. The signs are composed of Libras parameters and their transitions, trained on the avatar, with hand movements such as linear, curved, circular, sinusoidal, and spiral, configurable for different directions.

The future goals of this collaboration include expanding the technology to allow a digital avatar to reproduce sign languages from different countries, stored in a database. This advancement aims to promote inclusion and accessibility for deaf people, reflecting on the potential impact of these technologies on the lives of deaf communities.

Chacón-Rivas (Vallejos, Zeledón, & Chacón-Rivas, 2019) explains that technology facilitates interaction with information and the environment, making possible things that would otherwise be difficult for people with disabilities. The author highlights that technological projects are increasingly oriented towards including these people, driven by the Sustainable Development Goals and the 2030 Agenda. A specific example is the Costa Rican Sign Language (LESCO) translation project, which began in 2015 and uses computerized avatars to represent Spanish texts in LESCO, helping to reduce communication barriers, through PIELS.

3. Final considerations

Throughout its analysis, this article illuminated the fundamental role of international collaboration and technological innovation in promoting the accessibility and inclusion of deaf people. The partnership established between Brazil and Costa Rica emerged as an emblematic example, resulting in notable advances in the field of technology applied to Sign Language, with an emphasis on the development and improvement of the International Platform for Editing Sign Language (PIELS).

The evolution of PIELS is a testament to the importance of innovative technological approaches in the education and communication of deaf communities. The expansion of the platform to encompass Brazilian Sign Language (Libras), in addition to the more than 2,200 signs already included in LESCO, reflects an ongoing commitment to the tool's improvement and accessibility.

The teams involved in the development of PIELS, composed of professionals from multiple disciplines, including members of the deaf community, reinforce the importance of an inclusive and collaborative approach. This diversity was essential not only for the technical development of the platform but also to ensure that it effectively meets the needs of the deaf community.

The creation of a prototype for the production of Libras signs, employing digital avatars, is a milestone that highlights the potential of digital technologies in the accurate and accessible representation of sign languages. This innovation aims to improve accessibility and also opens doors for future expansions, adaptable to various sign languages.

Looking to the future, the project envisions expanding the technology to allow digital avatars to reproduce sign languages from different countries. This advancement promises to further enhance inclusion and accessibility for deaf people, highlighting the transformative impact such technologies can have.

In conclusion, this article emphasizes the synergy between international collaboration and technological innovation as key elements in overcoming communication barriers faced by deaf people. The collaboration between Brazil and Costa Rica serves as an inspiring model, demonstrating how technology, combined with cooperation and intercultural understanding, can create meaningful solutions to accessibility and inclusion challenges. The continuation of this partnership, along with future technological innovations, has the potential to generate an even deeper and more comprehensive impact on the world of linguistic accessibility for deaf communities.

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ART FOR EVERYONE: EDUCATION TO PROMOTE BEAUTY IN SOCIETY

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Abstract

Today's universities have become commercialised. Programmes that cannot make a profit or have low career earning potential are shut down or not started. In this paper, I will argue that this is extremely damaging to societies because "Beauty" is demeaned and not considered important. Consequently, societies create human-made environments that are ugly, e.g., the concrete jungles of some cities. More importantly though, I will argue that the lack of beauty in our human-made environments de-sensitises everyone exposed to them, reducing their ability to appreciate beauty. This negative feedback loop is dehumanising humanity. Universities have a role to play to reverse this trend. The paper will present an approach "Art for Everyone" the author developed and promoted as President of a private university to overcome this problem. The underlying philosophy of my approach will be discussed, it is based on American pragmatism and environmental aesthetics. The approach was implemented in the Faculty of Arts and Design. Examples of student artworks will be presented to show what can be achieved.

Keywords: *Everyday art, art for everyone, environmental aesthetics, interactive art, art education.*

1. Introduction

Universities are "intellectual hubs" for their communities. They create and disseminate scientific knowledge and have a major influence on cultural development. Unfortunately, they have become more commercialised. Many face lower Government funding, with resultant pressure to reduce costs. This often leads to humanity and art-based programmes being dropped or not started, as happened in America after the Obama administration changed student funding regulations. I believe this, coupled with market economics, leads to a low public perception of the value and benefit of artworks (aesthetic objects created by humans) in our societies. This should be a major concern for all societies given that art and the pursuit of "beauty" are what makes us human.

In this paper I will explain my approach for promoting beauty through universities called "Art for Everyone". The approach is a philosophic worldview describing how to progress towards an Ideal of Beauty. It is a synthesis of American pragmatism and environmental aesthetics. Like religions it cannot be imposed by fiat and therefore can only be implemented through leadership and culture management. I will describe my experience in implementing the approach in a private university I started up in Malaysia and led from 2013-2021.

2. Experimentalism and the ideal of beauty

Charles Sanders Peirce is acknowledged as the founder of pragmatism and considered by many to be America's greatest philosopher. He deeply influenced the pragmatists William James and John Dewey whose works are more widely known internationally (Apel, 1970).

Edgar Singer, Jr. was a student of James. A major turning point in his thinking occurred after James presented his essay "The Will to Believe" (James, 1896) to a small number of his graduate students, including Singer: "...I do recall we were very much bewildered and not a little shocked at the reading." (Singer, 1925, p. 170). The reason for Singer's concern was James alleged that any philosophy of science is based on desire, the will to believe is a desire. The idea of the disinterested scientist was destroyed forever. James also stated that religious beliefs as a means for seeking the truth must be accepted as well as agnostic beliefs (philosophies), a viewpoint the experimentalists rejected (Singer, 1925). Although in 1979, Churchman (1979) discusses the limitations of the systems approach and argues for other ways of knowing he refers to as the enemies, two of which are religion and aesthetics. He says you must be the enemy, undergo the experience without thinking.

Singer (1959) derived his experimentalist philosophy through a logico-historical analysis of past philosophies of reason. Logic to ensure rigor through exclusive and exhaustive categories. Historical to learn lessons from the past. Note the reference is a post-humous summary of his work, which was carried out mainly in the 1920's and early 1930's. It is called experimentalism because he replaced the “thought experiments” of classical pragmatism with an empirical programme based on measurement theory. Later Churchman (1948) extended Singer's work to include all logically possible methods of inquiry.

Singer used the new approach to formulate how human behaviour could be studied, arguing that mind is behaviour (Singer, 1924). Churchman and Ackoff (1947) extended Singer's work by developing an ontology for the study of mind and social systems, based on modern science (of that time). Ackoff incorporated systems thinking and developed a rigorous ontological system for the study of human behaviour as a “system of purposeful events” (Ackoff & Emery, 1972). This is an extremely short summary of experimentalism; a more detailed overview is given in Britton and McCallion (1994).

One critically important feature of their philosophy was the inclusion of ideals and how these can be pursued (Singer, 1936, 1948; Churchman & Ackoff, 1947; Ackoff & Emery, 1972). An ideal is an end that cannot be attained but can be approached endlessly. The experimentalists argue there is one ideal sought by everyone: the power to achieve one's desires. Desire is meaningless unless there is at least some chance of achieving what one wants. They call this power “omnicompetence”. They then subdivided this overriding ideal into four sub-ideals: Ideal of Truth, Ideal of Plenty, Ideal of Good and Ideal of Beauty (the focus of this paper). They rejected the religious view of an ultimate authority (God) as a source of the power and argue that the source must come from humans themselves; a viewpoint supported by the work of anthropologists and evolutionary psychologists on how our ancestor Homo Sapiens evolved from animals to humans (Mumford, 1967; Harari, 2011).

Singer (1936; 1948) proposes four human sources of power: ourselves, our contemporaries, future generations, and past generations, the latter being the source for pursuing the Ideal of Beauty. What we gain from past generations are emotional experiences. Through art it is possible to invoke a sequence of emotions (a rhythm) that invokes a heroic mood, a dissatisfaction with the current state of affairs and a desire to make changes. This is the inspirational function of art, intensifying emotions. Art also has a cathartic function, purging emotions through recreation. The purpose of art is to create the creator (ourselves): “The artist creates no new ideals; *he creates the creator of ideals*” (Singer, 1936, p. 40). It is this innate ability to create ourselves that allowed our ancestor Homo Sapiens to rapidly evolve during the cognitive evolution; a human being is a “mind-making, self-mastering, and self-designing animal” (Mumford, 1967, p. 9).

The cognitive evolution occurred because Homo Sapiens suddenly developed large brains that allowed them to become conscious. Consciousness did not happen overnight but over a long period of time. Homo Sapiens had to learn how to control their bodies and minds. More importantly they created ways to communicate, both nonverbal and verbal, and by this means they invented culture (Mumford, 1967; Harari, 2011). Art, through inspiration and recreation, plays a key role in helping us maintain and develop our cultures.

When they talk about the function of art, experimentalists are referring to all artworks. They are not suggesting that each artwork on its own is capable of inspiring the heroic mood, but all artworks collectively. The implication here is that the more “good” artworks there are in our human environments the more people will be inspired and recreated. The corollary is that the more “bad” artworks there are the less people will be inspired and recreated, we will become less human.

I conclude this section with two pertinent quotations. The first is by Churchman (1979, p. 190): “...all experience, including dreams, has an aesthetic quality. In fact, my logical mind is tempted to say that aesthetics *is* that which gives the quality – rather than the content – of experience, and that experience without quality is dead – just as experience without thought is unintelligible.” The second is by Ackoff and Emery (1972, p. 245): “Art leads men [people] to find new meanings and commitments in life, and the man [person] that leads other men [people] moves them with visions of the possible and desire for the unattainable. Thus, leadership can be considered to be an art form.”

3. Environmental aesthetics

“Environmental aesthetics is a relatively new sub-field of philosophical aesthetics. It arose within analytic aesthetics in the last third of the twentieth century. Prior to its emergence, aesthetics within the analytic tradition was largely concerned with philosophy of art. Environmental aesthetics originated as a reaction to this emphasis, pursuing instead the investigation of the aesthetic appreciation of natural environments. Since its early stages, the scope of environmental aesthetics has broadened to include not simply natural environments but also human and human-influenced ones” (Carlson, 2019).

It also includes the aesthetics of everyday life such as common objects and daily activities in our everyday environments.

The inclusion of nature as a source of aesthetic experience resulted in environmental aestheticians rejecting prevailing aesthetic theories that included knowledge of the designer as being essential to an aesthetic experience. History and prior knowledge of the process that produces an aesthetic object are not necessary for an aesthetic experience (Heyd 2007). However, such knowledge may intensify the experience.

The non-cognitive viewpoint of environmental aesthetics by Berleant (1991, 1992, 1997, 2000) and Heyd (2007) has been incorporated into *Art for Everyone*. Some important properties of an aesthetic experience according to them are:

1. It involves all our senses.
2. The interested observer (person trying to have the experience) has to focus on the artwork or natural environment and immerse themselves in the experience for a sufficient period of time to induce the aesthetic response.
3. It is an act of creation (Berleant, 1997). It is not only the artist who is creative, but the interested observer as well. The interested observer re-creates the unifying perception of the artist for artworks and creates it for natural aesthetic experiences.
4. Each aesthetic experience is unique. Aesthetic objects are not interchangeable.
5. All aesthetic experiences are social. First, the society we live in influences our cultural upbringing and this affects the way we experience aesthetic objects. Second, society determines what objects are important by adding them to, removing them from, and preserving and maintaining our natural and cultural heritage. Society controls the aesthetic objects we can encounter and how we encounter them.
6. All environments have the potential to induce positive aesthetic experiences, whether they do so for human created environments depends on how they are designed.

There is considerable disagreement among aestheticians about what constitutes art. Some modern aestheticians define art as what the art world (people and institutions knowledgeable in art) says it is (Levinson 2003). A more tautological definition is difficult to imagine! Environmental aestheticians reject this notion. They believe art is for everyone, an idea propounded by Dewey in 1934 (Dewey, 2005). However, they acknowledge that experts can help us improve our ability to appreciate artworks.

According to Berleant (1997), artworks can induce positive aesthetic experiences, negative experiences or none at all. A positive aesthetic experience occurs if a creative or heroic mood or catharsis is achieved. The achievement improves the observer's ability to create further aesthetic experiences. A negative aesthetic experience occurs when no mood or catharsis is achieved and the resulting experience reduces the observer's ability to create aesthetic experiences. A neutral experience is one in which no mood or catharsis occurs and there is no impact on the observer's ability to create aesthetic experiences.

It is important to note that a positive aesthetic experience can be achieved through negative emotions. An ugly artwork may produce revulsion. A storm at sea may produce fear. But when the revulsion and fear lead to a creative or heroic mood they have generated a positive aesthetic experience.

Negative environmental experiences are of particular concern to Berleant, as they are for me. He says (Ibid, p. 63): "More striking, however, are those cases of environmental experience that have little or nothing to redeem them. These are, unfortunately, not difficult to find, from land surfaces gutted by strip mining to continuous blocks of plain, uniform high-rise apartment buildings. We make judgements of aesthetic disvalue just as we do of positive value." Some examples of negative environmental aesthetics are artworks that are offensive, trivial, deceptive, aesthetically harmful, and negative sublime (large scale systems that are degrading, such as mass culture and weapons of mass destruction). Aesthetic harm "coarsens perceptual consciousness, constricts the development of sensory awareness and the pulsating vitality of the body, and promotes sensory depravity" (Ibid, p. 75). It includes all forms of pollution.

Heyd (2007) focuses on natural environments and approaches the field from an anthropological point of view, by studying how people relate to nature. One of the most difficult aspects of any aesthetic experience is staying focused on the aesthetic object/motion; Heyd calls this aesthetic endurance. One practical way to improve endurance in natural environments is by learning stories about them. The stories guide and mediate the appreciation of nature. Stories can be verbal artistic (e.g. poetry), verbal non-artistic (e.g., Australian aboriginal dream time stories) and non-verbal (rock art, tombs, engravings, paintings, sculptures). The purpose of the stories is to help the observer view the aesthetic object in different ways.

A practical way to appreciate Nature is by wandering (Ibid). Wandering is human powered activity - walking, hiking, climbing, cycling, canoeing, snorkelling, diving, etc. – undertaken for its own sake. The aesthetic pleasure comes from the activity itself (bodily motion in space), the ordering of

objects and spaces along the journey, and the unmediated appreciation of the environment using all the senses, intensifying the aesthetic experience. Wandering is also a practical way to appreciate human created environments.

4. Art for everyone: a synthesis

Art for Everyone is a synthesis of the experimentalists' concept of the Ideal of Beauty and environmental aesthetics; the key features of which have been discussed in the preceding sections. Here I will focus on aspects that are important for taking action to promote beauty in our societies through universities.

1. Art for Everyone is philosophy of life. It cannot be implemented by fiat. People need to be encouraged to adopt the approach. This can be achieved through leadership and culture management. By culture management I mean the creation and maintenance of culture through rituals, stories, policies, and social groups (this list is not exhaustive).
2. Art should be democratic. The ultimate source of judgement for artworks in our societies is everyone, not a self-appointed group of experts. Universities can promote this viewpoint by creating societal designs that allow all members of their communities to participate in the management of their cultural heritage. Universities have an opportunity to take the lead here. If they take no action then cultural change will occur anyway as happened recently in the UK and Australia. Protesters have been successful in removing public statues of eminent people who they consider to be immoral.
3. The ability to have an aesthetic experience is an innate human trait. But like any skill it needs to be practiced and used regularly otherwise the skill level and motivation to use the skill decreases. The experience is a "whole body experience" employing all the senses. One effective way to achieve this is to build "wandering" into courses or providing "wandering" events as extra curricula activities. Universities should do all they can to improve the aesthetic skill of their stakeholders.
4. Universities should focus on experiential learning methodologies such as problem-based learning, project-based learning, service learning and situated learning. The methodologies provide "whole body" experiences within which aesthetic aspects can be included.
5. Universities are intellectual hubs for their local communities, they should embrace this notion and be open. By this I mean they should go out into their local communities and bring the communities in. They should use this openness to promote beauty in their communities. Experiential learning methodologies are practical ways to achieve this.

The Art for Everyone philosophy was implemented through my leadership skills. I actively promoted the concept of an open university and experiential learning at Raffles University, they go hand in hand. Academic staff in the Faculty of Art and Design were encouraged to look for ways to create artworks in their local communities. This is beneficial in two ways. First the communities benefit by getting beautiful artworks. Second, students benefit because they are carrying out practical projects valued by the community and learning how to manage the design/artistic process. Some examples are:

- (a) A design competition for an artwork for a business office. The owner offered prize money for the winning student.
- (b) Fashion design students designed costumes for the presenters and participants for a TV show. The wife of the owner of the show saw the costumes and was so impressed she asked a student to design one for her, which she wore to the show.
- (c) Students on an art course painted murals in a condominium and created 3D artwork in a shopping centre.
- (d) An art and design event was held in a shopping centre. It included a fashion show, drawing competition, student exhibits, and T-shirt painting for children (which they loved, it was the busiest section of the event).
- (e) Lecturers in art and design take their students on "wandering" tours to develop their aesthetic appreciation and reinforce art and design principles.
- (f) Service learning was used to develop a game for children at a daycare centre. Service learning can be used in many different ways to create positively affective artworks in the community.

Our greatest success was to be selected by Japan's Science and Technology Agency for the prestigious SAKURA Exchange program in Science. We were the first private university in Malaysia to win this award (Raffles University was only five years old at the time). Ten students and two academic staff were fully sponsored to travel to Japan on a ten day visit to conduct research. The programme was in collaboration with the Nagoya Institute of Technology, a premier engineering university in Japan.

The SAKURA programme is restricted to research in Science and Technology. Our achievement is impressive because the students were from Interior Design and Psychology. We were able to convince the SAKURA panel that designers and psychologists play a key role in translating scientific inventions into successful innovations. Staff from the Nagoya Institute of Technology were very impressed with our students' design, research and communication skills and said they gained new knowledge on how aesthetics and behavioural psychology could improve engineering design.

5. Conclusion

The paper has presented a philosophy for promoting beauty in our societies through universities. It is a synthesis of the experimentalist concept of the Ideal of Beauty and environmental aesthetics. The author implemented the approach in the Faculty of Art and Design in a private university in Malaysia. The implementation was executed through leadership and culture management. Some examples of student works were presented to show what can be achieved in practice.

Like religions, the philosophy is based on the "ought". A university "ought" to apply this philosophy because it is a good thing to do. Naturally, a university can choose to do so or not.

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ARTIFICIAL INTELLIGENCE (AI) ENHANCED NEXUS LEARNING APPROACH AS AN EXAMPLE OF STUDENT-CENTERED LEARNING

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Abstract

This paper reports on student-centered learning, dubbed Nexus Learning. It covers pedagogy related to academia-industry collaborations in the development of product opportunities while utilizing Artificial Intelligence (AI) capabilities. It focuses on putting students in an industry project situation where their combined contribution is required to achieve the final goal. Thus, it aims to develop clear sense of the requirements of a graduate for the future workplace. This teaching approach requires students to construct knowledge by engaging collaboratively with industry partners, and has proved more effective than traditional didactic approaches in developing innovative thinking, knowledge creation capacity, and professional skills. It meets the emerging needs of industry to develop managers, designers, and engineers into more accomplished practitioners in the global economy. With Nexus Learning, students learn by designing and constructing actual solutions to real-life problems. In this paper optimization of the food system distribution in Pottstown, Commonwealth of Pennsylvania in the United States, is considered. It has been noted in literature that effective project learning has five key characteristics: Project outcomes are tied to curriculum and learning goals; Driving questions and problems lead students to the central concepts or principles of the topic or subject area; Learners' investigations and research involve enquiry and knowledge building; Learners are responsible for designing and managing much of their learning; and Projects are based on authentic real-world problems proposed by industry partners that students care about. Industry sponsored projects are ideal instructional approaches for meeting the objectives of Nexus Learning, because they employ the 4Cs Principle – critical thinking, communication, collaboration and creativity with learning structured in real world contexts. Researching across subject boundaries, managing different parts of the projects, critiquing each other's work, and creating a professional, quality product opportunities, helps develop real-world problem-solving skills. In addition, motivating learners to utilize the power of Artificial Intelligence, manage their own time and efforts, and present and defend their work, equips them with valuable skills for their workplace.

Keywords: *Higher education, artificial nexus learning, student-centered learning, industry sponsored student projects.*

1. Changes in educational theory and learning

Historically, Thomas Jefferson University (TJU) was an academic medical center with a campus in the center of Philadelphia that has a long history rooted in the graduate health sciences. Philadelphia University was on the city's outer edge has a long history rooted undergraduate education, particularly design, engineering, and business. In 2017 these two universities merged and are now known as Thomas Jefferson University. The East Falls campus, formerly Philadelphia University, has a long history of applied research and had experienced success with a signature pedagogy known as Nexus Learning. Nexus Learning actively engages all learners in a collaborative approach to solving real-world problems and uses a humanistic approach to designing effective solutions (Frisby and Sztandera, 2020).

Educational theories of learning have changed as well. Professors encourage group learning activities following constructivist models. Students work in teams to solve real world problems. Thomas Jefferson University has captured these components and integrated them into Nexus Learning "with a little help of your friend" Artificial Intelligence.

2. Nexus learning

Active and engaged learning, along with collaborative inquiry, with the use of real-world problems and experiences, supported by the strong integration of the liberal arts and sciences with professional disciplines, has defined Nexus Learning. As reported before by Mathews and Soistmann (2016) as well as Frisby and Sztandera (2020), campus learning spaces, including libraries and team meeting places, had to be re-designed to represent innovative rethinking of the classroom space that allowed the learning facilitator to be less encumbered by the physical constraints of space, furniture and technology. Those spaces ultimately enhanced student learning and creative teaching. For example, Nexus Learning classrooms allowed for seamless transitions to different modes of active and engaged learning. The knowledge hubs also optimized collaborative involvement for all students through movable furniture and appropriate technologies that fosters co-creation and sharing of ideas. Our students self-reported significant gains in class participation, ability to focus, Professor feedback opportunities, learning through multiple means, physical movement, stimulation, and comfort level in Nexus Learning classrooms compared to traditional classrooms on campus.

3. Artificial intelligence focus

Following the success of the Nexus Learning classroom we believed it was time to reinforce the use of Artificial Intelligence software across the undergraduate and graduate curricula. We have utilized IBM® Business Analytics Enterprise software that provides a single entry no-code content hub to discover, personalize and recommend business analytics content. It is an analytics platform that combines predictive analytics, reporting, data analytics and data integration capabilities natively out-of-the-box to help students navigate real data industry challenges.

In addition, AI Trilogy package has been utilized to provide students with actionable recommendations based on the data. It provides an analysis of independent variables (inputs) to help determine which ones are most important in the models. In our case, in research supported by Smart and Health Cities grant, the power of Artificial Intelligence approaches as related to increasing the capacity of the Pottstown Area Food System, has been utilized to increase connections between producers and markets by completing a food supply chain analysis. This analysis will identify changes needed to the Pottstown Food system to increase affordable, healthy food access for those living in the 6 census tracts. It will also help to corroborate the food chain supply analysis model by utilizing a research protocol developed in the Jeff Smart Seed grant. In terms of Artificial Intelligence, development of models to discover and prioritize data patterns to provide information and actionable knowledge stakeholders as well as public health policy decision makers will be explored. Artificial Intelligence is used: 1. To explore data to find new patterns and relationships (data mining); 2. To evaluate and test previous decisions (randomized controlled experiments, multivariate testing); 3. To explain why a certain outcome happened (statistical analysis, descriptive analysis); and 4. To venture into the future (forecast) results (predictive modeling, predictive analytics). All four research avenues capture very well the significance and impact of Artificial Intelligence to discover hidden and actionable outcomes. These packages listed below are part of the AI Trilogy business and scientific artificial intelligence software.

3.1. NeuroShell Predictor

The NeuroShell Predictor contains state-of-the-art algorithms that train extremely fast, enabling you to effectively solve prediction, forecasting, and estimation problems in a minimum amount of time without going through the tedious process of tweaking neural network parameters. Designed to be extremely easy to use, this product contains our most powerful neural networks, it reads and writes text files for compatibility with many other programs. The prediction algorithms are the crowning achievement of several years of research. Gone are the days of dozens of parameters that must be artistically set to create a good model without over-fitting. Gone are the days of hiring a neural network expert or a statistician to build your predictive models.

The two training models available to the students are:

1. The first training method, which is called the “neural method” is based on an algorithm called TurboProp2, a variant of the famous Cascade Correlation algorithm invented at Carnegie Mellon University by Fahlman and Lebiere (1990), TurboProp2 dynamically grows hidden neurons and trains very fast. TurboProp2 models are built (trained) in a matter of seconds compared to hours for older Neural Networks.
2. The second method, the “genetic training method”, is a genetic algorithm variation of the General regression neural network (GRNN) invented by Specht (1991). It trains everything in an out-of-sample mode; it is essentially doing a "one-hold-out" technique, also called "jackknife" or

"cross validation". If you train using this method, you are essentially looking at the training set out-of-sample. This method is therefore extremely effective when you do not have many patterns on which to train. The genetic training method takes longer to train as more patterns are added to the training set.

Both training methods provide an analysis of independent variables (inputs) to help users determine which ones are most important in their model.

3.2. NeuroShell Classifier

The NeuroShell Classifier was crafted from the beginning to help optimization of classification and decision-making problems. NeuroShell Classifier can detect categories in new data based upon the categories it learned from case histories. Outputs are categories such as {cancer, benign}, {buy, sell, hold}, {acidic, neutral, alkaline}, {highly qualified, qualified, unqualified}, {winner, loser}, {product 1, product 2, ..., product N}, {decision 1, decision2, ..., decision N}. Like the NeuroShell Predictor, it has the latest proprietary neural and genetic classifiers with no parameters to set. It reads and writes text files.

The classification algorithms are the crowning achievement of several years of research of software development. Gone are the days of dozens of parameters that must be artistically set to create a good model without over-fitting. Gone are the days of hiring a neural net expert or a statistician to build the predictive models.

There are two training models to select from:

1. The first training method, which we call the "neural method" is based on an algorithm called TurboProp2, a variant of the famous Cascade Correlation algorithm invented at Carnegie Mellon University by Scott Fahlman (1989). TurboProp2 dynamically grows hidden neurons and trains very fast. TurboProp2 models are built (trained) in a matter of seconds compared to hours for older neural networks types.
2. The second method, the "genetic training method", is a genetic algorithm variation of the Probabilistic neural Net (PNN) invented by Donald Specht (1991). It trains everything in an out-of-sample mode; it is essentially doing a "one-hold-out" technique, also called "jackknife" or "cross validation". If you train using this method, you are essentially looking at the training set out-of-sample. This method is therefore extremely effective when you do not have many patterns on which to train. The genetic training method takes longer to train as more patterns are added to the training set.

3.3. GeneHunter

The genetic method provides an analysis of independent variables (inputs) to help determine which ones are most important in the selected approach.

GeneHunter is a powerful software solution for optimization problems which utilizes a state-of-the-art genetic algorithm methodology. GeneHunter includes an Excel Add-In which allows the user to run an optimization problem from Microsoft Excel, as well as a Dynamic Link Library of genetic algorithm functions that may be called from programming languages such as Microsoft® Visual Basic or C.

Genetic algorithms (GAs) seek to solve optimization problems using the methods of evolution, specifically survival of the fittest. In a typical optimization problem, there are a number of variables which control the process, and a formula or algorithm which combines the variables to fully model the process. The problem is then to find the values of the variables which optimize the model in some way. If the model is a formula, then we will usually be seeking the maximum or minimum value of the formula. There are many mathematical methods which can optimize problems of this nature (and very quickly) for fairly "well-behaved" problems. These traditional methods tend to break down when the problem is not so "well-behaved."

The algorithms provide analysis of independent variables (inputs) independent variables (inputs) to help determine which ones are most important in the models. The power of Artificial Intelligence approaches as related to increasing the capacity of the Pottstown Area Food System will be utilized to increase connections between producers and markets by completing a food supply chain analysis. This analysis will identify changes needed to the Pottstown Food system to increase affordable, healthy food access for those living in the 6 census tracts. It will also help to corroborate the food chain supply analysis model by utilizing a research protocol developed in the Jeff Smart Seed grant. In terms of Artificial Intelligence, development of models to discover and prioritize data patterns to provide information and actionable knowledge stakeholders as well as public health policy decision makers will be explored. Artificial Intelligence will be used: 1. To explore data to find new patterns and relationships (data mining); 2. To evaluate and test previous decisions (randomized controlled experiments, multivariate testing); 3. To explain why a certain outcome happened (statistical analysis, descriptive analysis); and 4. To venture

into the future (forecast) results (predictive modeling, predictive analytics). All four research avenues capture very well the significance and impact of Artificial Intelligence to discover hidden and actionable outcomes.

While the Smart and Healthy Cities Institute at Thomas Jefferson University (TJU) provides the funding for the undertaking, the Pottstown Area Health & Wellness Foundation (PAHWF) is the primary testbed for the project. Based on previous project research outcomes (DiSantis et.al 2011), TJU contributes two co-investigators to collaborate with stakeholders to conduct community engagement and complete assessments focused on: 1) Neighborhood food environment and the influence of neighborhood food access on chronic disease risk and overall health, and 2) Food supply chain; and develop recommendations for food system adjustments. The partners will integrate qualitative and quantitative data gathered through PAHWF's 2018 Tri-County Area Community Health Needs Assessment and 2022 Pottstown Community Health Needs Assessment, PAFC's food system stakeholder interviews and 2022 community engagement plan, and other relevant works to inform assessments, community engagement strategies, and strategic plan drafting. Partners will identify knowledge gaps and develop approaches to improve local food systems production, processing, distribution, and consumption.

Thomas Jefferson University students are moving beyond the current commercial and financial understanding of innovation as they go through an educational experience that requires break through ideas, approaching industry challenges with an experimental mind frame, as well as compelling insights and a focus on the human element with data written all over it (Sztandera, 2023). We have been teaching Integrative Interdisciplinary Project at the undergraduate level and New Product Development at the graduate level to instill industry interactions and professionalism in students, in that regard.

4. Conclusions

As Universities and Colleges update their classrooms to enable active learning methodologies, adjust their student-centered teaching approaches, Artificial Intelligence aided curricula could provide meaningful support to the teaching and research communities in academia to affordably educate students and prepare them for the jobs of the future. Colleges must also build the technological infrastructure to house and converge the massive volume of academic data. Furthermore, they need to invest in the human capital, educating big data scientists and engineers, and computational intelligence experts to further guide us into the exciting frontiers of business, science, and population health.

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TOWARDS INTERCULTURAL COMMUNICATIVE COMPETENCE: ZOOM EXCHANGE BETWEEN U.S. AND FRENCH UNIVERSITY STUDENTS

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Abstract

In the absence of an authentic immersive setting for language learning and exposure to the host cultures, virtual interactive exchanges have been demonstrated to be appropriate substitutes for such skill development (Conboy, Ugalde & Reuber, 2017). Learners of French at a U.S. university conducted virtual dual-immersion (VDI) interactive exchanges, over Zoom, with students of English at a French University. In each session, students spent 15 minutes speaking in French and 15 minutes speaking in English and answered questionnaires prior to and following each of the exchanges. Reported levels of student confidence improved. Self-reports indicate that, in the conversations, students learned new concepts, both linguistic and cultural. We address (a) advantages and disadvantages compared to the use of proprietary interactive exchanges; (b) assess the possibilities and challenges of setting up an independent VDI exchange and; (c) demonstrate that the use of VDI in the foreign language classroom enhances language learning and integrates 21st century skills and the guidelines of the American Council on the Teaching of Foreign Languages (ACTFL).

Keywords: *Intercultural communicative competence, VDI exchanges, French as a second language.*

1. Introduction

O'Rourke and Stickler (2017) defined synchronous computer-mediated communication (SCMC) as “dialogic communication that proceeds under conditions of simultaneous presence (co-presence) in a shared communicative space, which may be physical or virtual” (p. 2). The authors espoused the pedagogical utility of such technology. Such tools can be used to supplement in-class learning through, for example, virtual dual-immersion (VDI) language exchanges with native speakers of the target language. The utility of proprietary software for this effect has been shown to be effective in enhancing learning outside of the classroom, contextualizing and consolidating knowledge from the communicative classroom, and facilitating the building of community relations (Conboy, Ugalde & Reuber, 2017). One popular SCMC application is Zoom, whose use has skyrocketed since the Covid-19 pandemic.

Phillips and Abbott (2011) describe the 21st Century Skills Map, which results from the collaboration between the American Council on the Teaching of Foreign Languages (ACTFL) and the Partnership for 21st Century Skills (P21). The map integrates key skills for 21st century learners and the ACTFL World-Readiness Standards for Learning Languages. It incorporates the ACTFL standards and “the five C’s” (Communication, Cultures, Connections, Communities and Comparisons), as well as the three modes of communication (interpersonal, interpretive, and presentational) recommended by the Council. The pedagogical use of SCMCs can require students to exercise initiative and responsibility, agency and autonomy, become “doers” and “creators” in a personalized and real-world environment, mimicking the immersion experience, as desired for 21st century learners (National Standards Collaborative Board, 2015). Language-learning research demonstrates that different forms of SCMCs can provide multiple opportunities for teachers and students, as they create an interactive and authentic setting for learning (Wu, Marek & Chen, 2013; Terhune, 2016). At this moment in history, many language programs are being cut across the United States (Lusin et al, 2023), and AI may be threatening the future of individual language learning, interpretation and production. The implementation of international collaborations via SCMCs is vital for developing intercultural communicative competence (ICC) and citizenship in our students.

Intercultural communicative competence implies honing a set of knowledge, skills and behaviors that allow an individual to navigate complex intercultural situations and communicate effectively and

appropriately in specific contexts. It comprises, therefore, not just linguistic elements, but also empathy, openness and adaptability, cultural sensitivity, and critical cultural awareness (Byram, 2021). The pedagogical challenge SCMCs present to language students is in line with social constructivist theories of education: Encouraging students slightly beyond their level of comfort, into the zone of proximal development, supports long-term, effective learning (Silver, 2011).

The main objective of the project is to assess the viability of organizing an interactive language exchange with a partner school in France, evaluate its benefits and challenges and judge how it enhances ACTFL standards and learning of ICC. The study followed the previous use of a pedagogy-specific proprietary software in earlier iterations of FREN211. Though effective, high costs made the program unsustainable. Contacts at the University of Strasbourg led to a decision to experiment with a SCMC in fall 2019. This presentation focuses on students' perceived levels of anxiety and confidence prior to beginning the project and after the first conversation. We also look specifically to student-reported learning of linguistic and cultural elements from the conversation partners. Considering Terhune's suggestion (2016), the intervention was structured with specific and scaffolded tasks and goals. We demonstrate how students of foreign languages, through VDI exchanges, were able to learn from each other, linguistically and culturally, but also to cultivate the human experience through connection and cross-cultural relationships.

2. Method

In the fall 2019, 13 students enrolled in FREN211: French Language and Culture II at the College of Saint Benedict and Saint John's University (CSB/SJU, Minnesota, USA), participated in an interactive Zoom language exchange with 21 students of English as a second language, from the University of Strasbourg, France. FREN211 is the third semester in a three-semester language sequence at CSB/SJU and is a part of the general education curriculum for proficiency. The goal is for FREN211 students to reach the Intermediate Low threshold as described by ACTFL. The student population was homogenous in terms of experience with the French language: all were learners of French as a second language, had at least one year of French in high school and were at least in their second semester of college-level French. None had attended an immersion school. Approximately a third of the students had visited a francophone country and approximately a third reported having conducted a conversation in the target language with a native speaker in the past for more than 10 minutes.

Together with weekly TA conversations, the exchanges were worth 10% of the students' final grade. The two instructors organized the pairs and trios of language partners. Students communicated directly with the language partners via email to coordinate the appropriate times to conduct two exchanges over the course of the semester. The language instructors collaborated in the conception of prompts for each of the exchanges. The CSB/SJU students received detailed and methodic prompts which closely followed grammar functions and vocabulary covered in class. Prompts were provided to students two weeks in advance of the scheduled online conversations to allow them time to prepare and to meet with a TA, if needed. Prior to the first exchange, students were introduced to Zoom and worked with the institution's Instructional Technology staff to learn how to set up a meeting, record it and share the recording with the instructors and language partners. Students signed an Institutional Review Board (IRB) consent form prior to the beginning of the study. Students' identities are confidential.

Each conversation was recorded and conducted in two stages: 15-20min in English, and 15-20min in French. Students were informed that it was meant to be a linguistic and cultural exchange, via Zoom, and that it would be a part of their summative oral comprehension evaluation. Students were asked to prepare questions in advance, addressing each of the points in the prompt provided. They were encouraged to seek additional help from the TA and prepare extra questions, in case of time left at the end of the exchange, but these two items remained optional. Students from CSB/SJU were also encouraged to conduct their conversations on their own, though a few opted to have a classmate from FREN211 present for the conversation with their French interlocutor(s). At the end of each exchange, students sent the audio/video file to the instructors for assessment and spot checking.

Students responded to three questionnaires pertaining to the language exchange experience: one pre-exchange, and one after each of the two conversations. Questionnaires were composed of questions using a six-point summative scale as well as open-ended questions about students' expectations and constructive feedback. While the pre-exchange questionnaire included questions about the students' background and experience with French language and cultures, the subsequent questionnaires included questions about students' perceptions following each of the conversations.

3. Results

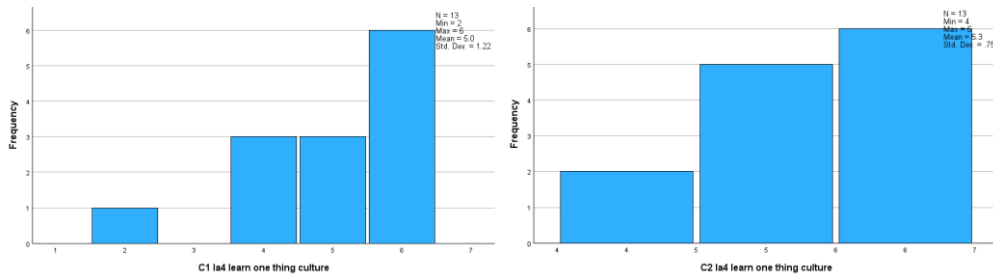
Figure 1 shows the means (with 95% confidence intervals) of students' perceived confidence and anxiety levels before and after the first conversation. Both demonstrate an improving trend that approaches significance: Confidence increases (one-tailed, paired $t(12) = 1.62, p = .07$) and Anxiety declines ($t(12) = -1.17, p = .13$). Observed effect size, with Hedge's correction, was $d = 1.28$ for Confidence; for Anxiety, $d = 1.01$.

Figures 1a and 1b. Students' perceived confidence and anxiety levels (means) before and after the first conversation.

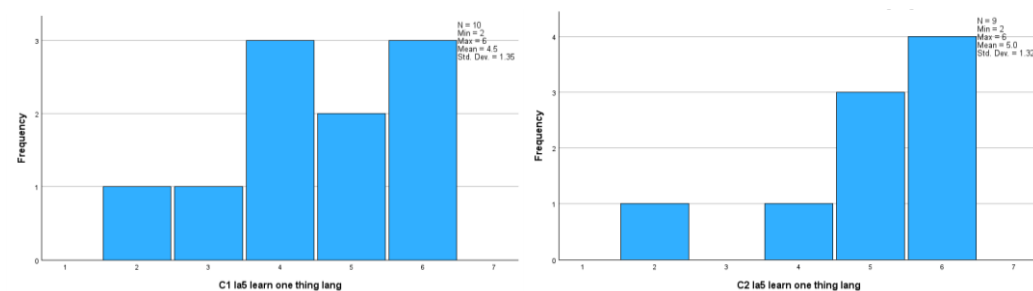


Figures 2 and 3 present the distribution of responses to the question whether students perceived that they had learned cultural and linguistic elements through the conversation. After the first conversation, 9 students (69.2%) agreed or strongly agreed with the affirmation “I learned at least one thing about another culture and its heritage,” whereas 11 students (84.6%) agreed or strongly agreed with that affirmation after the second conversation (Figure 2). With regard to new linguistic elements, after the first conversation, 5* (50%) agreed or strongly agreed they “learned at least one thing about French language,” while 7 (77.8%) reported similarly after the second conversation (Figure 3).

Figures 2a and 2b. Frequencies of student responses to the item “I learned at least one thing about another culture and its heritage” after the first (C1) and the second (C2) conversations.



Figures 3a and 3b. Frequencies of student responses to the item “I learned at least one thing about French language” after the first (C1) and the second (C2) conversations.



Students' narratives described the project in a generally positive light. When asked what their expectations were for the upcoming conversations, one student summed up the objectives of the research project: “I expect to grow in my oral skills as well as my confidence in my oral skills [...] learn new terms that I wouldn't have the chance to learn in class.” Another student touched on the goals of ICC, when mentioning the desire to “come away with a better understanding of how people live in the francophone world and how it differs from the ways that I live,” while another alluded to “how it will differ from any stereotypes or expectations I may hold.”

* Due to a questionnaire error, only 10 students reported this item after the first conversation, and 9 reported after the second conversation.

After the first conversation, these sentiments continued with comments such as, “Overall the conversation was a very cool experience and I thoroughly enjoyed it. Talking with my partner in French helped me to *solidify some of my speaking skills* and *affirm my confidence in my speaking skills*” (author’s emphasis), and “It’s great to compare your cultural similarities and differences with someone around the world.” This last student even noted “talking for about 50 minutes,” instead of the 30-40 minutes required. Another student explained, “I had a lot of fun doing it [...] I am very excited for the next conversation,” while another noted that “overall it went a lot better than expected.” After the second conversation, one student reported learning “new cultural aspects along with understood most of what they said,” and another expressed how it was “super fun and I really enjoyed it.” Students also reported being pushed beyond their comfort zone: “The conversation allowed me to challenge myself with oral comprehension;” “It was very beneficial because it pushed me to actually put my knowledge to the test.” As a result, students reported they felt “like [they] improved [their] French from the conversations.” After the completion of the experience, a student recommended the project for the class, even though it was “nerve wracking.”

The theme of connection with others was present in several of the students’ responses. At the end of the exchange, one student noted, “I created a connection with my partner in which we rely on each other with English/French, hope to continue.” Another wrote, “I thoroughly enjoyed it and I know [I] have a friend who I can converse with in French. We plan to stay in touch. It was a great way to make connections. Felt like more than just an assignment.” Moreover, students elaborated on their sense of gratitude for the project by saying, “now that it’s done I see what a cool opportunity it was along with how much I learned,” and “it was a very unique and cool opportunity that other students aren’t lucky enough to have.”

Complaints reported centered mostly around logistical and technical difficulties. Students reported feeling nervous, but “in the end, felt comfortable with [the] partner.” Another student noted, “the more we talked, the easier the conversation was.” Finally, there were some students who expressed confusion during the conversation since the expectations for the students at CSB/SJU and those at the University of Strasbourg appeared to be different.

4. Discussion

Fewer students reported meeting with the TA ahead of the second conversation than they did for the first conversation. This may be due to busier schedules in the later part of the semester, but it also may imply that students felt more confident going into the second conversation than they did at the beginning of the exchange. This hypothesis can be corroborated by the average perceived confidence level in students after the first exchange (3.46 in the 6-point scale) in comparison to the average perceived confidence level in students prior to the first exchange, when asked if they believed they were capable of leading a 30min conversation with a native interlocutor (2.92); while not statistically significant, it does show an improving trend with student perceived confidence. The observed effect size of about one standard deviation is certainly educationally significant, if replicable. Moreover, it is notable that, even if the majority of students chose to bring notes to the exchange, they reported not reading them directly during the conversation, and rather allowing for the conversation to flow more naturally.

Unlike an exchange whereby students are logging into a proprietary software tool to communicate with interlocutors in the target language, this VDI exchange was mutually beneficial for the two groups of students. Each group had the agency and opportunity to share and teach in their native language. Each group also had the benefit of learning from the other group when communicating in the target language. As one student notes in the final questionnaire, “I was nervous about the idea of talking to a native French speaker, but overall, the conversation was great. It helped that my partners were fun.” Student responses in the open-ended sections of the questionnaires suggest that the project is in line with (a) social constructivist theories of education and the creation of a zone of proximal development and; (b) the tenets of ICC, as concerns the learning of cultural elements, the development of linguistic skills, and the openness and connection towards Other. Anecdotally, one of the students reported continuing the exchange beyond the semester of 211 and was still communicating with the partner in Strasbourg nine months later. Another student visited the respective partner when studying abroad in France, in fall 2021.

The independent organization of a VDI exchange has, of course, challenges. There were two main challenges observed in this project: first, for the students, the coordination of schedules with a 7-hour time difference is not simple; second, for the instructors, the preparation and coordination of the exchanges is time-consuming and can be challenging amid all other responsibilities, and in the context of courses that have a set content that needs to be covered during the semester. While the plan had been to continue a similar exchange in future semesters, institutional restrictions on class offerings, limited numbers of students enrolled in classes at the University of Strasbourg, and the impact of the Covid-19 pandemic precluded its maintenance, at least for the time being. Anecdotally, some of the students who

had taken FREN211 in fall 2019 acknowledged that the experience with Zoom that semester had set them up for success when courses transitioned to Zoom in spring 2020.

5. Recommendations and conclusion

In order to confirm the hypothesis that fewer students chose to meet with the TA prior to the second conversation because of confidence levels, it would be important to include a question in the questionnaires to assess their rational. In terms of technical aspects, since it was the first time everyone was using Zoom, there were the expected “glitches” with recording and audio concerns in the first conversation. These were resolved for the second one. Even though students were guided step-by-step in setting up the Zoom meeting before the project, it is recommended that a trial run of the software be conducted, so students have hands-on experience and can prevent or resolve any problems that may arise.

If a similar study is conducted in the future, it is important that the instructors maintain constant and clear communication with each other throughout the project, to ensure that the students in both groups have similar expectations and similar prompts. Two students indicated that it may be worth increasing the percentage the project counts for in the final grade. While the original thinking centered around limiting student anxiety related to the weight of the assignment, these students reported believing that awarding it a larger percentage of the final grade would increase their motivation. Moreover, even if some students reported the exchange might be better suited to students in higher level French classes, students also reported being challenged and learning from the exchanges (“It definitely made me nervous but I am glad we did it”). We conclude that it is possible and, in fact desirable, to conduct language exchanges at the third semester of college French, provided there is appropriate scaffolding, preparation for the assignment and detailed prompts that guide the students. It may be beneficial to: (a) carve out more time in class with students collaborating on preparation for the language exchanges; (b) explore the option of three language exchanges, since one student suggests, “Maybe more conversations so that we get to know our partners a little bit better.” Students clearly appreciate the opportunity to exchange with, and learn from, peers from other parts of the world. Therefore, even though it requires effort, extra time, and organization on the part of the instructors to plan and implement a VDI exchange, it is an effective way for students of language to develop greater intercultural communicative competence.

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EXPLORING FLIPPED CLASSROOM AND CONTINUOUS ASSESSMENT – A CASE STUDY INVOLVING GENERATION Z UNDERGRADUATE TOURISM STUDENTS

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Abstract

The flipped classroom is an active, student-centred teaching-learning methodology. It aims to increase the quality of time spent in the classroom. This approach quickly spread throughout the world and has attracted the attention of teachers and researchers from different areas. As Mathematics teachers, the authors are faced with students' lack of interest and consequent failure in the subjects in this area. In an attempt to increase students' interest and commitment, one of the authors decided to use the flipped classroom model in one of her courses. In an effort to further strengthen student commitment, a continuous class assessment methodology was also used. Students were aware that any and all activities carried out in the classroom could be considered for evaluation. To understand how these changes were perceived by the students, a quantitative survey was conducted. The participants in the study are undergraduate students from a Portuguese higher education institution enrolled in the course of Applied Statistics, from the 2nd year, 1st semester of Marketing for Tourism degree. The didactic approach adopted by the teacher and the activities developed made the learning process more interesting and promoted a more positive attitude towards Statistics.

Keywords: *Flipped classroom, pedagogical innovation, math education, continuous assessment, higher education, Generation Z.*

1. Introduction

Mathematics, considered a foundation subject in most higher education degrees, has been a cause for concern for many authors and researchers due to the enormous academic and educational failure to which it has been subjected. (Pais, Cabrita & Anjo, 2011; Faulkner et al., 2014; Pais & Hall, 2021; Santos et al., 2021; Maharjan, Dahal & Pant, 2022). The lack of interest and motivation that students feel towards the subject is one of the problems identified in the failure of the teaching-learning process of Mathematics. It is fundamental to reverse the existing and widespread feeling towards Mathematics, it is necessary to motivate, encourage taste and interest, thus promoting the success of students in mathematics subjects (JMC, 2011).

Changes are needed in the teaching-learning process, starting with the role of the teacher and the student. The process should be centred on the student's learning, respecting the pace, and learning style of each one (Felder & Brent, 2005). The biggest challenge that teachers face today is being able to motivate and involve students in the classroom, so that they have an active role in their learning process (Felder & Brent, 2005). If students enjoy Mathematics, they are much more likely to remember what they have learned. If students are motivated to learn about a subject, they are much more likely to develop a long-term understanding of that subject (Lester, 2013). A powerful ally in this demand is the use of technologies (Skuzza, 2020; Billet et al., 2022). Technologies are part of the daily lives of young people, especially those born in the late twentieth and early twenty-first centuries, the so-called "generation Z".

There are different teaching strategies such as group work, problem-based learning, classroom discussions or project-based learning, which allow the creation of active learning environments that

encourage student engagement, stimulating them to take an active role in their learning process (Dunlosky et al., 2013; Konopka et al., 2015; Caena & Redecker, 2019). The variety of teaching strategies that encompass active methodologies invest in the construction of knowledge, requiring the movement of search, criticism, study, production, autonomy and sharing among peers (Fonseca & Neto, 2017). One of the strategies that has been used with good results is the flipped classroom (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016; Galindo-Dominguez, 2021). The use of the flipped classroom encourages student engagement in the learning process (Ryan, 2020), promoting understanding of the topics covered and the development of lifelong skills such as critical thinking, problem solving, creativity, initiative, autonomy, teamwork, communication and leadership (Caena & Redecker, 2019; Ryan, 2020), considered, according to the World Economic Forum (2020), some of the essential skills for 2025.

Transversal to any strategy adopted, technologies assume a prominent role when it comes to capturing the attention of students and increasing their motivation (Skuzza, 2020; Billet et al., 2022), as the childhood of today's young people, generation Z, was marked by the massive use of mobile phones; by the proliferation of digital content (including video); by the emergence of social networks, blogs, chat rooms and wikis; etc.

Aware of all the above, and in an attempt to increase the commitment and engagement of her students, the first author of this work decided to reformulate the way she taught her classes, adopting the flipped classroom methodology. At the same time, and trying to strengthen the students' commitment, a continuous class assessment methodology was also used. Students were aware that any and all activities carried out in the classroom could be considered for evaluation.

The flipped classroom is a very popular pedagogical approach, in which the activities traditionally carried out in the classroom (for example, presentation of theoretical content) become homework, and the activities that normally constitute homework become classroom activities (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016). This methodology is structured around the idea that lectures are not the best use of class time. Instead, the teacher provides information and makes theoretical content available before class, promoting the pre-study of theory and freeing up class time for practice.

The study here presented involved the students of Applied Statistics (1st semester of 2023/2024), a second-year course in the Marketing for Tourism bachelor's degree, offered by a higher education institution specializing in undergraduate degrees in Tourism.

2. Methodology

This study aimed to understand whether the changes introduced in Applied Statistics, adopting the flipped classroom methodology in parallel with a continuous assessment methodology, contributed to increasing the motivation and involvement of the students, namely in the Tourism area, in the learning of mathematics, in general, and, in particular, of Statistics.

Taking that into consideration, the authors developed a questionnaire for the students who attended the course under evaluation. At the end of the semester, students were asked to fill in the questionnaire. The questionnaire was distributed online to the students who attended the classes and aimed to assess the students' opinion on the changes made to the way the course was taught. After data collection, qualitative analyses were carried out, quantified whenever necessary and possible. Statistical analyses were performed with Excel.

2.1. Description of the study

In the first class of the semester, students were informed of the methodology adopted, so that they could understand their role. In an attempt to motivate them to carry out the prior autonomous study, it was stipulated that any and all activities carried out by the students, in the classroom or as homework, could count for the evaluation, with a weight of 20% in the final grade. They were also informed that they would not be previously informed of which activities would be evaluated.

Considering that there are different learning styles and different abilities, the teacher tried to diversify the tasks and resources made available. In addition to scripts with detailed explanations of the theoretical contents, detailed resolutions of exercises, tasks of a diverse nature, worksheets and tutorials, explanatory videos about the various programmatic contents were also made available. Some videos were searched on websites that offer educational resources, such as Khan Academy and YouTube, but the vast majority had been designed by the teacher during the emergency remote teaching due to Covid 19.

Students had to autonomously study, in advance, the theoretical component, either by watching the videos or by studying the scripts with the detailed explanation of the theoretical contents, of the topic that was being addressed at each moment. This study could be individual or in a group, at the discretion of each student. The aim was that when they had class they would already recognize and understand the

study topics to a minimum, freeing up class time for more practical and interactive activities, thus allowing students to take a more active and participatory role.

In the classroom context: in the first part of the class, a summary of the theoretical contents was made and there was some space dedicated to clarifying doubts; followed by the resolution of exercises/tasks in which they had to apply the theoretical knowledge studied at home. Some of these tasks were carried out individually, others in small groups. The teacher’s role was to dynamize the tasks carried out in class, to guide, to clarify doubts and to give feedback on the students’ performance in the tasks developed. At the end of each class, the teacher would summarize the work done so far and give instructions on what content and materials the students should study autonomously before the next class.

2.2. Respondents

Out of the 59 students enrolled in the course, 23 attended the classes regularly. This significant difference between the number of registered students and the number of students who attended the classes is mainly due to the high number of students who were repeating the course and who, because they were enrolled in another curricular year, did not have a compatible schedule to attend the classes of this course. Of the 23 students who attended the classes, 20 responded to the questionnaire. The respondents were between 19 and 24 years old, with only one student above 21; 80% were female and 20% were male; all were attending the course for the first time and were full-time students. All the students who answered the questionnaire passed the course: 80% passed by continuous assessment and the remaining 20% by exam.

This was a convenience sample, as participants were easily accessible to researchers.

3. Results and discussion

The teacher of the course involved in this study (also one of the authors of this article) considers that the flipped classroom approach was not fully achieved because many students did not attend classes regularly and consequently did not study the materials beforehand. However, a significant number of students embraced this approach (23 out of 59).

In the questionnaire, students were asked to rate their agreement on a five-point Likert scale with various statements about the use of the flipped classroom methodology. Table 1 shows the results.

Table 1. Heatmap with frequencies of responses to questions about the flipped classroom; mean and standard deviation. (Likert scale: 1 - strong disagreement; 5 - strong agreement).

The use of the flipped classroom methodology contributed to:	1	2	3	4	5	mean	std deviation
make learning more interactive	0	0	4	8	8	4.20	0.59
make the classes more stimulating	0	0	4	11	5	4.05	0.47
involve the students in the learning process	0	0	6	8	6	4.00	0.63
a more positive view of Maths/Statistics	0	2	4	8	6	3.90	0.94
better understand the importance of Statistics	0	0	6	6	8	4.10	0.73

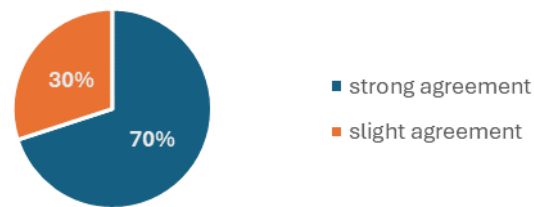
An analysis of the responses obtained (Table 1) shows that the results are quite good: students have a positive opinion about all the statements except for the statement “The use of the flipped classroom methodology contributed to a more positive view of Mathematics/Statistics”, with which 2 students slightly disagree. The statement with the highest mean value is “The use of the flipped classroom methodology helped to make learning more interactive” (mean = 4.20). However, all the other statements have mean values very close to this one.

These results are in line with what the teacher could observe during the semester. Students who attended classes regularly showed commitment to both independent study and the activities carried out in the classroom. Below are some of the students’ comments:

- “It’s a good way to keep up with our studies.”
- “[...] it was great, when it came time to study for the tests, I still knew the material that was given at the beginning of the semester.”
- “I think it’s a good way to involve students and ‘force’ them to study.”

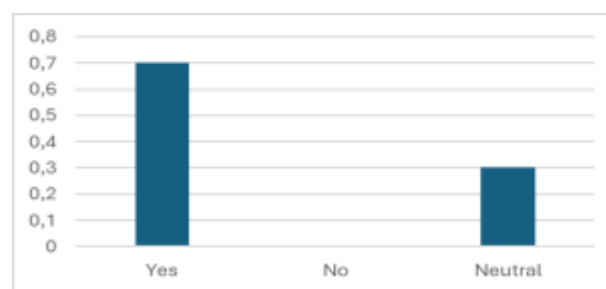
Of the various materials made available by the teacher, the videos were the most enthusiastically received by the students. All the students who answered the questionnaire stated that they considered the use of video to be relevant in the teaching-learning process and all agreed that the videos made available by the teacher facilitated keeping up with the contents (Figure 1). In their comments, they essentially highlighted the great advantage of being able to watch them as many times as they wanted, when and where they wanted, at their own pace.

Figure 1. Pie chart of opinions on whether the videos made available facilitate keeping up with the contents.



Regarding the continuous assessment methodology used in this course, all the students who answered the questionnaire, without exception, evaluated it positively and considered that it contributed to the achievement of better results. When asked if this methodology promotes motivation for keeping involved in the course, 70% gave a positive answer as shown in Figure 2.

Figure 2. Frequency chart of responses to the question: Do you consider that the continuous assessment methodology adopted in this course promotes motivation for keeping involved?



When asked what they would maintain in the planning of the course for the incoming year, the students mentioned the videos and the continuous assessment methodology adopted. Concerning what they would change, they only mentioned dividing the class into smaller groups (shifts).

4. Conclusions

The results of this project show that the adoption of the flipped classroom model together with the continuous assessment methodology adopted had a very positive impact on the students who embraced this model, increasing their involvement and commitment. Other studies show similar results on the adoption of the flipped classroom methodology (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016; Galindo-Dominguez, 2021).

Regarding the limitations of this study, it is important to mention that a convenience sample was used, so the results cannot be generalized. Another limitation was the high number of students enrolled in the course, which makes it quite difficult to adopt this type of methodology. The ideal would be to have classes with a maximum of 25 students. Although many of the students did not attend the classes, there is the question of whether they did not do so precisely because there were no shifts and they considered that almost 60 students in a classroom is not beneficial.

Overall, it is the authors' belief that this study can positively contribute to disseminate new strategies that can impact students' motivation for learning, as well as the possible benefits it can have on the students' learning process.

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ADS AND MONETIZATION DIMINISH WEB EXPERIENCES

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Abstract

The nearly ubiquitous presence of marketing ads on websites has reached a point where it often detracts from the end-users' experience and compromises the intended purpose of the website. Online educational websites are not immune to this practice and often educational research is hindered by distracting marketing advertisements. Marketing ads are more pervasive than ever before and have become the basis for monetization of websites. As users navigate online spaces, they find themselves bombarded with intrusive advertisements that disrupt their ability to complete their original goal. Ads, whether inline with the body of the document or on a sidebar, autoplay videos that the user may not want to see, and excessive banners not only slow down page loading times, but also create an environment where the actual content takes a backseat to marketing content. When viewing some websites on a mobile platform, often an article can have so many advertisements inline with the story that it becomes nearly impossible to finish or even follow the article that was the user's intended purpose for the visit. This saturation of advertising elements can erode the overall appeal of websites, diminishing the quality of user engagement and user experience. From a business standpoint, striking a balance between revenue generation and user-friendly design is crucial for preserving the integrity of online platforms and ensuring a positive browsing experience. However, from an end-user perspective, it appears as though website content creators and companies view the monetization through marketing ads as immensely more important than the content itself. This paper will explore the perceptions and potential impacts of marketing advertisements on educational experiences using the web.

Keywords: *Ads, web-experience, diminished web quality.*

1. Introduction

In the digital age, advertising has become an inseparable element of our online experiences, permeating various facets of the digital landscape. This ubiquity is particularly evident in the realms of phone apps, phone websites, and websites across the internet. This extensive presence of ads is a testament to the evolving nature of advertising, technology, and the economic models that underpin the digital ecosystem.

Ads are disrupting traditional modes of communication and content consumption by infiltrating various aspects of our lives. The pervasive nature of advertising has evolved, driven by technological advancements and changing consumer habits. Online platforms, social media, and websites have become saturated with ads. Many content platforms, especially free ones, rely heavily on ads for revenue. Some ads use intrusive techniques, such as pop-ups, auto-play videos, or full-screen takeovers, disrupting the seamless flow of content consumption. These tactics can be annoying and lead to users having a negative experience. While personalized ads aim to provide relevant content, the extensive collection of user data raises privacy concerns. The disruption caused by ads prompts ongoing discussions about ethical advertising practices, user consent, and the detrimental effect it has on user experience.

2. Social media and advertising

The rise of digital platforms and social media has significantly contributed to the prevalence of ads. Platforms like Facebook, TikTok, Instagram, X (formerly Twitter), and others are ad-supported, and they leverage user data to target ads more effectively (Chu, Deng, & Mundel, 2024). Many content platforms, especially free ones, rely heavily on ads for revenue. While this model allows users access to content without direct payment, it also means that users are frequently interrupted by ads during their

viewing or reading experience. Additionally, the use of surveillance technologies to track user behavior for ad targeting disrupts the balance between personalized advertising and individual privacy.

Advances in data analytics and machine learning enable advertisers to target specific demographics, interests, and behaviors. This personalized approach increases the effectiveness of advertising, making it more likely that users will engage with the content (Wiese, Martinez-Climent, & Botella-Carrubi, 2020). Search engines, particularly Google, are a primary avenue for advertising. Ads appear prominently in search results, and search engine advertising allows businesses to reach users actively looking for relevant products or services. The targeted nature of digital advertising, driven by data analytics, ensures that ads are tailored to individual preferences, but this constant bombardment can disrupt the online user experience (Kerr & Richards, 2021).

3. Mobile devices and apps

The widespread adoption of smartphones has permanently changed the way people search for and consume content, connect with others, and access information. As more and more internet users accessing the web through mobile devices, advertisers have shifted their focus towards mobile advertising to reach a broader audience. Phone apps and websites have become prime real estate for advertisers to engage with users through various formats such as display ads, video ads, and interactive content.

Advertising has become incredibly pervasive. Mobile apps, games, and websites, ranging from social media platforms to news aggregators and gaming applications often incorporate ads and serve as effective conduits for targeted advertising as the constant connectivity of mobile devices provides advertisers with more opportunities to reach consumers. Advertisers leverage user data, app preferences, and behavior patterns to deliver personalized and relevant ads. With the rise of online content consumption, websites and content creators, especially free ones, often rely on advertising as a primary source of revenue. This includes banner ads, interstitial ads, and rewarded ads, creating additional touchpoints for advertisers. These in-app advertisements seamlessly blend with the overall user experience, providing brands with a direct channel to engage users during various activities (Chu, Deng, & Mundel, 2024). This is seen in display ads on websites, sponsored content, and pre-roll ads on videos. Automated, data-driven advertising (programmatic advertising) allows for real-time buying and placement of ads. This efficiency has contributed to the widespread distribution of ads across various digital channels.

In parallel, the optimization of websites for mobile devices has become imperative. Responsive web design is a method of adapting websites to different screen sizes, facilitating a seamless transition between desktop and mobile browsing. Mobile websites, too, have become fertile ground for ads, with banner ads, pop-ups, and sponsored content strategically placed to capture user attention (Wiese, Martinez-Climent, & Botella-Carrubi, 2020). In fact, many mobile websites have become cumbersome to nearly impossible to read content between the plethora of advertisements that popup during scrolling.

Beyond the confines of mobile apps and dedicated mobile websites, ads have infiltrated virtually all websites across the internet. Whether you are perusing news articles, watching videos, or shopping online, advertisements are an omnipresent companion in the digital space. As mentioned earlier, many websites rely on ad revenue as a primary monetization strategy. Content creators, news outlets, and online platforms often offer free access to their content, supported by advertisements. This symbiotic relationship between content and ads allows users to access a wide array of information without direct monetary exchange, while advertisers gain exposure to diverse audiences.

The diversity of ad formats and placement strategies contributes to the ubiquity of ads. From traditional display banners to native advertising seamlessly integrated into content, the goal is to capture user attention without disrupting the overall user experience. Dynamic and responsive ad placements ensure optimal visibility on various devices, including phones, tablets, and desktops.

4. Personalization and targeted advertising

One of the driving forces behind the ubiquity of ads is the advent of targeted advertising and personalization. Advanced algorithms and data analytics enable advertisers to analyze user behavior, preferences, and demographics. Armed with this information, ads can be precisely tailored to individual interests, increasing the likelihood of engagement.

With the increase in smart TVs and the popularity of streaming services, targeted ads are integrated into these platforms. Advertisers can reach specific audiences based on viewing habits and preferences. Online shopping platforms use ads to promote products to users. Ads are strategically placed on these platforms to capture the attention of potential buyers. Businesses are in constant competition to

reach wider audiences. Advertisers strive to make their products or services known to as many people as possible, leading to the widespread use of ads across different mediums.

User data, collected through cookies, user accounts, and other tracking mechanisms, fuels data-driven ad campaigns. This approach allows advertisers to deliver content that aligns with users' preferences and past interactions. Consequently, users are more likely to encounter ads that resonate with their interests, creating a more personalized and engaging experience (K. V., KP, & Kamath, 2021).

The increasing reliance on user data for personalized advertising has raised concerns about privacy and ethical practices. Striking a balance between providing personalized content and respecting user privacy remains a significant challenge for advertisers and the digital ecosystem at large. Ongoing discussions about data protection, consent, and transparency shape the landscape of ethical advertising practices.

As ads have become more ubiquitous, users have sought ways to mitigate interruptions to their online experiences. Ad-blocking tools and browser extensions have gained popularity, allowing users to filter out or block certain types of ads. This user response reflects a desire for a more streamlined and uninterrupted browsing experience, prompting advertisers to reconsider their approaches.

The prevalence of ad blockers poses a challenge to the traditional revenue models of content creators and publishers. Ad-dependent platforms are forced to explore alternative revenue streams, such as subscription models, sponsored content, or exclusive memberships. The evolving landscape encourages advertisers to prioritize creativity, relevance, and non-intrusiveness to maintain audience engagement (K. V., KP, & Kamath, 2021).

5. Future trends

As technology continues to advance, the landscape of digital advertising will undoubtedly undergo further transformations. Emerging technologies such as augmented reality (AR), virtual reality (VR), and interactive content present new avenues for immersive and engaging ad experiences. Additionally, the integration of artificial intelligence (AI) into ad targeting and delivery algorithms holds the potential to refine personalization further.

The future of ads in phone apps, phone websites, and all websites may witness an emphasis on enhanced interactivity and user engagement. Interactive ads that allow users to participate in the content, rather than passively consume it, could redefine the relationship between advertisers and audiences. Gamification elements and storytelling techniques may become integral components of ad campaigns.

With an increasing focus on privacy and ethical considerations, the future of advertising may see a shift towards more transparent and user-friendly practices. Advertisers and platforms may prioritize obtaining explicit user consent for data collection, offer greater control over ad preferences, and adhere to stricter guidelines for responsible advertising (Wiese, Martínez-Climent, & Botella-Carrubi, 2020).

6. Conclusions

In conclusion, the ubiquity of ads in phone apps, phone websites, and all websites is a multifaceted phenomenon shaped by the evolving dynamics of technology, consumer behavior, and business strategies. From the rise of mobile advertising to the infiltration of ads on all digital platforms, the digital landscape is marked by a delicate balance between user experience, personalization, and revenue generation. As we navigate this intricate terrain, the future of digital advertising holds promises of innovation, interactivity, and ethical considerations, seeking to create a harmonious coexistence between advertisers and audiences in the ever-expanding digital realm.

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AGILE LEARNING: USE OF EDUSCRUM IN HIGHER EDUCATION

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Abstract

Eduscrum is a methodology that applies agile project management principles to the field of education. The Scrum methodology is an established approach in software development, where iterative product development is carried out by a small development team in work cycles. Originally, Scrum was an agile framework that originated in software development but has since been adapted to various industries, including education. The idea behind Eduscrum is to apply agile project management principles to education, aiming to be more flexible in addressing the needs of learners, fostering collaboration, and enabling continuous feedback. Eduscrum organizes the learning process into sprints, which are time-boxed periods typically lasting one to four weeks. During each sprint, students and teachers work collaboratively to achieve specific learning objectives. Scrum defines roles which are sometimes difficult to adapt to the educational context. The role of the product owner is often taken on by the teacher, who defines the learning goals and prioritizes the content. The Scrum master moderates the learning process, removes obstacles, and ensures that the Scrum framework is followed effectively. Students take on the role of the development team. Regular meetings, often referred to as "stand-ups" or "Scrum meetings," are held to discuss progress and challenges. These meetings provide a platform for students and teachers to collaborate, share insights, and identify any impediments. The Scrum process includes artifacts, like a backlog to prioritize tasks and charts which track the progress of the sprints. One of the key principles of Eduscrum is flexibility. It allows for adjustments based on student needs, enabling a dynamic and responsive learning environment. Eduscrum promotes regular feedback loops between students and teachers, fostering a culture of continuous improvement. Collaboration is a central theme in Eduscrum. Students work together on projects, share ideas, and contribute to the overall learning experience. The paper describes how the methodology is used in a master's level class for computer science. Content of the course subject is social network analysis. The students work together in small groups. They perform together a self-chosen project and write a research paper together. Every process step is accompanied by the professor and an assistant, in accordance with Eduscrum. Each project group gets constant feedback. The students are guided step by step through the whole process. In the course evaluation, the students state their high learning outcomes, but they find that the projects are a lot of work.

Keywords: *Agile learning, Eduscrum, higher education, science education, social network analysis.*

1. Motivation

Agile learning is essential in today's rapidly evolving landscape as it enables individuals and organizations to swiftly adapt to changing technologies and market demands. "Agile Learning generally refers to the transfer of agile methods of project work, especially Scrum, to learning processes" (Longmuß, 2016). Agile learning proceeds in incremental steps and through an iterative design which alternates between phases of learning and doing. The tutors rather have the role of a learning attendant or supporter (Morcov, 2020).

Agile learning encompasses various approaches that emphasize adaptability, collaboration, and continuous improvement. Scrum-based learning (Fernandes, Dinis-Carvalho & Ferreira-Oliveira, 2021) involves short learning cycles called sprints, regular reviews and adjustments to the learning process based on feedback. Similar to Scrum, Kanban-based learning (Saltz & Heckman, 2020) focuses on a continuous flow of learning. It uses visual boards to track progress, allowing for ongoing adjustments based on current needs. Design thinking in learning (Jamal, Kircher & Donaldson, 2021) integrates the principles of design thinking into the learning process. Learners engage in creative problem-solving, hands-on applications, and collaborative projects. Agile project management for learning projects (Marnewick, 2023) applies agile project management methods like Scrum or Kanban to educational projects. This allows for a flexible and iterative approach to develop learning materials and activities.

Agile coaching and mentoring (Stray, Memon & Paruch, 2020) utilizes agile principles in coaching and mentoring of learners. This may involve promoting self-organization, providing continuous feedback, and adapting to learners' evolving needs. Agile games and simulations (Bruzzone et al., 2014) incorporate agile principles through games and simulations to make learning more interactive. These activities enhance collaboration and deepen understanding of complex concepts. Lean learning (Chatley & Field, 2017) draws inspiration from lean principles, focusing on reducing waste and creating efficient learning processes tailored to learners' needs. Agile e-learning (Chun, 2004) integrates agile principles into the development of e-learning modules. This facilitates quicker updates to content and continuous adaptation to changing requirements. These approaches can be applied individually or in combination, depending on the learning objectives, target audience and available resources. The goal is to create a learning environment that is responsive, dynamic, and aligned with the principles of agility.

Agile learning is necessary to equip students with the skills, mindset and adaptability required to thrive in a constantly changing and competitive environment. It ensures that learning is not a one-time event but a continuous and dynamic process. Research and practical experiences can deepen knowledge in the field of agile learning and clearly outline the strengths and weakness of this methods. This paper follows the approach Scrum-based learning and focusses on the method Eduscrum. This method is explained in the following section. Afterwards, a case study which uses Eduscrum in higher education is described and the experiences are discussed.

2. Eduscrum

Scrum (Sutherland, 2014) is an agile project management methodology widely used by software companies worldwide, but applicable to any area. The Scrum methodology is an established approach in software development, where iterative product development is carried out by a small development team in work cycles. Originally, Scrum was an agile framework that originated in software development but has since been adapted to various industries, including education. The main concepts behind Scrum are team empowerment (the team manages its own work and periodically reviews its internal processes in order to continuously improve), sprint-based scheduling and planning (at the beginning of each sprint, a set of tasks are chosen from the project's backlog, i.e., work to be done, and a work plan is defined for the sprint) and periodic client feedback. Scrum follows a set of well-defined procedures and events to guide the development process.

The product owner creates and maintains the product backlog, a prioritized list of all desired features, enhancements, and bug fixes for the product. The Scrum team (product owner, Scrum master, and development team) collaborates to select items from the product backlog for the upcoming sprint. A daily 15-minute meeting is scheduled, where the development team discusses progress, plans for the day, and any impediments. The development team works on tasks from the sprint backlog to create a potentially releasable product increment. Every sprint contains the phases planning, implementation, review and retrospective. At the end of the sprint during the review phase, the team demonstrates the completed work to stakeholders, receives feedback and discusses any adjustments needed for the product backlog. In a retrospective meeting reflects the Scrum team on the sprint, identifies what went well and what could be improved and develops action items for continuous improvement. This cycle repeats for each sprint, typically lasting 2 to 4 weeks. The process is iterative, and feedback from stakeholders, team members and the product itself is used to continuously improve the product and the development process. The scrum process results at the end in a completed product. The Scrum framework provides a structured, yet flexible approach to product development.

Scrum defines specific roles, events, and artifacts to help teams work together more efficiently. The Scrum master is a facilitator and servant leader for the Scrum team. This role ensures that the team follows Scrum practices and removes any obstacles or impediments that may hinder the team's progress. The product owner represents the stakeholders and is responsible for defining and prioritizing the product backlog. The development team is a cross-functional and self-organizing group responsible for delivering a potentially releasable product increment at the end of each sprint.

Eduscrum is an adaptation of Scrum to education (Neumann & Baumann, 2021) (Delhij, van Solingen & Wijnands, 2015). The idea behind Eduscrum is to apply agile project management principles to education, aiming to be more flexible in addressing the needs of learners, fostering collaboration, and enabling continuous feedback. Eduscrum organizes the learning process into sprints, which are time-boxed periods typically lasting one to four weeks. During each sprint, students and teachers work collaboratively to achieve specific learning objectives.

Scrum defines roles which are sometimes difficult to adapt to the educational context. The role of the product owner is often taken on by the teacher, who defines the learning goals and prioritizes the content. The Scrum master moderates the learning process, removes obstacles, and ensures that the Scrum

framework is followed effectively. This role is taken on sometimes by a student, sometimes by a teacher. Students take on the role of the development team. The Scrum procedure is adapted to Eduscrum: The teacher creates an educational backlog, a prioritized list of learning objectives, activities, and assessments. The Scrum team collaborates to select items from the educational backlog for the upcoming educational sprint. An educational standup is a regular, brief meeting, where students and educators discuss progress, plans for the next few days and address any challenges or questions related to the educational tasks. The educational sprint is the learning period: Students actively engage in learning activities, collaborative projects and assessments outlined in the sprint backlog, with teachers providing guidance and support. At the end of the educational sprint, students showcase their learning achievements, discuss their experiences, and receive feedback from educators and peers. The educational retrospective is a reflective session where students and educators discuss what worked well, what could be improved, and collaboratively plan adjustments for the next educational sprint.

This iterative learning cycle repeats for each educational Sprint, allowing for a student-centric, adaptive, and collaborative approach to education. The Eduscrum framework emphasizes active student participation, continuous feedback, and a focus on achieving educational objectives.

Regular meetings are held to discuss progress and challenges. These meetings provide a platform for students and teachers to collaborate, share insights and identify any impediments. The Scrum process includes artifacts, like a backlog, to prioritize tasks and charts, which track the progress of the sprints. One of the key principles of Eduscrum is flexibility. It allows for adjustments based on student needs, enabling a dynamic and responsive learning environment. Eduscrum promotes regular feedback loops between students and teachers, fostering a culture of continuous improvement. Collaboration is a central theme in Eduscrum. Students work together on projects, share ideas, and contribute to the overall learning experience.

3. Case study

In a master's degree class of the computer science department, the Eduscrum concept is implemented in a course which contains subjects of Social Network Analysis (SNA). SNA is an interdisciplinary field of study that investigates social structures and relationships by analyzing the patterns of connections among individuals, groups, organizations or even countries. SNA enables researchers to visualize and quantify the complex webs of social interactions that shape human behavior and outcomes. SNA draws on theories and methods from sociology, psychology, anthropology, economics, computer science, and mathematics to study social networks. SNA is a useful tool for studying a wide range of social phenomena, from the spread of diseases to the adoption of new technologies, from the emergence of social movements to the evolution of organizations. SNA has been applied in various fields, including sociology, political science, communication studies, marketing, management, and health care (Fu et al., 2017). It has also been used to study online social networks, such as Facebook, Twitter, and LinkedIn (Schötteler et al., 2022).

The students of the master's degree class worked in teams about three to five persons on a project which they had to choose themselves. It was their task to define a research question, collect data, analyze and interpret this data. The result of their project is a research paper which describes their project work. They took over the role of the development team. The role of the product owner was taken over by the professor, who defined the requirements. A PhD student, who is an expert in the field of social network analysis, took over the role of the Scrum master. The PhD student assisted the students answering a lot of technological questions and guided them through the development process.

After the definition of the roles, the tasks for the backlogs were formulated. The tasks for the single sprints and the time slices (between 1 and 4 weeks) were defined by the professor. This is an adaptation of the process. because the course must fit chronologically into the structure of a semester. The professor sets the subgoals to be achieved, to reduce the complexity of the project for the students. Another adaptation of the model was the fact that the students got professional input about the learning materials before every sprint.

The course was structured as follows: In the first lesson, the professional input contained the theory of SNA. The students learned what social networks are and how to analyze them. The methodological input was how to formulate a research question. Students got their first task: the definition of their research question. This was their first sprint.

For the second sprint, the students got input how and where to find relevant literature and how to write literature excerpts. The task was the systematic search for relevant literature in the particular research domain. The expected result of this sprint was an overview of the relevant literature in their research domain.

During the next sprint, the students had to write a research exposé about their projects. They heard explanations of relevant metrics and their meaning in SNA. The students learned how to conduct a SNA, which tools they can use for it and how to interpret the metrics. The students learned how research exposés were structured and had to write their own exposés. In feedback loops (the review phase of the sprint), the exposés were discussed with the professor.

The following sprint included planning and executing the data collection and designing a hypothesis model. The students heard explanations about statistical methods for their data work. They learned how to produce and interpret statistical metrics. They learned what they have to consider for their data collection when they execute surveys, interviews, observations and data scraping. This sprint lasted 4 weeks because of the work load. In the review phase, the partial results were discussed.

The next sprint was the data analysis and the interpretation of the results. Over a number of iterations, the results were discussed between the team, the professor and the PhD student. Subsequently, a sprint which included the writing of the research paper followed. The last sprint was the final presentation of the students' work.

4. Evaluation and limitations

While adapting the classical Scrum process to Eduscrum, some limitations were observed: The selection of tasks from the educational backlog is often dependent on a sequence, so that the tasks had to be chosen in a given order. In this project, the selection of tasks for a sprint was done by the professor and not by the development team itself. In this presented course concept, the selection of the learning content was not part of the scrum process. Alternative course concepts may allow students the choice of the learning content. That depends on the specific conditions: whether one can leave that to the team or to the teacher.

The educational standup was not held as a daily meeting because of the class time tables. In our course, it was a weekly meeting. Therefore, it was not a short meeting to discuss the daily task, but a longer meeting to talk about the progress of the project. The review phase of the sprints usually included a number of iterations, until the expected results were reached. The retrospective phase of the sprints was mostly the responsibility of the teams. It depended on the team itself whether this phase was done effectively.

Up until now, three runs of the course with 41 participants organized in 11 teams have been done. The professor and the PhD student worked with the students on their projects in the course of the semester. The outcomes have had a high effect: three research papers have already been published about the self-chosen SNA projects of the students. However, for this concept, two teachers are necessary: one in the role of the product owner and one in the role of the scrum master. Alternative concepts may transfer the role of the scrum master to the teacher or to a student team member.

Like any project-oriented teaching/learning method, agile learning reaches its limitation when the goal is the systematic coverage of a pre-defined curriculum. Because of the high expenditure of time for the coaching of the teams, this format is not suited for large classes.

5. Future work

In the next steps, at our university we will widen this concept to the bachelor's degree program and enable bachelor's students to work on their own research projects according to Eduscrum. As part of this research project, students should create a learning game about a startup company. For the requirements engineering phase, interviews will be conducted with startup companies to generate ideas for the case studies. Afterwards, concepts of gamification will be examined for their suitability, which are best suited for application to this case study. A prototype for a computer-based learning game will be created and tested. First, studies with test persons will be carried out to analyze the attention of the players and the usability of the user interface of the learning game. Findings from the eye-tracking analysis will be used to improve the user interface of the learning game. Afterwards, a questionnaire will be conducted to collect feedback from the participating students about their learning success. The data from the questionnaires will be statistically evaluated to evaluate the success of the project. This project will also be conducted with Eduscrum.

In agile learning, the participants may gain new competencies that are, unlike in classical formal education, directly linked to their work context. In pursuit of individual problem-solving as well as in exchange with the learning team and the coaches, their increase in competencies becomes readily apparent, so that successful learning strategies can also be harnessed in the future. Therefore, the main potential of this approach lies in the practical relevance of the acquired competencies and the demand-oriented communication of contents, techniques, and skills.

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UTILIZING LEARNING ANALYTICS IN LARGE ONLINE COURSES

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Abstract

In courses with hundreds of students, online or hybrid implementation may become more practical than standard classroom teaching. However, it can be difficult for teachers to track student progress in all areas reliably in large courses. In this paper, we present a study where two large online computer science courses were analyzed. Detailed data about student performance in different types of exercises and assignments were collected. In addition, students' perceptions about their learning performance, and the quality and difficulty level of learning materials were collected during all seven weeks of the course. The performance data was analyzed to try to recognize the effectiveness and quality of different course areas. Moreover, we found out if the time usage or perceived difficulty level affected students' performance. The strong correlations between different types of exercises and exam scores indicate that the material is effective and the exam measures the learning properly. However, time usage and perceived difficulty level seem to have little effect on the result.

Keywords: *Learning analytics, programming, online learning, feedback.*

1. Introduction

Keeping up student motivation is important. However, it can be difficult as well. In smaller courses or classes an experienced teacher can easily collect informal feedback and adjust the teaching accordingly when needed. In larger courses, this can be difficult, especially when the number of students reaches several hundreds. Online learning makes this even more difficult. Although it has its benefits in making education more reachable and independent of time and location, the lack of contact can make it difficult for teachers to track the learning experience as a whole.

Learning analytics is usually defined as collecting and analyzing data collected on learning and teaching (for a more precise definition see e.g., Elias 2011). Utilizing learning analytics can potentially enable us to track students' progress and their perceptions on a detailed level and use the results of analysis in course design and to improve teaching processes (Leitner et al. 2017). The problem, however, is often the data: collecting enough up-to-date data on learning during the courses can be difficult.

In this paper, we present a study where two large online courses were researched. We used an educational platform that automatically collected data on students' solutions to exercises. The scores of the assignments done outside the platform were also manually inputted there, providing teachers and students with a real-time and holistic view of the progress. Additionally, weekly surveys were used to collect students' perceptions about their time usage and difficulty level of the tasks.

2. Related work

There are many different frameworks and approaches for learning analytics (LA). The term 'learning analytics' covers a significant area of different fields and techniques, often utilizing vast amounts of data. According to Clow (2013), some of the possible application areas for learning analytics are predictive modeling, social network analysis, recommendation engines, content and semantic analysis, and usage tracking e.g. of an LMS. A quite common way to define LA into different categories is to separate learning analytics into three categories, as defined by Daniel (2015). These three different categories are descriptive, predictive, and prescriptive analytics. Descriptive analytics aims to describe what has happened. Descriptive analytics is based on the data gathered from students, teaching, research, policies, and other administrative processes. Predictive analytics aims, as the name suggests, to predict future events and performance based on the collected data. As a more concrete example, predictive analytics could be used to identify students who are at risk of failing the course. Prescriptive analytics combines the previously

mentioned analytics to explain what should be done next and why. It is important to note that no LA framework is perfect in predicting students holistically. Hence, it is important to consider the ethical aspects of analytics as well. As a more concrete example, Susnjak, Ramaswami, and Mathrani (2022) note that misclassification of a student to “at-risk” student might lead to actions that discourage the student and thus cause a potential negative impact on the student performance in the course.

Additionally, some LA frameworks are only conceptual, while some have concrete implementations. Quite often, the designed frameworks are designed to work across disciplines. In a systematic review, Khalil, Prinsloo, and Slade (2022) compared different LA frameworks. They noted that 40 of the 46 analyzed frameworks, presented in papers published between 2011 and 2021, were designed to be used across disciplines. Furthermore, according to the review, “12 papers mentioned a prototype or case study application”. On a graver note, out of 46 LA frameworks that they analyzed, only about 1 in 3 mentioned privacy and ethics. They also pointed out that although interest in these themes has increased over time, not even all relatively new frameworks have considered ethics or privacy. Additionally, there is still room for improvement in LAs. According to Susnjak, Ramaswami, and Mathrani (2022), most LA dashboards presented in studies published between 2018 and 2021 utilize only shallow, surface-level descriptive analytics. Learning analytics have had a concrete impact as well. For example, Lim et al. (2021) utilized a learning analytics-based feedback system for students on a large course and found that students given personalized feedback via email had significantly higher marks on the final exam compared to a control group that did not receive feedback. Furthermore, another study conducted by Kew and Tasir (2022) noted, that utilizing LA for intervention seemed to improve the student’s motivation in e-learning. These findings emphasize the potential impact LA can have on students.

Combining data from different sources might work as well. For example, López-Pernas, Saqr, and Viberg (2021) combined data related to study material viewing from LMS and submission data from an automated assessment tool to understand the learning process of students learning basics of web development. They were able to cluster students into three distinct groups based on their learning behavior and noted how in different scenarios, students seemed to prefer their study materials in different formats.

3. Research setup

The research was conducted during the academic year of 2023 to 2024 at the Department of Computing at the University of Turku. Two large programming courses were selected for the study (see next subsection for details). The courses are typically the first two programming courses taken by students at our university. In addition to computer science majors, students from many other subjects participate in the courses. The students can take the courses fully online, but live workshops are organized additionally for students who prefer contact learning.

Both courses lasted for seven weeks. The exams were organized after seven weeks. Each week, a 2-hour online lecture was given via Zoom. There was a Discord server with an online discussion forum, which the students could use to ask for help with any exercises. Course instructors were present in Discord and at live workshops at given times, but naturally, the students could ask questions at any time online. To enable this, peer support was encouraged. AI tools (such as ChatGPT, Copilot, or similar) were allowed, but there was a strict set of rules for using them.

3.1. Course instances and data collection

The details of the course instances are displayed in Table 1.

Table 1. The details of the course instances studied.

Course abbreviation	Course 1	Course 2
Name	Fundamentals of Programming	Introduction to Object-Oriented Programming
Students (N)	602	381
Programming Language	Python	Java
Time	Fall 2023	Spring 2024

Each week the topics were covered in a tutorial, a combination of course materials (such as text, images, and example code) and automatically assessed exercises. An educational platform called ViLLE (Kaila, 2018) was used for tutorials. The exercises were mainly coding tasks, where the students needed to write a program (or a part of it) according to the instructions. The code could be executed in the platform without additional programs or plugins. The students received immediate feedback after execution and could modify their code immediately and execute it again, if necessary. Other exercises types included code

sorting exercises and quizzes. The students needed to collect at least half of the available tutorial points to pass the course. In total, there were 171 tutorial exercises in Course 1 and 139 in Course 2.

Another form of learning was demonstration assignments. In these assignments, the students practiced topics that are more advanced. The demonstrations were completed with an external coding editor. The same editor is widely used in the industry to write program code. The course staff manually assessed all the assignment answers. Again, the students needed to complete at least half of the assignment points to pass the course. At the end of the course, the students completed an exam. The exam consisted of 5 to 7 programming tasks and was completed in ViLLE. All the tasks were automatically assessed and scored. Students' final grade was based on tutorial, assignment, and exam points.

There was a short feedback survey at the end of each week on both courses. In this survey, the students were asked to list what they had learned, what remained unclear, and how they would improve the session. Additionally, they were asked to estimate the time they had used to complete the exercises and the perceived difficulty level of the tasks. In addition to research purposes, this data was evaluated each week and changes to lectures, materials, and exercises were made based on the student feedback. A more detailed analysis of the feedback on earlier courses can be found for example in Kaila & Lokkila (2022).

3.2. Research methodology

ViLLE automatically collects all the points for all the students in the course. In addition, the instructors inputted the manually assessed assignment points in ViLLE. For analysis, all the scores were exported from ViLLE as Excel spreadsheet. After this, the data was fully anonymized by replacing all the student identifiers with randomly generated codes. Common statistical descriptors (such as averages) were calculated using Microsoft Excel. The advanced analysis and some data cleanup was done by using the Python programming language.

4. Results

The course results after the first exam are displayed in Table 2. It should be noted, that both courses provide three exams for students to try, but we focus on the first exam, as that was the only exam we had comprehensive data at the time of the writing. The grade level used is 0 to 5, where one is the first accepted grade and five is the best possible grade.

Table 2. Results after the first exam.

Grade	Course 1	Course 2
5	334 (55%)	171 (45%)
4	56 (9%)	45 (12%)
3	35 (6%)	34 (9%)
2	11 (2%)	29 (8%)
1	11 (2%)	8 (2%)
Total passed	447 (74%)	287 (75%)
Fail	155 (26%)	94 (25%)

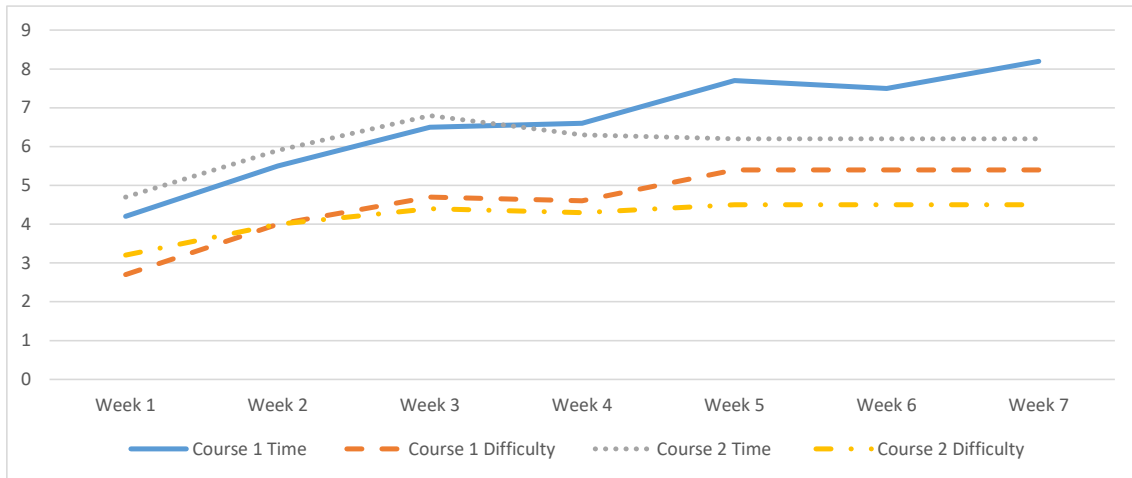
As seen in the table, the results are quite similar at both courses: majority of students has passed the course with the highest grade or failed it. The mean points collected from different parts of both courses are displayed in Table 3. The points are calculated distinctively for student who passed the course and for all students.

Table 3. Points collected from different sections of the course. Points are displayed separately for students who passed the course and for all students.

Part	Course 1	Course 2
Tutorial points (passed)	87%	88%
Demo assignment points (passed)	79%	69%
Exam points (passed)	94%	87%
Tutorial points (all)	72%	74%
Demo assignment points (all)	63%	56%
Exam points (all)	70%	67%

While the trends between the two observed courses seem to be somewhat similar, the students who passed the course seemed to do remarkably well in the Course 1 exam. Students' perceived difficulty levels for all weeks as well as their estimate of the time usage is displayed in Figure 1.

Figure 1. Students' perceived time usage (in hours) and difficulty level (1...7, 7 most difficult) at each week.



In both courses, the time usage and the perceived difficulty level increased until the end of the first two or three weeks, but seem to remain quite steady after that. However, the time usage in Course 1 seems to keep increasing until the end of the course. The correlations between different course sections are displayed in Tables 4 and 5.

Table 4 and Table 5. Correlations between different sections of the courses (calculated using the Pearson correlation). A correlation is a decimal value between -1 and 1, with values over 0.7 (or under -0.7) typically indicating strong correlation between two variables.

Course 1				
	Tutorial	Demo	Exam	Time
Demos	0.87			
Exam	0.83	0.78		
Time usage	0.13	0.12	0.08	
Difficulty	0.09	0.10	0.05	0.55

Course 2				
	Tutorial	Demo	Exam	Time
Demos	0.80			
Exam	0.76	0.76		
Time usage	-0.08	-0.11	-0.07	
Difficulty	-0.18	-0.17	-0.08	0.58

The correlations between different sections seem to be quite similar in both courses. Notably, there is a strong correlation between tutorial, demonstration assignments and course final exam. The perceived time usage and difficulty level have a correlation with each other, but do not seem to correlate with any other parts of the course.

5. Discussion

Mostly, the two courses' statistics are quite similar. There is a statistical difference between the grade distribution (Table 2) between courses (Mann-Whitney U-test gives a p-value <0.01), but the majority of grades in both courses still seem to be either the highest possible or a failure. This indicates, that the students who are determined to complete the course, do so as well as possible. The high amount of points collected from different parts of the course (Table 3) also indicates that the students who passed the course

have worked much more than the required minimum (which was 50% in all parts). The workload of the courses, based on students' perceived time usage and difficulty level, seems to increase steadily during the first three weeks (Figure 1). After that, it seems to stay at the level except for the time usage in Course 1, which kept increasing until the last week.

There is a strong correlation (Table 4) between all three major sections in both courses: tutorials, demonstration assignments, and the final exam. The fact that the performance in tutorials and demonstration assignments correlates strongly with the final exam indicates that the students, who work hard during the course also succeed in the final exam. Time usage had a moderate correlation with difficulty level, which seems logical: if the tasks feel more difficult, you need to spend more time doing them. However, neither the time-usage nor the difficulty level had any correlation between performance in tutorials, demonstrations, or exams. This is likely due to high variance in both of these variables: some students spend less or more time on some exercises or find them easier or more difficult, but this does not seem to correlate with learning outcomes.

6. Conclusion and future work

Overall, it seems that analyzing the learning data can provide useful information and insights for teachers, students, and researchers. The strong correlation between coursework and the final exam indicates the importance of working hard during the course. The difficulty level and time usage can provide teachers with important information in keeping the workload at an acceptable level. Moreover, by comparing the performance of two separate but similar courses, it is possible to recognize anomalies in different areas of materials and teaching. In the future, we are going to observe the feedback provided by the students even closer and try to isolate factors that affect student performance and motivation by combining the feedback data with the performance data.

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SME RESPONSIBILITY AND LEARNING BY DEVELOPING PEDAGOGY

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Abstract

In recent years, teaching related to environmental responsibility and biodiversity loss has been implemented in Finnish comprehensive schools and upper secondary schools, for example, through various tasks related to forests, nature, and urban environments. Corporate social responsibility (CSR) has been part of higher education studies since the early 2000s. Large companies actively communicate about their level of responsibility and actions. Sustainability communication is at different levels in SMEs, and practical, responsible business implementation is not seen as vital through SME communications. The practical implementation of responsibility in SMEs is essential to meet the goals and requirements outlined in the UN 2030 Agenda and the EU Corporate Responsibility Reporting Directive. Finnish universities of applied sciences have good opportunities to promote responsibility and support practical implementation in SMEs through close regional and corporate cooperation. Laurea University of Applied Sciences' Learning by Developing Pedagogy (LbD) creates opportunities to develop the performance of responsibility and combine education and the practical work of SMEs, strengthening the competence of SME personnel and the practical implementation of responsible business as well as responding to other stakeholder demands through training. The SME cooperation between Laurea University of Applied Sciences and LAB University of Applied Sciences' Green Responsibility project revealed room for improvement in the practical implementation of responsibility competence and responsible business in the SME sector. Based on the observations made in the Green Responsibility Project 2021-2023, Laurea and LAB Universities of Applied Sciences created a follow-up project to implement responsible business and competence development. This article provides an outlook in the follow-up project: SME personnel members can strengthen their responsibility competence while participating in their studies and, at the same time, produce development and implementation plans for their operating environment, thus promoting the implementation of corporate responsibility in the company and further value chains. The goals of the studies are formed by combining theory related to the topic, small-scale research focusing on the operating environment, and various development and implementation tasks based on LbD pedagogy and company practices. Through the studies offered and implemented, it is possible to combine the promotion of responsible business in practice, the competence development of SMEs, and the theoretical and guidance support provided by educational organizations to promote global responsibility.

Keywords: *LbD, pedagogy, responsibility, SME, sustainability.*

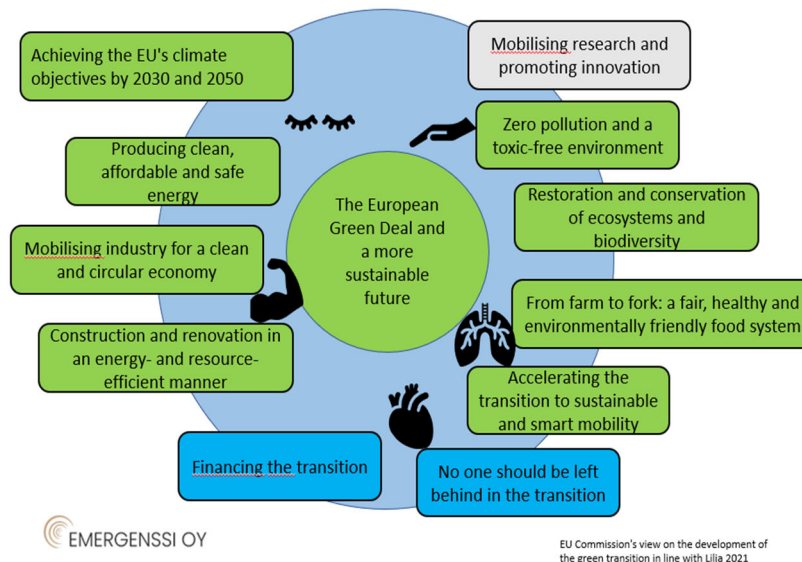
1. Introduction

Over the past five years, the European Parliament and the Commission have developed initiatives and binding legislation to promote responsibility, sustainable development, and the green transition, such as the EU Green Deal and the EU Corporate Sustainability Reporting Directive (CSRD). (Official Journal of the European Union, 2022). Due to the economic transformation that has begun at different levels, everyone should strengthen the transparency of responsibility in their operations throughout value and supply chains.

Previous encouraging and globally concluded agreements have not been sufficient to preserve the planet's functioning. To maintain the planet's functioning, we must examine how companies and organizations can operate more responsibly in their value chains while caring for the environment. The value chain assessment and review can utilize, for example, the UN's 2030 Agenda SDG (Sustainable Development Goals), which defines development through 17 main goals. (UN, 2021).

The environmental objectives of the Taxonomy Regulation on Sustainable Finance will be based on the attributes of practical responsibility work. According to it, responsible behavior includes the following purposes: climate change mitigation, adaptation to climate change, sustainable use and protection of water and marine resources, circular economy, Prevention and reduction of pollution, safety, and restoration of biodiversity and ecosystems. (Lilja, 2023).

Figure 1. The EU Green Deal and a Responsible Future (Lilja 2023).



The Green Deal steers the operations of companies and organizations, strengthening the carrying capacity of the future. (Green Deal) Directives, regulations, and national legislation will further specify the country-specific green transition targets, affecting responsibility and sustainable development. However, not all SMEs, for example, have internalized the significance of their business in this context. For example, the EU's CSRD, the UN's 2030 Agenda, and the ESG Framework extend to SMEs through value chains. In addition to economic and environmental responsibilities, these highlight social and cultural responsibility, especially due diligence concerning human rights.

2. Objectives

The working life cooperation and competence-based nature of Laurea University of Applied Sciences' LbD pedagogy, together with flexibility and student-centered approaches, provide an opportunity to implement and develop competence in responsibility in connection with the practical activities of SMEs. Directives and regulations related to sustainable development and responsibility at the national, EU and global levels, directly and indirectly, impact the operations of SMEs through various stakeholders.

From this point of view, the development needs for responsibility competence and practical implementations of responsible business in the SME sector, which emerged in the SME cooperation of Laurea University of Applied Sciences and LAB University of Applied Sciences' Green Responsibility project, was a reasonable consideration for further development. For example, with the help of the service model and corporate responsibility survey conducted in the Green Responsibility project, companies can set concrete goals for themselves regarding responsible business and monitor the development trajectory of responsibility through sustainability reporting while increasing the responsibility competence of their personnel. Based on the observations made in the Green Responsibility project, Laurea University of Applied Sciences and LAB University of Applied Sciences planned a follow-up project for the implementation of responsible business and competence development (VALIOT).

In the VALIOT -Project, SME personnel strengthen their competence in responsible strategic business, recruitment, human resource management, sales, and commercialization. When participating in their studies, they produce responsible development and implementation plans for their business environment, promoting the implementation of corporate responsibility in the company and further in value chains. The studies combine theory related to the topics and small-scale research on the operating environment through various development and implementation tasks based on LbD pedagogy and company practices. The studies combine promoting practical, responsible business, the competence development of SMEs, and educational organizations' theoretical and guidance support to promote global responsibility.

Figure 2. Competitiveness through personnel responsibility competence (VALIOT 2024).



The value proposition of the VALIOT project is to support the participants and plan together how to create and build a sustainability strategy and a competitive advantage from responsibility and business by developing commercialization, sales, and recruitment expertise. The aim is to implement the tools used in studies as part of companies' operations, strengthen the personnel's expertise in responsibility by increasing competitiveness, improve companies' responsible growth, and increase the competence of factors affecting responsible business operations as part of profitable operations, for example, by taking impact and resource efficiency into account.

3. Method

At Laurea University of Applied Sciences (Laurea), the primary pedagogical method is Learning by Developing (LbD), which is based on genuine working life cooperation or Laurea's research, development, and innovation projects (RDI). In the LbD model, the teacher guides the students systematically and gives continuous feedback that supports the student's professional growth. According to LbD's pedagogical vision, the student learns, among other things, to combine practice and theory to solve problems and learn critical thinking and cooperation. (Laurea 2023)

In LbD, the exploratory and developing work approach is combined as part of project work and the visualization of the overall picture. To achieve the competence goals, the students must commit to active interaction and sharing their expertise to build competence successfully. To secure development and research, close cooperation with working life strategically supports the goals of the representative of working life, the higher education institution, and the student. To strengthen this, Laurea develops teaching to meet working life's and society's needs. (Laurea 2023)

In developing and renewing students' skills, they are learners, experimenters, developers, and researchers supported by their operating and learning environment. Laurea's goal is to create new work-life competencies for the future skills needs of work-life and society. The answer to this is, among other things, constant interaction with working life. (Laurea 2023)

Competence-based learning goals appear concrete both for students and other participants. The competence goals related to them are formed based on the needs of society and working life, for example, from the perspective of sustainable development, future awareness, and foresight, strengthening the student for global cooperation. The operating environments of the implementations are formed together with working life partners and RDI projects, applying researched knowledge as part of practical activities and, at the same time, developing the student's skills. (Laurea 2023)

4. Discussion

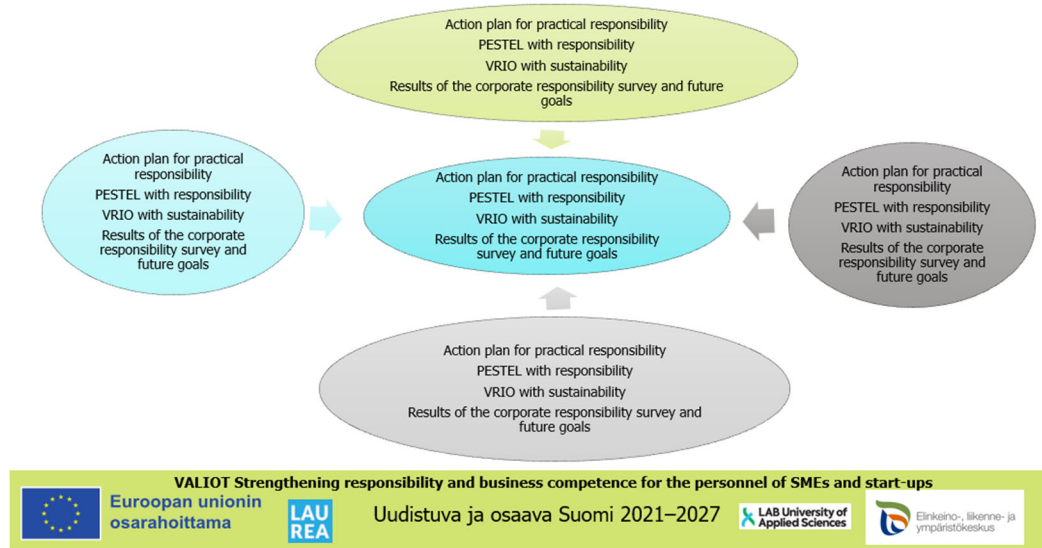
Developing responsibility competence and business operations through co-creation methods and analysis tools increases companies' competitiveness and personnel's ability to change. These include utilizing the results of the previous Green Responsibility -Project, such as the Corporate Responsibility Survey. Concrete measures include the practical planning and implementation of a responsibility strategy in the companies of the project participants.

Figure 3. Construction of implementation points competitiveness through responsibility expertise (VALIOT 2024).



For example, strategy and foresight tools, such as PESTEL and VRIO analyses, concretize the responsibility strategy. The benefits of PESTEL analysis studies include identifying changes in the company's operating environment and developing responsible business operations as part of the company's operations. The VRIO analysis aims to find the company's most valuable resources by developing and utilizing them as efficiently as possible in its strategic management and development.

Figure 4. Outputs for responsible everyday operations – competitiveness through responsibility expertise (VALIOT 2024).



The teaching sessions are carried out using gamification, for example, through Teams, as group work, or as an intensive business simulation. In group work in Teams, strategy tasks related to responsibility are carried out in small groups, and the company simulation focuses on strategic management. The Seppo platform is used in gamification, and the support platform is, if necessary, Moodle or Canvas. A material bank will be formed on the support platforms, which the student can use and participate in guidance meetings to complete the tasks defined for the studies and broaden the understanding of areas related to responsibility, developing competence by concretizing theory in practical business.

By participating in the studies, the student will gain the skills to draw up a development and action plan for practical actions related to corporate responsibility, developing the competence needed to develop responsible business by combining responsibility goals and practical measures. By combining theory and an authentic company's operating environment, responsibility assessment skills develop, based on which the presentation of development proposals improves, and it is possible to envision the implementation of

the plan into practical measures. PESTEL and VRIO analyses and the corporate responsibility survey are used to develop analysis skills in promoting responsible business. To support the assessment of the development of one's competence, a self-assessment related to the topics is carried out at the beginning and end of the studies.

5. Conclusions

During the studies, the students acquire the skills to utilize the practical development and action plan of a responsible business based on the practical operations of the company. At the same time, they are developing the student's competence in combining responsibility goals and practical measures to create responsible business. The studies include company-specific, national, and global approaches to sustainable development and responsibility, strengthening the participant's competence in evaluating and implementing practical responsibility measures as part of business operations.

The students learn to use a corporate responsibility survey as a basis for the evaluation report of practical responsibility actions. Students' competence in assessing responsibility and sustainable development develops by determining the level of commitment in practical business now and in the future and by presenting development proposals based on the assessment. Based on this, the student concretizes the responsibility vision as part of the practical, responsible business by utilizing the development and action plans made during the studies and can use, for example, PESTEL and VRIO analyses to support and promote operations.

The online implementation of studies creates an equal opportunity for SME personnel members as students with different levels of education in companies. When studies are carried out flexibly with versatile teaching methods, the students' opportunities to study regardless of time and place are increased. At the same time, the use and implementation of digital tools, such as business simulations and various analysis tools, as part of the SME's regular work will be developed.

After completing the studies, the students will be able to act to promote realistic responsibility activities by utilizing commercialization, sales, recruitment, and strategy work as part of responsible business. For example, self-assessments and a corporate responsibility survey can assess students' competence.

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BRIDGING THE CAREER READINESS GAP: EXAMINING THE PROMISE OF VIRTUAL INTERNSHIPS

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Abstract

This mixed methods study explored the perspectives of 14 graduate students in a virtual instructional technology (IT) internship. Guided by the authentic learning framework, the research identified perceived value, support needs, preparation gaps, and improvement opportunities. Findings revealed interns valued applying knowledge to real projects, developing professional skills, and receiving mentorship. Participants desired pre-internship technology training and clear expectations. Proactively developing time management, organization, and communication abilities was crucial. Though limited to one program, the study provides insights for designing effective virtual internships aligned with authentic learning principles.

Keywords: *Virtual internships, instructional technology, authentic learning, work-integrated learning, online experiential learning, graduate education.*

1. Introduction

Virtual internships offer remote, practical experiences for students to develop professional skills (Feldman, 2021; Jeske & Axtell, 2014). However, research on graduate virtual IT internships is limited. This mixed methods study investigates 14 graduate students' perspectives to uncover the value, supports, preparation needs, and improvement suggestions for a virtual IT internship program. Findings can inform best practices in virtual internship design and delivery.

2. Literature review

Virtual internships provide hands-on learning without traditional constraints (Bayerlein & Jeske, 2018; Hora et al., 2021). They offer flexibility, cost-effectiveness, and accessibility advantages (Pittenger, 2021). Successful virtual internships require clear objectives, regular communication, and strong mentoring (Hruska et al., 2022; Jackson, 2019). Challenges include limited supervision and missing in-person culture immersion (Crowell et al., 2022). However, the literature suggests virtual internships can deliver valuable experience and preparation.

3. Methods

This mixed methods study used inductive qualitative coding to identify themes from 14 graduate students' journals and surveys. The authentic learning framework's nine characteristics guided evaluation. Likert-scale items were analyzed with descriptive statistics. Research questions explored perceptions, value, modifications, and preparation needs.

4. Findings

Qualitative analysis revealed participants viewed the internship as providing meaningful workplace exposure, knowledge and skills for career readiness, and expanded networking. Technology training and clear expectations were recommended. Communication, software, time management, and planning skills were deemed crucial. Quantitative results supported the value of real-world projects and skill development.

The internship exhibited several authentic learning characteristics: real-world relevance, knowledge articulation, expert scaffolding, and multiple perspectives. Sustained collaboration and complex problem-solving were less evident.

5. Discussion

This study provides evidence that virtual internships enable authentic skill-building and career clarity for graduate students. Practical applications, networking, tailored scaffolding, and reflection proved impactful. Participants agreed the virtual format allowed flexibility and real-world experience. Communication, industry tools, and time management were key development areas. Findings suggest virtual internships can provide meaningful preparation with authentic tasks and strong mentorship.

Intern perceptions aligned with literature-noted virtual internship advantages (Bayerlein & Jeske, 2018; Feldman, 2021). Over 80% of responses highlighted the value of practical projects. Mentor relationships offered critical guidance and support. The internship strongly exhibited the authentic learning characteristics of real-world relevance, knowledge articulation, expert scaffolding, and multiple perspectives.

6. Conclusion

This mixed methods study explored graduate student perspectives on a virtual IT internship's value, supports, preparation needs, and improvement recommendations. Findings revealed deepened workplace competencies, expanded networks, and refined self-concepts. With thoughtful design and mentoring, virtual internships can facilitate rich, accessible professional preparation. Additional research with larger, comparative samples across disciplines is recommended. Each participant's unique growth highlights the promise of online experiential learning for all.

7. Implications

To enhance virtual IT internships, programs should:

1. Require software proficiency or provide training access
2. Simulate virtual teamwork in courses
3. Offer professional skill workshops
4. Establish regular mentor check-ins with clear expectations
5. Proactively assess and address skills gaps

For practitioners, recommended supports include:

1. Providing clear project milestones upfront
2. Requiring intern progress reports
3. Conducting skills assessments
4. Encouraging feedback
5. Gathering post-internship evaluations

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E-LEARNING COURSES ON SUSTAINABILITY: TOOLS, ASSESSMENT AND VERIFICATION

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Abstract

E-learning courses on sustainability are essential for education in this field, encompassing various aspects of life and learning. This paper explores the significance of these courses, conducted at two universities in different countries, focusing on their creation, usage, and quality verification. Due to the subject's multifaceted nature, creating e-learning sustainability courses demands a holistic approach. To form a comprehensive educational program, it should integrate ecology, economics, society, and technology knowledge with didactic and pedagogical methods. The courses must be up-to-date, grounded in the latest scientific research, and tailored to meet the needs of a diverse audience, including students from various majors. A crucial aspect is the accessibility and flexibility of e-learning courses, enabling learning at any time and place. E-learning platforms should be user-friendly, fostering interaction and engagement through various activities such as hands-on exercises, online discussions, and progress tracking. A key component of e-learning sustainability courses is verifying content quality and teaching methodology. The verification process should assess the relevance of educational materials, the reliability of information sources, and the effectiveness of teaching methods. Furthermore, it is important to consider course participants' feedback through regular evaluations and surveys. Courses should be revised and enhanced if issues are identified or updates are required.

Keywords: *e-Learning, sustainable development, course assessment.*

1. Introduction

Sustainability is an important global issue that requires the involvement of different sectors, including higher education institutions, through research, education, and action. Another educational goal is inclusive education, which is now one of the priorities and standards promoted by the European Commission. One way of providing such education is through distance learning. Unfortunately, this is a very popular form of education that is not yet well standardized. E-learning combines teaching and communication technologies; its objectives and outline may vary depending on the related context and specific application. One explanation for this phenomenon may be the different degrees of combining these technologies, from classroom support to blended learning, distributed learning, and distance education (Carliner & Shank, 2008). As engagement increases, so does the demand for systems to support virtual learning, such as Learning Management Systems - LMS. Electronic or technology-assisted forms of learning are being used in various educational settings (Lau et al., 2014). New popular trends, such as massive open online courses - MOOCs and digital learning, make it even more challenging to standardize these activities.

E-learning has many benefits, such as time flexibility to adapt the learning schedule to individual needs and responsibilities, accessibility, regardless of geographical location - anyone can acquire knowledge and develop skills online, and personalization, adapting the pace of learning to individual needs (Al-Fraihat et al., 2020; Al Rawashdeh et al., 2021). Unfortunately, e-learning also has disadvantages, such as a lack of interaction and difficulties with self-motivation (Gherheş et al., 2021). Some learners find it difficult to learn independently and prefer traditional learning methods that provide direct contact with other people. The lack of direct feedback means that students must rely on automatic grading systems or wait for answers to their questions. This can lead to delays in learning and an inability to solve problems immediately. E-learning also limits the possibility of socializing and building relationships with other learners. For some people, social interaction is an important part of the learning process, and being unable to meet face-to-face can be disruptive. This was shown, for example, in an earlier study of two universities

in Poland and Norway (Fojcik et al., 2023). Another disadvantage may be technological limitations - E-learning requires access to a computer, a stable internet connection (Schleicher, 2020), and technically good materials. Any problems with audio or video quality or even technical issues can lead to interruptions in learning.

Higher education institutions have a special responsibility to shape future professionals. (Ferrer-Estévez & Chalmeta, 2021; Klačnja-Milićević & Ivanović, 2021). In recent years, knowledge of implementing a sustainability curriculum in higher education, campus practices, and outreach activities has expanded (Menon & Suresh, 2020). Other work has described pedagogical approaches to teaching sustainability in higher education (Seatter & Ceulemans, 2017). Through the thoughtful use of technology, universities can create more engaging, accessible, and student-centered learning experiences. Educators should introduce technology with forethought and a clear purpose to maximize the benefits while minimizing the drawbacks. However, despite the growing awareness of the importance of sustainability, there are impediments, such as a lack of resources and funding. Another difficulty is the traditional approach to education, which can make it difficult to create the necessary interdisciplinary cooperation. For this reason, it is important to recognize that sustainability is a cross-cutting issue that requires cooperation and commitment between disciplines and sectors (Otto & Becker, 2019).

2. Project goals

Since the emergence of various forms of e-learning, these modes have been used to spread sustainability (Corbeil & Corbeil, 2015). In the prepared scientific and didactic project, the main aim was to enrich the remote education offer for University WSB Merito students by preparing, in cooperation with Western Norway University of Applied Sciences (HVL), 10 innovative e-courses in English on the latest economic and social trends in sustainable development. The interdisciplinary topics of the courses highlight the innovativeness of the project, building greater awareness of students in the field of sustainable development, referring to the latest economic and social trends, and the flexible modular formula of the curricula for use in remote education, which can be easily integrated into curricula in a different way than before (e.g., the environmental course in the Management course, or the 'Wellbeing' course in the Computer Science course). The target beneficiaries of the project results will mainly be UWSB Merito and HVL students and teaching staff.

An initial audit before the project started revealed deficiencies in the UWSB's offer regarding compliance with inclusive education. As a result, the project developed 10 e-courses on topical, socially relevant topics for remote study, which can be flexibly used in the curricula of both UWSB Merito and HVL in different majors and specializations in a way that is convenient for any user (including disadvantaged people, e.g., disabled people, other people with limited possibilities to reach the university and attend regular classes for various reasons), which is in line with the idea of inclusive education. E-courses are prepared in the formula of "self-study" and constitute free open educational resources (Open Educational Resources, 2024) in an attractive graphic and multimedia form using various modern teaching methods and tools (e.g., short films, tests, or quizzes with the possibility of self-checking). As a result of the project, new technological solutions and teaching methods will be integrated into the course of academic education. Following an analysis of the situation, the current educational offer of both universities was analyzed, and by consulting lecturers and students, the following main conclusions were made:

- the e-course base needs to be updated to reflect the latest socio-economic trends, and their interface and format should be modernized in line with the latest standards,
- the highest possible quality of e-learning and its inclusive nature should be ensured,
- inclusive education should be built upon and promoted in the development of new learning materials, as current curricula are not sufficiently interdisciplinary,
- there is a need for more English courses, especially in subjects related to the functioning of international companies (IT, sustainability, management, logistics, etc).

In response to these findings, the subject areas of 10 e-courses were defined in correspondence with the fields of study, i.e., logistics, IT, finance, and accounting or management. The themes are:

1. Edu-Tech,
2. Fossil Fuel Free,
3. Work and mental,
4. Wellbeing,
5. No Trace,
6. Immersive Experiences: Blue Farming,
7. Smarter Living & Working,
8. Blockchain Ecosystem,
9. Deep Impact,
10. Machine Learning.

3. Course characteristics, structure and format

The e-courses were prepared using the "self-learning" formula, attractive graphics, and multimedia, such as short films, tests, or quizzes, to self-evaluate the student's progress. The production of the course used the latest technological solutions used in modern remote and face-to-face didactics, e.g., artificial intelligence, to render the lecture commentary (technical solutions and tools presented later). Consequently, the visually appealing, varied, and interactive nature of e-courses makes them more attractive.

Course authors from HVL and UWSB Merito followed similar general guidelines for course construction. The idea was to create a unified course model that would meet the functionalities and standards of the RES platform e-course and fulfill the educational objectives. The structure and preparation of the course consisted of preparing the initial assumptions on the course format, the method and type of student verification, and the method of visualization description. The courses were planned and created as 3 separate parts: substantive (scientific and pedagogical content), visual (interactivity, animation, chosen language, text), and matching with the educational platform present at the university. Subject matter experts prepared the content, and the E-learning department's visual was based on subject matter experts' guidelines. Matching involved adopting a common presentation format - SCRUM. All courses were adapted to the Moodle and OZE platform environment of UWSB Merito and the Canvas platform at HVL.

3.1. Format

The content of the course should be provided in PowerPoint and consist of:

- Introduction: presenting goals, agenda, planned learning outcomes,
 - 4 modules (40-50 slides each) - duration of approximately max. 2 h,
 - The total duration of the whole course: max. 8 h.
- Each module should include:
- Introduction to the topic of the given module,
 - 40-50 slides in total,
 - 6 test questions - self-assessment module, e.g., multiple choice or true/false. Other suggested forms are also acceptable,
 - Duration time: max. 2 h
- Other guidelines and covered:
- provide a recording with the commentary for each slide (or a written scenario for AI),
 - each slide should be described in detail, and additional audiovisual materials (graphs or diagrams, films, etc.) should be placed in separate folders with detailed instructions,
 - the entire course content should be delivered in English.

3.2. Thematic scope

The choice of topics for preparing the e-courses is relevant to the idea of the project, i.e., to provide education and promote the concept of sustainability. The thematic scope of the materials refers to the most important current trends related to sustainability - mainly how to create a work-life balance, take care of mental well-being, how and where to find alternative materials to plastics and switch to a closed-loop economy, how to use natural resources wisely, how to apply smart solutions in society or how to use technological innovations such as AI or VR in education.

The e-courses created aim to raise environmental awareness among students, change their perception of the world, rethink their individual approach to everyday choices and routines, and show how individual decisions affect the environment.

All e-courses can be used as distance learning or as a supplement to full-time education in various courses and specializations within the curricula - 30 hours and assigned ECTS credits - or as part of self-study. The target group of the e-courses is undergraduate and graduate students, including those with fewer opportunities, of both partner institutions, who have free unlimited access to the OER (Open Educational Resources) website.

3.3. Programs, software and tools

Designing visually appealing and engaging material is a long process that requires creativity and skill. Often, the biggest challenge is the right choice of graphics, animation, content visualization, and the whole concept for the presentation and digitization of the material. Ensuring that the course is visually appealing so that it does not look like mere slides is the most complex and time-consuming process. Animations and videos make the material much easier to understand, and the consistent design and intuitive user interface make the platform a pleasure to use. Features such as quizzes, drag-and-drop, open-ended

questions, and clicking on-screen items allow students to assimilate knowledge better. The subdivision into smaller sections makes it easier to absorb the material, and an additional narrator adds to the appeal of the course. The ability to use the table of contents and modules to control the pace of learning is important in a personalized approach to learning. E-course developers have also used other solutions to achieve interactivity and increase the attractiveness of the course:

- Elements that appear at different times, depending on what the narrator is saying
- Visually changing shapes
- Insertion of films and animations
- Inserting elements such as a slider, drag and drop, or icons for the user to click on
- Inserting text
- Inserting sound effects and a narrator
- Text appears from left to right (imitates writing)
- Grouping of subject threads
- Some elements that only appear when the user performs a specific action
- Navigation blocks or setting up navigation within slides and between slides
- Creation of tests and quizzes with visual and sound effects

Simply having the software does not mean being able to use it correctly and effectively. Thanks to a joint team of specialists who knew the strengths and weaknesses of the various tools, several different programs were used to achieve the most suitable effect for all the courses prepared. These included software tools such as PowerPoint, Apple Final Cut Pro, Apple Motion, Adobe Illustrator, Articulate Storyline, Animaker, Doodly, Revoicer, Canva, LeiaPix, DaVinci Resolve, Audacity, Paint.net, and Affinity Designer.

4. Testing and evaluation of selected e-courses by students

The final stage in developing all e-courses was the evaluation stage, i.e., testing two selected, earliest-developed e-courses by their target group of students. Participants in the evaluations of “Wellbeing” and “Immersive Experience. Blue Farming” had 101 students representing various fields of study: finance and management, engineering specializations, and English philology. The evaluation results will provide valuable material for improvements to the e-courses currently under development. They will also provide important guidance for universities in the long term in developing e-resources. Preliminary results obtained so far show student evaluations for the quality of the content, interactivity, and friendliness of the courses. It is planned to compare the different means (programs) used to prepare the courses.

Figure 1. Evaluation of the Wellbeing course.

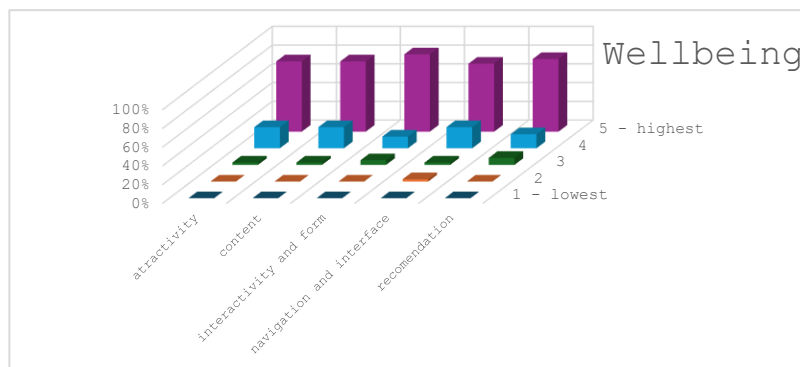
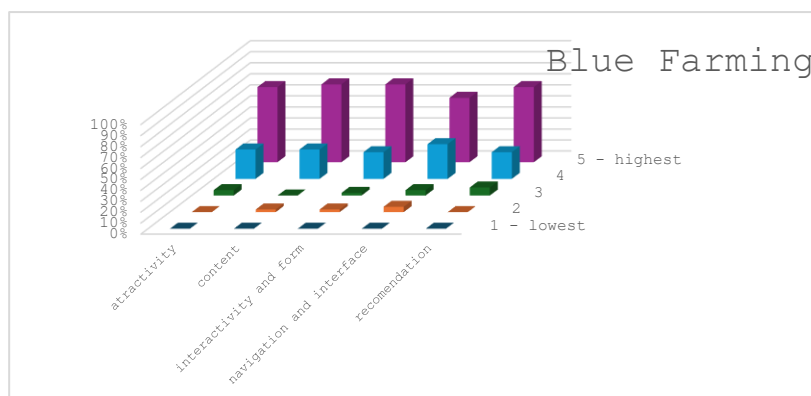


Figure 2. Evaluation of the Blue Farming course.



5. Discussion

Creating an engaging and effective e-course can be challenging, but with the right approach, it is possible to create an informative and enjoyable course for users. The following list of tips for e-course developers has been developed through experience:

- Define clear learning objectives: It is important to define clear learning objectives that are consistent with the course's goals and outcomes. This helps create relevant and meaningful content.
- Use of multimedia elements: Including multimedia elements, such as videos, images, and interactive activities, helps to keep students engaged and improve their learning experience.
- Accessible design: The e-course should be accessible to all students, including those with disabilities. This includes providing subtitles for videos and ensuring the course is compatible with assistive technologies.
- Peer collaboration: Encouraging collaboration between e-course authors can help them learn from each other and share knowledge and good practice, developing coherent courses.
- Regular feedback: Regular feedback to e-course authors and users is crucial. Authors' feedback is collected during the testing phase, allowing them to understand user expectations better and adapt courses to meet students' needs. Students' feedback can be provided through short tests, quizzes, and discussion forums to encourage interaction.

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TEACHER WELLBEING AND RETENTION: THE IMPACT OF RAPIDLY TRANSFORMING LEARNING AND TEACHING WITH DIGITAL TECHNOLOGIES

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Abstract

All students, worldwide, have the right to access high quality education. However, there are often many factors that can negatively impact on access to high quality education. In particular, many countries have reported the need for an increase in teachers to ensure that access to high quality educational learning experiences are maintained. This concern is reported in several studies across Europe and Australia where there is a growing concern focused on a shortage of teachers and an increased argument around the need for the retention of teachers once they are employed in schools. COVID-19 shed some light on education and the role of teachers, and often how resilient teachers were in transforming their existing teaching practices through the use of new and emerging digital technologies to better support students. This change was often referred to as emergency remote teaching and was witness to teachers needing to rapidly transform their learning and teaching with digital technologies. It is within this context that this paper explores the relationship between teacher wellbeing, the need for educators to rapidly learn new digital technologies and emergency remote teaching across six (6) European countries during Covid-19. This paper reports on the preliminary findings of a case study that involves a survey of 27 teachers and semi-structured interviews with three teachers, to capture the rich description of each of the participants. A qualitative thematic analysis of the data was conducted with two main themes emerging. These two themes were (1) time and workload, and (2) leadership and support. While the nature of the study is quite small, it still has the potential to contribute to current literature pertaining to teacher wellbeing and teacher retention within schools. As educational institutions continue to look towards new digital pedagogies and digitally transform current practices, further emphasis needs to be placed on the notion of teacher wellbeing and retention.

Keywords: *Teacher wellbeing, digital transformation, digital technology, leadership, emergency remote teaching.*

1. Introduction

There is no doubt that the role of a teacher is quite complex and challenging (Herbert et al., 2022; Nykvist, Mukherjee, & Blundell, 2022), however, this complexity can be seen to be amplified when teachers also need to use digital technologies to enhance and transform learning and teaching in a new context. Covid-19 added an additional layer to the challenges that teachers in schools and universities faced, especially as many went to a mode of emergency remote teaching, where they needed to rapidly respond to student needs (Carolan, Davies, Crookes, McGhee, & Roxburgh, 2020; García-Morales, Garrido-Moreno, & Martín-Rojas, 2021; L. Mishra, Gupta, & Shree, 2020). Prior to Covid-19 many teachers already found difficulties in using digital technologies to enhance and support learning and teaching and these difficulties have, in some cases, been associated with increased anxiety and workload amongst teachers (Henderson & Corry, 2021; Hu, Arnesen, Barbour, & Leary, 2019), hence having an impact on overall teacher wellbeing. There are multiple reports about shortages of teachers and the need to retain teachers (Symeonidis & Eloff, 2023). The wellbeing of teachers is a critical factor in the retention of teachers.

The term 'wellbeing' is used commonly within educational research, however, it is a term that is quite broad and difficult to define (Muir, 2019). Wellbeing can be defined as "interchangeably with other terms such as 'happiness', 'flourishing', 'enjoying a good life' and 'life satisfaction', all which have very

different interpretations and underlying meanings” (Carter & Andersen, 2019, p. 20). Though wellbeing can also be subjective in nature and is often described as subjective wellbeing (SWB) (Diener, 2000). In this sense each and every person would describe a positive sense of wellbeing in a different way. Promoting positive wellbeing no matter how it is defined or described is critical and there is a consensus that early intervention is the best way to achieve this (Fox et al., 2015). The research relating to wellbeing in education is often associated with mental health (OECD, 2017) and it is within this context that this study is situated. The significance of positive wellbeing is seen in the strong link between teacher wellbeing, student wellbeing and academic achievement (Schleicher, 2018). Research on the impact of Covid-19 and wellbeing in schools has largely focussed on student wellbeing (König, Jäger-Biela, & Glutsch, 2020; Tang, Xiang, Cheung, & Xiang, 2021) with some recent studies emerging on the impact on teacher wellbeing (Eblie Trudel, Sokal, & Babb, 2021; Vargas Rubilar & Oros, 2021).

Given the significance of teacher wellbeing and how rapidly many teachers needed to adapt and transform their learning and teaching during Covid-19, especially in terms of the use of digital technologies, there is a need for more research on teacher wellbeing. While Covid-19 saw a rapid digital transformation of learning and teaching, many schools were already transforming their learning and teaching prior to Covid-19 and this meant that some teachers were better prepared than others. Over the past decade or more educational institutions and governments have developed policies and undertaken large projects aimed at digitally transforming education (König et al., 2020; Steinar, Sara, & Siri Sollied, 2018; Tamim, Borokhovski, Pickup, & Bernard, 2015). However, according to Bisri, Putri, and Rosmansyah (2023) there is no established definition of what digital transformation means though there is some consensus that it refers to the use of digital technologies to improve teaching and learning. Langseth, Jacobsen, and Haugsbakken (2023a, 2023b) define digital transformation as a comprehensive organisational and strategic change that affects the entire organisation. They further posit that despite the importance of supporting teachers' entrepreneurial activities such as digital transformation, in large-scale projects, support is often lacking or inconsistent. Moreover, the lack of sustained leadership involvement further undermines the educational system's ability to adapt to rapid changes, leaving it ill-prepared for the challenges often associated with digital transformation.

While there has been a push for digital transformation in learning and teaching and that digital technologies have the potential to transform learning and teaching (Ertmer & Newby, 2016; Tamim et al., 2015), there is an argument that the full potential of digital technologies in learning and teaching has not yet been realised (Newman & Beetham, 2017). The use of digital technologies to transform education is “fraught with many challenges” (Nykqvist et al., 2022, p. 207) and it should be used purposely and not as a bureaucratic tool or for convenience where it has little positive impact (Haßler, Major, & Hennessy, 2016; Kirkwood & Price, 2014). It is within this context, where there was a rapid transformation of learning and teaching with digital technologies that this paper focuses on the impact that this had on overall teacher wellbeing.

2. Research approach

The study employed a mixed methods approach to answer the question, ‘how did teachers adapt their digital pedagogical approaches during the pandemic and what impact did this have on their overall wellbeing?’. Qualitative data was collected through a survey and semi-structured interviews, while quantitative data was collected through the survey instrument. The qualitative approach used in the research design was informed by grounded theory (Thornberg, 2012).

The data was collected from a survey of teachers (N=27) from schools in Norway, Germany, Poland, Portugal, Spain and the UK. Three (n=3) randomly selected participants were invited to participate in a 20-minute semi-structured interview. The semi-structured interviews were broadly focussed on three main questions.

1. What changes did you need to make to your current teaching practices during the COVID-19 pandemic (both pedagogically and technologically)?
2. What type of support and or resources did you receive when you needed to move to an online or hybrid mode of teaching?
3. Was there an increased workload associated with moving to an online or hybrid learning environment?

The interviews were transcribed and analysed to identify concepts, categories, sub-categories and how they relate to each other through a process of open coding (Corbin & Strauss, 2008).

A thematic analysis of the qualitative data was based on a descriptive phenomenological approach. This approach aims to draw out the rich data associated with the lived experiences of the participants and their environments (Sundler, Lindberg, Nilsson, & Palmér, 2019). Descriptive statistics were drawn from the quantitative data.

3. Findings and discussion

Two inter-related themes emerged from the data analysis. These were (1) time and workload, and (2) leadership and support. The themes are inter-related in nature as each can influence the other. In this section we will highlight the major findings relating to the themes and supported with relevant literature. The following quote from one of the teachers '*I am glad it's all over!*' is a testament to how many teachers were feeling during the emergency remote teaching that they had to undertake. The findings highlight the many challenges and lessons learned during the rapid digital transformation of learning and teaching during Covid-19.

3.1. Time and workload

All participants indicated that they were faced with many challenges moving to an online only mode of learning and teaching. They all reported that they spent considerable time preparing their classes and familiarising themselves with the affordances of the available technology. They had to constantly adjust their pedagogy according to their students and their home situation, which put a strain on their workload and well-being and overall family life in many situations. Consequently, teachers experienced high levels of uncertainty over a long period, which caused additional stress as they had to rapidly learn new ways of working and in many cases, learn new technologies. This impacted their ability to cope (Talbot & Mercer, 2018) as well as their work and family life balance (MacIntyre, Gregersen, & Mercer, 2020). We argue that all of the participants struggled with mastering the technological, pedagogical and content knowledge (as indicated by the TPACK framework (P. Mishra & Koehler, 2006), needed to design learning experiences when a disruptive digital context was introduced (emergency remote teaching). The working conditions also included large amounts of screentime and sitting, which put a strain on them both mentally and physically. Sensemaking and response to their situation was mainly an individual, and to some extent a collegial preoccupation, at lower levels in the school. The participants indicated that they had no authority to regulate their work conditions to reduce the added workload that they experienced. Hence, the notion of support and ultimately leadership in their schools comes to the forefront.

3.2. Leadership and support

Most respondents referred to support and leadership as lacking in quality and consistency. Leadership was rarely mentioned and often related to more administrative issues. Teachers mainly developed their professional digital competence independently in the context of their online teaching from home or informal collegial networks. Our findings suggest that a majority of teachers developed professional digital agency in a bottom-up approach to online teaching and learning. They all experimented with lesson designs, broadened their practice with available digital tools and developed a deeper understanding of the many pedagogical options and restraints in online schooling. These findings are in line with previous (non-pandemic) research about online schooling at the K-12 stages (Langseth et al., 2023b) in Nordic countries, where teacher digital agency led to transformation in the way schools were able to offer more flexibility in the choice of subjects and the form of delivery (online, blended or face-to-face) for students. The findings indicated that this rarely happened, and we speculate that this is due to a lack of leadership involvement in digital transformation prior to and during the pandemic. According to Snowden and Boone (2007), an event, such as Covid-19, can be described as a state of chaos, where leaders have to take immediate action (i.e. emergency remote teaching), and then proceed to build support by sensing and responding to the situation that teachers are experiencing.

The pandemic offered a limited space of time for leadership and management to learn from teachers' experiences to improve their leadership and adjust the educational system in the long term. The limited support by leadership and the reported lack of access to support resources (personnel and digital technologies) can be seen as contributing to stress and anxiety, hence impacting teacher wellbeing (Lambert, Boyle, Fitchett, & McCarthy, 2019). It is in this context that a distributed leadership model, in combination with coaching in schools, has the potential to better support teachers' overall wellbeing. Teams with complementary competences (teachers, resource teachers and middle-situated leaders) can potentially support teachers and inform leadership about actions in the short and long term in this complex domain (Sjovold, 2014; Snowden & Boone, 2007). The following quote from one of the interviews is indicative of how a number of teachers felt during this time '*Still to this day, there has been no recognition for the work or increased workload that we had to perform during COVID19 - no recognition of how I had to put my students before my family, no pay increase, not time off – nothing. I feel like teachers were just at the bottom of the food chain having to hold on to everything*'.

4. Conclusion

There is no doubt that digital technologies will play a substantial role in learning and teaching now and into the future, however, it is of utmost importance that the notion of teacher wellbeing is considered as schools embrace digital transformation and recognise that people are part of the process. There is a correlation between teacher wellbeing and teacher retention, and it is necessary to consider the two themes that emerged from this study: time and workload, and leadership and support. While the study has its limitations in the size of the participant sample, there is a need for further research in this area. Schools need to provide a safe and supportive environment that is not only conducive to learning for students, but also one that is focussed on teacher wellbeing, especially if they want to avoid teacher burnout and retain their teachers. The digital transformation of schools will continue, and the process is complex and requires all stakeholders to be aligned with the vision of the school, supportive of the process and the many challenges associated with such an endeavour.

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S.T.E.A.M. AND D.D.A.T.A.: A MULTISENSORY APPROACH TO MUSIC AND DEVELOPMENT OF SKILLS AMONG STUDENTS WITH INTELLECTUAL DISABILITIES

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Abstract

The Differentiated Didactic Approach to Teaching the Arts (D.D.A.T.A.) is a contemporary pedagogical method which proved thoroughly successful when applied to almost 300 students with intellectual disabilities, in five Special Needs schools and a private, Special Education unit. The learning facilities were located in two cities of Greece and the D.D.A.T.A. method was applied within the framework of those schools' music lessons. Combining the principles of D.D.A.T.A. with those of the Science, Technology, Engineering, Math and the Arts (S.T.E.A.M.) method, and learning Music from a multisensory pedagogical angle is an altogether new approach in international literature. By means of a series of sensors and controllers, multisensory learning can help people with intellectual disabilities to play music notes and generate music by touching conductive objects (S.T.E.A.M.). By using a computer under the guidance of a controller, and through a source of visual signals (D.D.A.T.A.) provided by the teacher, learners can arrive at the musical composition desired. In that manner, persons with intellectual disabilities can participate inclusively in an ordinary musical ensemble. The present work aims at recording the multisensory approach to Music via a combination of D.D.A.T.A. and S.T.E.A.M. Its purpose is to help learners with intellectual disabilities to develop their musical skills. The research was based on a methodology that relied on systematic observation within the framework of applying the above multisensory approach of teaching (D.D.A.T.A. & S.T.E.A.M.) to a group of middle school learners during the school music lessons, for a period of three months (Autumn 2023). In terms of both psychology and pedagogy, results were as spectacular as they were significant. The multisensory approach to Music through the use of D.D.A.T.A. and S.T.E.A.M. encourages learners to participate and improve their self-confidence, bolsters their self-expression skills, and helps them communicate and socialize. At the same time, learners acquire a range of kinetic and cognitive skills such as focusing their attention, and honing their perception, memory, and thinking.

Keywords: *S.T.E.A.M., D.D.A.T.A multisensory, music, intellectual disabilities.*

1. Introduction

The D.D.A.T.A. method (Differentiated Didactic Approach to the Arts) is a contemporary pedagogical method that has been successfully applied in Greece to almost 300 students with intellectual disabilities (Makris, 2022). D.D.A.T.A. emerged as a necessity through the clinical work (2014-2024) of Dr. Ioannis Makris (Makris 2015a; Macri & Makris, 2014a, 2014b, 2014c) and focuses on individualized (personalized) teaching. It cultivates the skills of learners with intellectual disabilities by utilizing their strengths and taking into account each one's specific needs and abilities. (Makris 2015a, 2015b, 2019; Makris & Mullet 2009; Mullet & al, 2012). It tailors lessons to each student's strengths and needs, allowing them to actively participate and develop musical skills. This approach emphasizes five key principles: (a) Individualization: content, methods, and activities are adapted to each student's learning style; (b) Multisensory Learning: sight, sound, and touch are engaged to lead to deeper understanding; (c) Positive Reinforcement: successes are applauded, fostering encouragement and self-confidence; (d) Collaboration: teamwork and peer support are cultivated; (e) Technology integration: digital tools enhance learning, creativity, and participation.

D.D.A.T.A. benefits learners by improving musicality, creativity, social interaction, self-confidence, and reducing anxiety. It can be implemented in Special Education schools, conservatories, and therapy programs, promoting inclusive and effective music education. Successful implementation requires collaboration among educators, parents, and specialists, ensuring a holistic

student support. Further, combining D.D.A.T.A. with S.T.E.A.M. (Science, Technology, Engineering, Arts, Mathematics) creates an empowering learning environment: (a) Individualized learning: technology is adapted to student needs during music activities; (b) Multisensory experience: visuals and touch enrich the musical experience; (c) Skills development: critical thinking, problem-solving, communication, and digital skills grow (d) Enhanced self-confidence: success in dealing with technology motivates students. D.D.A.T.A. with S.T.E.A.M. fosters holistic development and a smoother integration of learners with intellectual disabilities into the world of Music.

2. Design

Our research was carried out in the period September 2018 to December 2023. It is based on systematic observation during implementation of the multisensory approach mentioned earlier (D.D.A.T.A. with S.T.E.A.M.). It was conducted in three middle school (Gr: Gymnasium), 7th-grade classes, each in a different type of Special Education school in Athens, where we taught music for one hour weekly. We held an overall of fourteen (14) such classes. The total sample size is shown in Table 1 and comprises seventeen students. In the first Special Education Middle School (School 1), we implemented a combination of D.D.A.T.A. & S.T.E.A.M. in a 7th-grade class. In the 7th-grade class of the second Special Education Middle School (School 2), we carried out our session using D.D.A.T.A. only. In the 7th-grade class of the third Special Education Middle School (School 3), we conducted the music lesson in the conventional manner that Greek schools follow when teaching Music. More specifically: At School 1 (Peristeri EEEEEK), we applied the D.D.A.T.A. method using D.D.A.T.A. in combination with S.T.E.A.M. controllers, in a class consisting of students with significant learning difficulties. In School 2 (Ilion Special Education School), we implemented the D.D.A.T.A. method alone, using only visual cues, in a class of learners with mild learning difficulties. Last, in School 3 (ENEKY-L Ilion Special Education School), we conducted the music lesson in the conventional manner for learners with small learning difficulties.

3. Objectives

There were two objectives: (a) evaluate the effectiveness of D.D.A.T.A. when combined with S.T.E.A.M, and (b) evolve and improve existing teaching strategies and materials for use by the D.D.A.T.A. and S.T.E.A.M. combination. We evaluated the effectiveness of that combination with a view to assessing: (a) the developmental impact the D.D.A.T.A. & S.T.E.A.M combination had on the musical skills of learners with intellectual disabilities; (b) whether that multisensory approach to music bolsters the self-confidence, expression, communication, and socialization of intellectual disabilities learners; (c) the developmental impact of the method on the special needs learners' motor and cognitive skills (concentration, perception, memory, thinking); and (d) the results of our research efforts to record and analyze in detail the experiences of students with intellectual disabilities during their participation in the D.D.A.T.A. & S.T.E.A.M. project. We also aimed at: (a) comparing and contrasting the effectiveness of this method with that of other traditional music education methods for intellectual disabilities learners; (b) identifying any challenges/ difficulties faced by students/teachers during implementation with a view to developing and improving existing teaching strategies and materials already in use by the D.D.A.T.A. & S.T.E.A.M. combination so that we may more efficiently address the needs of intellectual disabilities learners; and (c) disseminating our research results to the broader educational community so that even more learners with intellectual disabilities may benefit (see Table 3, Objectives).

4. Methods

Data were gathered through systematic observation although legal restrictions did not allow for video recording. The methodology implemented involved three phases: (a) preparation (5-10 minutes) during which we held a reflective discussion with learners. In School 1, where we had four students with learning difficulties (Table 1), we briefly talked with the only student who could communicate through speech. It is worth noting that, early in that year, the three students who could not communicate had been engaged in other activities (e.g., painting, doing puzzles) and had taken no music lessons; (b) music interpretation (30 minutes) dedicated to music teaching and song interpretation; (c) reflection (last 5 minutes), focused on discussion and reflection. During the session, we closely observed the progress and development of each student, continuously making adjustments to improve both the technical and musical content. After the lesson, we recorded all of those observations keeping in mind the objectives we had already set (Table 3): observation and systematic recording were the key elements by which we could analyze overall progress.

We organized data analysis as follows. (1) Data: a spreadsheet was created, with columns per learner, observation date/time, observation category (e.g., preparation, music interpretation, reflection), detailed descriptions of observed behavior, and progress towards objectives (Table 3). (2) Category analysis: (a) preparation: content, time spent, and effectiveness in engaging learners were analyzed, and differences between schools based on student capabilities were examined; (b) music interpretation: student participation, level of interest, understanding song interpretations, and any technical challenges were analyzed; and (c) reflection: content and quality of discussion, student reflection on their progress, and any insights were analyzed. (3) Student progress analysis: (a) comparison of observations: trends in each student's performance across different phases and observations were identified; (b) monitoring progress towards objectives by comparing our observations to the set objectives (Table 3) in order to assess student achievement; (c) accounting for individual needs: the analysis was differentiated so that we may understand how individual learner differences (language skills, prior experience) impacted progress. (4) Overall effectiveness analysis focuses on: (a) combining student analysis by identifying common themes across all student observations so that we may gauge the teaching method's overall effectiveness; (b) areas needing improvement which, based on the analysis, we identified as areas in which the program could be improved in terms of content, delivery, or student engagement. The key findings of the data analysis were summarized and are included in the Results section.

5. Results

The results were impressive for School 1 where we implemented the D.D.A.T.A. & S.T.E.A.M. combination. Results were equally impressive for School 2, where only D.D.A.T.A. was implemented. More specifically: (A): At School 1 (the school with the most difficult cases), where the D.D.A.T.A. & S.T.E.A.M. combination was carried out, the students reached the point where they could prepare for their first public performance (March 21, 2024). After fourteen sessions, learners were able to function as a group and showed that their musical and cognitive skills had improved significantly. S.T.E.A.M. technology proved an additional incentive in their progress, as technology had made it possible to combine objects with sensors transforming them into musical instruments. Two of our learners handled the sensors while the other two played keyboards. (B): At School 2 (D.D.A.T.A. method only), despite the fact that we did not use the foot-operated, visual-cue generator and worked only with visual colored cues, progress was remarkable: students reached the point of being able to respond to a wide musical repertoire with astonishing promptness, just like the students at School 1. (C): At School 3 (the easiest cases), neither the D.D.A.T.A. nor the S.T.E.A.M. methodology was applied: we followed the classic, conventional teaching program. Student enthusiasm in participating dropped to such a degree that learners were not even interested in singing one single song as the conventional music teaching method did not foster a climate of team spirit as in the cases of Special School 1 (D.D.A.T.A. & S.T.E.A.M.) and School 2 (D.D.A.T.A. method only). All we observed at School 3 was the predictable cognitive progress of a typical student reacting to a conventional lesson.

6. Discussion

The usefulness of D.D.A.T.A. (Differentiated Didactic Approach in the Arts) and S.T.E.A.M. (Science, Technology, Engineering, Art, Mathematics) in music education for intellectual disabilities learners is reinforced by the research findings presented in this study that involved the three Special Education schools mentioned earlier. D.D.A.T.A., as cited in the works of Macri & Makris (2014), and Makris (2020), tailors teaching to the individual needs and abilities of each learner, ensuring equal access to music education (Macri et al., 2019). D.D.A.T.A. encourages active participation and autonomy of learners, contributing to the development of critical thinking, problem solving, and creativity (Macri et al., 2019), skills that are all too necessary for the 21st century (Makris, 2015a). That type of approach also contributes to the reinforcement of empathy, teamwork, and socialization (Macri et al., 2019), cultivating meaningful relationships and interactions that contribute to the learners' wellbeing (Peterson & al, 2008; Slavin, 2012). The D.D.A.T.A. & combination enriches music education with visual, tactile, and auditory stimuli, facilitating the understanding and assimilation of new knowledge (Macri et al., 2019). S.T.E.A.M. also contributes to the development of Science, Technology, Engineering, and Mathematics (S.T.E.A.M.) skills in an entertaining and engaging way (Macri et al., 2019), preparing students for the demands of the future job market (Makris, 2015a).

7. Conclusions

Our research highlights the benefits of D.D.A.T.A. and S.T.E.A.M. in music education for learners with intellectual disabilities. D.D.A.T.A. personalizes learning, while S.T.E.A.M. adds a multisensory experience. Together, they promote skill development, self-confidence, and holistic growth. Future efforts should focus on training educators, creating accessible materials, and ensuring program sustainability. This research paves the way to improved music education among intellectual disabilities learners.

Table 1. Schools.

	Case	Sex M: male F: female	Age	Prior Knowledge of Music	Verbal Communication	Non-Verbal Communication
School 1	1	M	12	None	Yes	Yes
	2	M	12	None	No	Yes
	3	M	12	None	No	No
	4	F	12	None	No	No
School 2	5	M	12	None	Yes	Yes
	6	M	12	None	Yes	Yes
	7	M	12	None	Yes	Yes
	8	M	12	None	Yes	Yes
	9	F	12	None	Yes	No (blindness)
School 3	10	M	12	None	Yes	Yes
	11	M	12	None	Yes	Yes
	12	M	12	None	Yes	Yes
	13	M	12	None	Yes	Yes
	14	M	12	None	Yes	Yes
	15	M	12	None	Yes	Yes
	16	F	12	None	Yes	Yes
	17	F	12	None	No	No

Table 2. Equipment.

	Technical Equipment	Music Equipment
School 1	Optical Signal Generators Operated by Foot Pedals, Laptop, Electronic Circuit for Converting Electrical Signals into Audible Frequencies (Notes), Conductive materials, Sensors	Two keyboards, Guitar, DAW Cubase VST, Tambourine, Daf (drum)
School 2	Visual, colored indicators	Two keyboards, Guitar, Tambourine, Daf (drum), Maracas
School 3		Guitar, Keyboard, Tambourine, Daf (drum), Maracas

Table 3. Objectives.

	Objective	Description
Evaluation of effectiveness	Developing Musical Skills	Assessment of the impact of the D.D.A.T.A. method in combination with S.T.E.A.M. on the development of musical skills in students with intellectual disabilities
	Improving self-esteem, expressiveness, communication and social skills	Exploring the potential of this particular multisensory music intervention to enhance: Self-esteem, Expressive abilities, Communication skills, Socialization
	Improvement of motor and cognitive functions	Measuring the impact of the method on the development of motor and cognitive skills, such as: Concentration, Perception, Memory, Cognition
	Recording of children's experiences	Recording and detailing the analysis of the experiences of students with intellectual disabilities during their participation in the program by combining the D.D.A.T.A. and S.T.E.A.M. methodologies.
	Comparison to traditional methods	Comparison of the effectiveness of the specific method with other traditional music education methods for students with intellectual disabilities

	Identification of challenges	Identification of any challenges or difficulties faced by students, teachers and/or educators during the implementation of the method
Development and improvement	Strengthening of teaching approaches and materials	Development and improvement of existing teaching strategies and materials used in the D.D.A.T.A. methodology in tandem with S.T.E.A.M. to better meet the needs of students with intellectual disabilities.
	Dissemination of results	Dissemination of the research results to the broader educational community so that even more children with intellectual disabilities may benefit.

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POTENTIAL OF HAPTIC FEATURES IN MOBILE LEARNING: A CASE STUDY BASED ON A LANGUAGE LEARNING APP

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Abstract

The landscape of mobile language learning has expanded significantly, fostering global connectivity through the widespread use of mobile apps. However, despite the increasing integration of haptic features into mobile devices and applications, their potential within mobile language learning apps remains largely unexplored. This paper aims to bridge this gap by investigating the impact of haptic features on language learning outcomes and designing respective exercises. In particular, the goal of this paper is to explore the integration of haptic feedback into an Android-based language learning app, considering its implications for improved learning outcomes, engagement, reinforcement of learning, skill acquisition, and inclusivity in app design. To achieve this, we designed and implemented a language learning app featuring three haptic exercises for vocabulary training: vibration-based repetition, clicking for memory exercises, and drag-and-drop interactions. These exercises are discussed in relation to their practicality using the Jetpack Compose library in Android and relevant literature.

Keywords: *Mobile learning, interactive learning, language learning, haptic feedback.*

1. Introduction

Advancements in technology revolutionized language learning, evolving from audio tapes over CD-ROMs to smartphones. Each leap enhanced performance and diversified learning tools. The shift from Computer-Assisted Language Learning (CALL) to Mobile-Assisted Language Learning (MALL) became a standard (Davies, 2023; Godwin-Jones, 2011). Mobile learning granted learners' flexibility, enabling study anywhere, anytime, and at their own pace, empowering individual progress. The rise of mobile apps, dominating various aspects of life, supported mobile learning, leveraging mobility and wireless technology for active education. These trends fostered global interconnectedness, offering unparalleled opportunities to explore diverse cultures and languages through mobile language apps (Miangah & Nezarat, 2012).

This resulted in a plethora of language learning apps on the market today. However, one area of research that is widely overlooked is how the inclusion of haptic features such as clicks, swipes, drags, or vibrations, affects language learning outcomes, especially when implemented in a mobile application. Such apps typically strive to enhance and enrich the user's learning experience by leveraging the latest tools and technologies available for mobile devices, such as speech recognition, the use of auditory media to improve pronunciation (Joseph & Uther, 2006), or even machine learning (Kumar & Goundar, 2023; Chen et al., 2020).

The lack of research in this field is surprising considering that the development of haptic technology and its use in mobile devices has been steadily increasing over the last decade, see (IDTechEx, 2023; Statista, 2023). Haptics are nowadays used in increasingly sophisticated ways not only in games and other types of mobile apps, e.g., through drag-and-drop features for moving objects, but also in the operating system of mobile devices, e.g., through vibration feedback in response to user interactions, such as a button click. As the trend of incorporating such features into mobile devices indicates further growth, the most beneficial ways of using haptics for improved outcomes in mobile language learning should be explored.

The goal of this paper is to provide an overview of the potential of haptic feedback in the context of mobile language learning and in extension mobile learning in general. We will show how haptic features can be effectively integrated into mobile language learning exercises on Android while considering the latest studies and theories on (language) learning to improve learning success (Liu et al., 2017; Mohammad et al., 2021). To investigate the impact of adding a haptic dimension to enhance the learning experience, we designed and implemented a mobile language learning app with three haptic exercises. The three exercises are: a repetition exercise that uses vibration as a haptic component, a memory exercise that uses

clicking as a haptic feature, and a drag-and-drop exercise. The exercises are discussed in terms of their practicability regarding the Jetpack Compose library in Android and the outlined literature.

The remainder of this paper is structured as follows: Section II introduces the use as well as advantages and limitations of haptic technology in educational contexts. Subsequently, Section III presents our design and implementation of a language learning app leveraging different haptic features. Section IV summarises the most important findings of this paper. Finally, Section V concludes the paper.

2. Haptic features to improve learning

Haptic technology for digital devices is a field of study that deals with the creation and manipulation of touch sensations in virtual or augmented environments. It is a bidirectional technology that facilitates the interaction between the user and these virtual representations by allowing them to apply force onto one another. This is analogous to our real-world interactions with physical objects as action-reaction pairs (Crandall & Karadogan, 2021). Haptic technology can be classified into two main types: tactile and kinesthetic. Tactile haptics refers to the stimulation of the skin receptors, such as vibration, temperature, or texture, while kinesthetic haptics refers to the stimulation of the muscles and joints, such as force, torque, or position (Liu et al., 2017).

Haptic technology has been widely used in various domains, such as gaming, entertainment, medicine, engineering, art, and education. In this paper, we focus on the application of haptic technology in education and learning, especially in the context of mobile devices. Haptic technology can provide a new human-computer interaction method, which allows the user to feel the motion and haptic information in virtual environments with haptic devices, and it is also a new kind of learning means (Liu et al., 2017; Crandall & Karadogan, 2021; Norouzinia et al., 2022).

2.1. Recent studies

The use of haptic technology in education and learning has been explored in various studies and theories. They have shown that haptic feedback can affect learning outcomes in different ways, such as engagement, motivation, reinforcement, performance, skill acquisition, accessibility, and inclusivity. For example, haptic feedback can increase the engagement and motivation of learners by providing a more immersive and interactive way of learning, which can stimulate their curiosity and interest (Liu et al., 2017, Hamza-Lup & Stanescu, 2010). Haptic feedback can also reinforce the learning outcomes by providing sensory feedback to the actions performed, which can help learners to consolidate their memory and recall. Furthermore, haptic feedback can increase the accessibility and inclusivity in learning apps by providing tactile input that can be felt by people with different abilities and preferences, such as visual or auditory impairments.

Several recent studies that in some form incorporate haptics base their work on the frameworks of cognitive psychology. In particular, the Embodied Cognition Theory (ECT) as proposed in (Atkinson, 2010) and the Cognitive Load Theory (CLT) developed in the late 20th century (Sweller, 2010) were mentioned in this context. The ECT assumes that sensory and motor systems have an impact on cognitive processes. More specifically, physical activity is suggested to positively influence the understanding of abstract concepts. Examples that support this theory are counting on one's fingers or rotating puzzle pieces to see if and where they fit. The idea behind this theory is that physical actions that accompany cognitive processes aid in freeing up cognitive resources, which in turn enables higher focus on the task at hand, since the working memory is not burdened to keep all information active at once.

This leads to the CLT, which proposes that the working memory only has limited capacities. Alternative expressions used for cognitive load are processing load or mental effort, and they each refer to the amount of work the working memory needs to deal with when met with a specific task. If the working memory's resources are exceeded, learning is suggested to be obstructed, or worse, prohibited. Therefore, the cognitive load should be considered in the design to achieve optimal results for learners.

The combination of the two theories leads to the assumption that the working memory may be able to offload mental processes onto the environment through physical actions of the body. Thus, it is speculated that the restrictions of the working memory may not pertain when it comes to processes that are supported by embodied actions (Crandall & Karadogan, 2021).

2.2. Studies focusing on mobile language learning

Although this phenomenon is not fully understood yet from a neurological standpoint, several studies have indicated positive results for language learning when haptic features were incorporated, which may be taken as supportive evidence for the discussed theories. For example, Xiong et al. (Xiong et al., 2013) conducted a study to investigate the results of haptic, visual and haptic-visual training methods for Chinese handwriting with French students by the aid of a tablet and a haptic arm. The best outcomes were

revealed for the haptic-visual group in terms of air time (i.e., pausing during writing) and overall performance. The researchers also found evidence suggesting that information provided only through the visual modality may aid in learning writing shape, while haptic information may support the skill transfer of shape learning.

Similarly, another study (Teranishi et al., 2018) explored the results of a haptic guidance system including a pen-like stylus designed to develop Arabic hand writing skills in participants unfamiliar with the language. The results showed the most effective method for this scenario to be partial guidance from the stylus, which encourages learners to draw actively on their own and only redirects by corrective force feedback if the reference trajectory has been exceeded too far. This is in contrast to full haptic guidance, where the learner is fully led by the system and follows the movements passively.

There is very limited research to specifically investigate the effects of haptic features in mobile language learning. In (Sheshadri et al., 2020), the results of a study on foreign vocabulary recall when learning was accompanied by free-form digital annotation on a mobile phone touchscreen are presented. Overall, participants showed better performance on tests when their learning process included free-form digital annotation compared to the control group, which was only presented with new words and their meaning, but they did not get the option of annotating. An additional objective of the study was to explore the influence of vibrotactile features during the annotation and encoding process, which was shown to have a significant positive impact on immediate free recall. In a similar vein, a systematic literature review of studies relating to mobile language learning apps in general was published in 2022 (Kumar & Goundar, 2023) which only amounted to a total of 47 studies. Yet, the authors proclaim mobile language learning to be an emerging field of research, and this paper shall be a hallmark in this direction.

The use of haptic technology in education and learning also faces some limitations and challenges, such as the cost and availability of haptic devices, the compatibility and interoperability of haptic software and hardware, the design and evaluation of haptic interfaces and interactions, and the ethical and social implications of haptic technology (Crandall & Karadogan, 2021; Ley & Rambukkana, 2021). Therefore, there is a need for further investigation and experimentation on how to effectively and efficiently integrate haptic features into mobile language learning apps, while considering the latest studies and theories on (language) learning.

3. Design of a mobile-language learning app

This section describes the Android mobile application “Kanji Memory” which we have designed and developed to facilitate language learning, specifically the acquisition of Japanese characters (kanjis), with English as a source language. The words, i.e., characters, used for this purpose were beginner level kanjis known to be part of the N5 level of the Japanese-Language Proficiency Test (JLPT), which is the first of five levels (JLPT, 2023).

The design of a mobile language learning app focuses on vocabulary training, which is reported to be the most common field of research in mobile language learning (Kumar & Goundar, 2023). We designed and developed this app for Android using Jetpack Compose. Jetpack Compose is the recommended toolkit for native Android UI development using Kotlin. Since its launch in July 2021, it has been steadily growing both in technical features as well as its community of Android developers who are using it daily. Jetpack Compose offers a quick and easy way to build screens in a declarative and straightforward way. In our “Kanji Memory” app, we implemented the following four exercises:

- A *scrollable* list of all items included in the three exercises. The list shows all kanjis and their respective English translation.
- A *Repetition* exercise with vibrational feedback where the user is shown a random kanji and a text field that the correct translation should be typed into. Regardless of the user input, the next random kanji will be shown as soon as the user clicks the “Check translation” button. If the answer was correct, a toast will pop up displaying a congratulating message, whereas it will show a message containing the correct translation if it was wrong. Additionally, the user receives haptic feedback via two different kinds of vibration patterns depending on the correctness of the answer. This exercise was intended as a spaced repetition system, where kanjis would reappear for translation after increasing intervals depending on when and how often they have been translated correctly.
- A *Memory* exercise, which was the first exercise implemented in this project. Upon entering the exercise, 10 clickable cards are shown across two columns, which contain 5 random kanjis and 5 matching translations each. To introduce a level of difficulty, the items are shuffled so as not to appear matched directly next to each other. Therefore, the user needs to identify and click the correct pairs of kanji and translation until each of them has been matched. Then, another set of 5 randomly shuffled kanji-translation pairs will appear.

- The aim of the *Drag and Drop* exercise is to match one out of five random draggable kanjis correctly with the translation shown as a drop target. Only if the correct kanji is dropped onto the translation, a new set of 5 random kanjis and one translation will appear. In either case, a toast will appear to let the user know whether the item was matched correctly.

The architecture of the “Kanji memory” app follows best practice standards in that several components are configured to manage the handling of data between the UI layer and the data layer, see (Android Developer, 2023). The main components of our architecture are: Room Database, KanjiRepository, ViewModel and User Interface.

4. Discussion

The exercises proposed in this paper vary in difficulty for learners, with the Drag and Drop exercise assumed as the easiest since only one out of five kanjis match with the translation it is to be dropped onto, and the number of possible attempts is infinite. Therefore, the exercise can be solved by process of elimination, which results in a maximum of 5 attempts for each set. Moreover, the user is provided with feedback via a toast message on each try. An improvement of this exercise could be the implementation of vibrational feedback as in the Repetition exercise. Furthermore, it could be designed to alternate between matching kanji to translation and matching translation to kanji.

The next level of difficulty would be the Memory exercise. While the process of elimination can also be applied in this exercise, the maximum number of attempts needed for this exercise is increased to 15. Although the cards appear greyed out upon being matched correctly, more visual feedback could be implemented for this exercise, such as a colour change upon selection. The study conducted by (Xiong et al., 2013) supports the notion of combining the visual and the haptic modality, which in this case is implemented via button click.

Finally, since the Repetition exercise requires active knowledge of the correct meaning of a word instead of passive recall, this exercise is deemed to be the hardest one out of the three. Upon entering a translation for a kanji, the user is provided with feedback both via a toast message and through vibration, which is used to signal a correct response in the form of a short effect, and an incorrect response through long vibration. Since (Sheshadri et al., 2020) found positive results for digital annotation while incorporating vibrotactile feedback, a next step to improve the Repetition exercise could be to incorporate digital annotation, for example by the use of an external library specifically designed to be able to draw on a Canvas in Jetpack Compose, such as provided by (Brysbart, 2019). Once combined with vibrotactile feedback, this exercise would correspond with the notion pointed out in (Sheshadri et al., 2020) that spaced repetition combined with vibrotactile feedback may lead to effective learning outcomes.

Future exercise implementations involving haptics and their research should also involve other areas of this field, i.e., listening, writing, pronunciation, grammar etc. for a more holistic language learning experience. Further, more varied, and complex exercises could be implemented, which may also include the use of different kinds of media, such as auditory, or AI components to allow for speech recognition. Additionally, the device’s motion sensors could be used, e.g., to learn directions. A possible implementation could be to show a direction word, i.e., front, left, right or back, and the goal is to rotate/tilt the device in the indicated direction. A next step toward further research in this field could be an evaluation of the exercises outlined in this paper or similar ones. For this purpose, (Nielson, 2023) recommended 40 test users for statistically reliable results from a user experience viewpoint, while (Brysbart, 2019) argued for much larger numbers in psychological studies to ensure a high-power statistical analysis, i.e., finding true effects that exist in a population. For example, (Brysbart, 2019) suggested a minimum of 52 participants for a repeated measures t-test and 200 participants for a between-groups comparison (100 participants for each of the two groups). A possible study design for repeated-measures could be to analyse the number of words that can be recalled after certain time periods, while a between-groups comparison could be achieved by having one group use the application as is, and one control group to learn kanjis in a different modality, e.g., only providing visual input of a word in the target language and its translation. Participants could then be tested on the learnt words, and their results compared for differences. Further, a mixed-design analysis of variance (ANOVA) could be executed to investigate both within- and between-subject differences, though this would lead to an even larger number of participants needed.

5. Conclusion

Haptic features can be used to create a more immersive and realistic experience for users. This technology can enhance mobile language learning by providing learners with different sensory modalities to interact with the learning content and environment. In this paper, we present an approach for implementing haptic features into a mobile language learning app. In particular, we implemented three

different exercises that support vocabulary training of Japanese characters with haptic feedback. Using Android Jetpack Compose the integration of such features is very straightforward. The haptic features implemented in the outlined exercises are not exhaustive. In future, additional exercises could be developed to also include swiping or scrolling, the latter of which was only used to display the list of kanjis and translations.

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ECODESIGN AS A NEW POSSIBILITY IN TEACHING TECHNICAL SUBJECTS IN SECONDARY SCHOOLS

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Abstract

The article's main goal is to provide a new tool for teaching technical subjects in secondary schools. Specifically, it is ecodesign as a systematic process of designing and developing a product, which, in addition to features such as functionality, safety, technical feasibility, etc., places great emphasis on achieving a minimal negative impact of the product on the environment, mainly from the point of view of the life cycle. Life cycle assessment (LCA) evaluates the environmental impacts of production, services and technologies. The LCA method is internationally recognised and can be applied in all spheres of human activity. LCA is used when comparing products and services, when planning processes in the field of the company's environmental policy, and when creating strategic plans in various industries. One of the fundamental and recognised factors that negatively affect our planet is global climate change, affecting not only stable global ecosystems but also human communities. The article uses studies prepared according to the international standard ISO 14040 Environmental management requirements. In the article's introduction, the product's production process is described as a system that is managed with respect to the environment. A manufacturing company must manage aspects not only of its own production and non-production processes but also aspects related to the impacts of its products throughout the entire life cycle of a specific product. In addition to the production phase, the life cycle also includes aspects of extraction of raw materials, purchase or production of materials, transport, distribution, logistics and the phase of product use, including preventive maintenance and subsequent disposal or recycling. The next part of the article summarises the theory on the integration of environmental aspects into the product design process using the ecodesign methodology. In conclusion, the article compares metal and plastic 3D printed products and considers the usual requirements for product properties such as functionality, quality, safety, price and appearance. The connection of ecodesign and environmental management systems is an effective implementation of a preventive approach to the identification of risks of products, activities and services and the subsequent setting of preventive measures, which will clearly show the students the importance of Ecodesign as a tool.

Keywords: *Ecodesign, sustainable development, life cycle assessment, recycling, 3D print.*

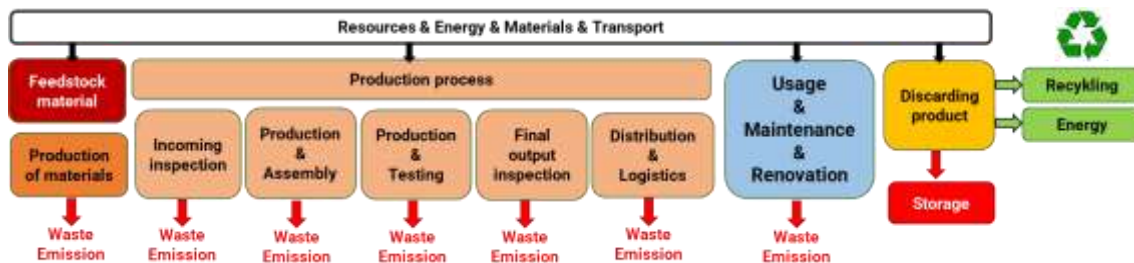
1. Introduction

Environmental education aims to lead to responsible behaviour towards the environment, living organisms, other people, and oneself. The key question is how to approach the teaching of sustainable development in schools and how to familiarise pupils with the topic. Here, we can encounter several problematic points. The first problem point may be the student's initial knowledge. It can be assumed that students have already heard about the theory of sustainable development and environmental management, but the constant question remains how extensive and deep the knowledge is. Another problem is the implementation of the theory of sustainable development and environmental management into study programs because sustainable development has an interdisciplinary character, and therefore, we must work simultaneously in areas such as economic, environmental, social, and cultural. Therefore, the main goal of the article is to provide a new way of teaching technical subjects in secondary schools. Specifically, it is Ecodesign as a systematic process of product design and development. Ecodesign is one of the very important preventive voluntary tools of environmental policy. Ecodesign, in addition to features such as functionality, safety, quality, technical feasibility, etc., places great emphasis on achieving a minimum negative impact of the product on the environment, mainly from the life cycle perspective. LCA is a method of assessing the environmental impacts of production, services and technologies.

2. Life cycle assessment of a product

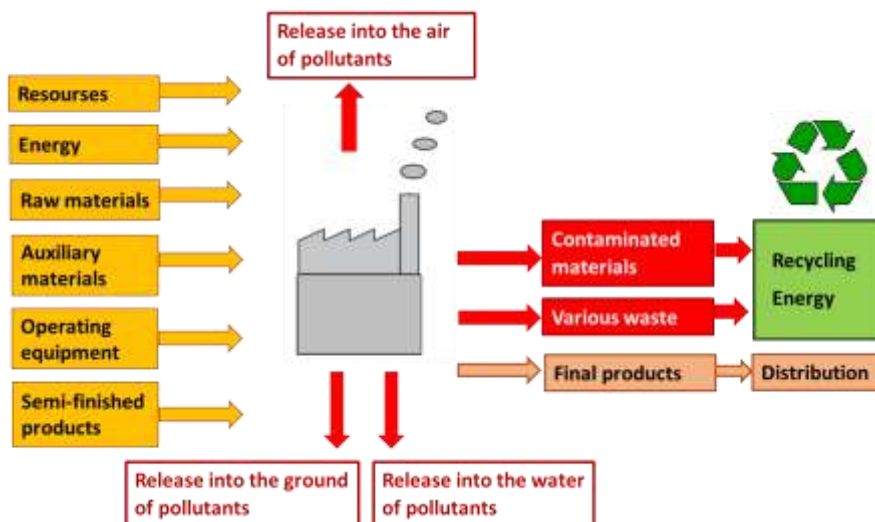
In the following part of the article, the teaching of the issue of sustainable development is demonstrated in the example of a comprehensive view of the general scheme of the production process, which is based on the concept of the product life cycle (Figure 1). This cycle does not start with production, but already at the stage of obtaining raw materials and materials. It continues with their transport, input control, processing in production, output control and subsequent packaging, selected transport and distribution of the final or semi-finished product. The life cycle continues with the preventive maintenance phase. In most cases, the life cycle ends with the disposal of the product at the end of its useful life.

Figure 1. General scheme of the production process, which is based on the concept of the life cycle of the product.



For most products, environmental aspects and impacts occur at all life cycle stages. Inputs and outputs at each stage of the product's life cycle are key to assessing these environmental impacts (Figure 2).

Figure 2. General scheme of inputs and outputs of an industrial company.



An educator using the goals of global education and a comprehensive view of the general scheme of the production process, which is based on the concept of the product life cycle (Figure 1 and Figure 2) and the use of active learning methods (for example, project and situational learning, experiential pedagogy, engaged learning) can draw up a sustainable development teaching plan. Considering the entire life cycle of a product allows students to obtain the following interesting information: an overview of all materials entering the life cycle; a description of all significant product features; familiarisation with the individual steps of production and processes; description of the environmental impact of intermediate products or auxiliary materials that are not part of the final product; understanding the function of the system within which the final product is used; identification of possible undesirable environmental impacts of the final product between individual phases of the life cycle.

3. Ecodesign – concept, goal, implementation

Ecodesign can be defined as a comprehensive concept of designing and developing products with the aim of reducing the number of negative impacts on the environment during the entire life cycle. By considering the environmental aspects of the products in addition to their standard properties such as functionality, durability, aesthetics, quality, safety, economy and ergonomics from the initial design phase, this approach aims to minimise the negative effects of products on the environment in the future. (Pigosso et al., 2010; Bertini et al., 2022).

The goal of the ecodesign concept is to reduce the product's negative impact on the environment in terms of its entire life cycle. It is important for students to realise that the main purpose of ecodesign is to find successful innovative solutions while simultaneously reducing the negative environmental effects of products. In this context, however, it is important to draw students' attention to the fact that ecodesign is not only an approach emphasising environmental issues in product designs, but also strives to introduce a global concept of the environment, which should ensure a systematic and comprehensive assessment of environmental impacts.

Ecodesign is a concept based on the principle of prevention, as it defines, based on analysis, the possibility of reducing potential adverse effects of the product even before its production. This principle is very important in the field of environmental standards and law, as environmental damage is often irreparable (Damohorský et al., 2010; Bundgaard & Huulgaard, 2023). Using a concrete example, it is necessary to explain to the students that due to the inclusion of dangerous and harmful substances in the composition of the product, subsequent recycling processes may be impossible, as such components prevent the reuse of the material. At the same time, it is necessary to show students a positive example of ecodesign, for example, if dangerous substances are not used during production, there will be positive effects immediately in two life stages of the product, which include using the product without health risks and another possibility is to use the material for recycling. As part of eco-design, it is important to analyse the product as well as logistics and infrastructure systems.

For a better presentation of the product life cycle to students, it is appropriate to divide the product life cycle into stages (Tab. 1). The first stage of conception and determination of requirements (e.g. customer, state) and includes, for example, the definition of requirements for quality, reliability, service life, safety. The next stage of design and development includes, for example, product design, material selection, creation of production documentation, prototype production, and sampling. Marketing and research can also be included in this stage, the results of which can be incorporated into the main phase. The main one is the production phase, and it includes, for example, serial production according to the documentation, delivery of materials from suppliers and performance of input inspection, performance of tests, establishment of rules for final inspection and issuance of a certificate of conformity, delivery of the product to the customer. In the operation stage, maintenance is important, which will extend the life of the products. The last stage is the disposal of the products and includes, for example, decommissioning, disassembly, and recycling.

The knowledge and skills of educators were defined for the individual stages of the product life cycle. For the students to be involved in the discussion, basic requirements for the student's knowledge were assigned for each stage of the product life cycle. At the end of the implementation of the project, newly acquired knowledge in the field of ecodesign and the product life cycle is expected.

Table 1. Educator's competency matrix for the presentation of the product life cycle to students

Stage Nr.:	Ecodesign process	Knowledge and skills of a teacher	Requirements for student knowledge	Newly acquired knowledge and experience
1.	conception and determination of requirements: the definition of requirements for quality; reliability; service life; safety; price	orientation in the standards and requirements of customers from various industrial sectors; knowledge of quality management; experience with financial analysis;	knowledge of the division of industry and its history; awareness of the role of work in our lives;	connecting the necessary knowledge from the field of quality to specific industrial sectors; basic knowledge of reliability theory - connecting technical issues related to construction and materials;
2.	design and development: product design; material selection; creation of production	knowledge of 3D modelling; knowledge of the basis of marketing and its role in product	knowledge of the structure and physical properties of substances; basics of technical drawing;	connecting the knowledge of the material engineering with technical documentation; knowledge of the role of

	documentation; marketing;	development; prototype production;		evaluating results of prototype production;
3	production phase: serial production; delivery of materials from suppliers; inspection and delivery of the final product to the customer;	knowledge of the importance of quality control of incoming material and final product in relation to the environment; overview of audit types;	knowledge of the classification of industries;	overview of the activities of production and non- production processes in a production company; knowledge of the setting production process;
4	operation and maintenance;	knowledge of the type of maintenance; basic maintenance rules; knowledge in the field of rationalization;	types of machines and equipment in households and industrial production companies;	knowledge of role of diagnostics and preventive maintenance using mathematical statistics;
5	disposal of the products: decommissioning; disassembly; recycling;	differences in the recycling of plastics, metal and other materials; carbon footprint of the product;	knowledge of basic waste sorting rules;	knowledge of sustainable development goals; knowledge of the principle and application of ecodesigning;

4. 3D printing technologies and developing creativity

The 3D printing process begins with design and modelling, followed by material preparation, printing, post-processing and quality control of the final manufactured product. If we compare the process of manufacturing a product on a 3D printer and a classic manufacturing process (for example, casting, forging, machining, pressing, extrusion, etc.), the technologies are different and related to this are also different requirements for the quality of the final product (Krotký et al., 2016; Böhm et al., 2023).

Table 2. Differences in the processes of 3D printing and standard production

Topic	Standard production	3D printing
Production method	Subtractive; Formative;	Additive
Production process	a) Transformation; b) Control quality; c) Transport & Storage;	a) Transformation; b) Control quality;
Production cycle time	Longer	Shorter
Materials according to production technology	Metals: Plate, Block, etc.; Plastics: Granulate;	Metals: Powder; Plastics: Filament, Tapes, Liquid Photopolymer;
Efficiency	Lower	Higher
Waste	Larger	Smaller
Human Recourses	Higher the number of various specialists	Deep knowledge of specific specialists
Life cycle	Longer	Shorter
Finance & Cost	Lower	Higher

This also gives rise to various rights and obligations in relation to the environment and waste management (Tomášková & Bícová, 2021; Bícová & Tomášková, 2022; Zhichao et al., 2016; Al Rashid & Koç, 2023). Some differences in the processes of 3D printing and standard production are shown in Table 2. When designing metal and plastic 3D printed products, safety, functionality and quality requirements are always taken into account. These requirements must always be in accordance with legislation and certain standards. An equally important requirement is the requirement for the appearance of the product, which is related to the intended use.

5. Conclusions

In environmental education, it is important to pay attention to the interconnectedness of seemingly different topics and to explain these connections even in areas that are very far away. Currently, an increasing number of secondary schools are observing the trend of implementing 3D modelling in teaching. More and more attention is being paid to this area, among other things, because

secondary schools are acquiring 3D printers for educational purposes. As the teaching of 3D modelling and 3D printing appears to be a very current topic, attention should be paid to this area at the level of the didactic theory of technical subjects. Future research will be devoted to preparing detailed mind maps for assessing environmental impacts according to inputs and outputs in each phase of the life cycle of a specific product. Mind maps will be linked to specific projects with defined goals, a described procedure, and clearly defined competencies and responsibilities of individual participants. Within these new projects, space will be created for creativity and originality, and this space will be accompanied by economic, environmental and social awareness.

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COLLABORATIVE LEARNING IN COMPUTER SCIENCE: A CASE STUDY OF CROSS-UNIVERSITY INTERDISCIPLINARY HACKATHONS

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Abstract

Interdisciplinarity as understanding of methods, objectives, and needs of representatives from other domains is increasingly expected from graduates in both computer science and legal professions. To promote these skills, a cross-university course concept in the field of Legal Tech was developed at the University of Vienna and the University of Applied Sciences FH Campus Vienna. Within the framework of the "Legal Tech Hackathon," law students from the University of Vienna and computer science students from FH Campus Vienna work in interdisciplinary teams on cross-disciplinary issues, supervised by academic experts and experts from the private sector. In this context, digital solutions for legal problems are collaboratively developed. Feedback and outcomes from this course reveal significant student engagement and satisfaction across both universities, with several startups emerging as a direct result. The course was also awarded with the highest national education award in Austria (Ars Docendi 2023). Furthermore, the success of this course concept has prompted its adoption in other educational settings, illustrating its potential to reshape professional development in the intersecting fields with technology.

Keywords: Collaborative learning, computer science, hackathon, higher education, legal tech.

1. Introduction

Higher education and Computer Science are changing fields as expectations for graduate qualifications evolve. The curriculum guidelines (ACM & IEEE, 2020) of the Association for Computer Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) aim to align specialist knowledge in Computer Science with contemporary trends. The qualification profile comprises both technical expertise and social skills. For instance, Computer Science programs are adapting to the field's expanding interdisciplinary nature and the increasing significance of Big Data and Artificial Intelligence. In terms of interpersonal skills, the focus is on teamwork, awareness of the needs of end users and understanding the domain of software solutions. Similarly, the Legal Sciences are experiencing parallel advancements. In this domain, there is a growing emphasis on fostering interdisciplinary collaboration and the understanding of methods, objectives, and requirements of representatives of various professional domains. Students increasingly need to be able to react quickly, methodically, and convincingly to challenges from other disciplines. Consequently, proficiency in Computer Science and digital skills are becoming increasingly relevant.

As technology continues to intersect with legal frameworks, there arises a critical demand for professionals who possess the ability to seamlessly navigate and integrate insights from both domains (Dudchenko et al., 2023). An annual survey conducted in the Austrian legal sector (Martinetz, 2023) emphasizes the increasing importance of technology in the legal sector, particularly in providing efficient services and retaining talent. It highlights that legal departments are seeking automation and digitalization to streamline repetitive tasks, freeing up time for more complex matters and enhancing client service. The study also shows that the problems law firms have in adopting new technologies are often due to a lack of technological knowledge, including a lack of IT-staff or IT-expertise and limited knowledge of available technologies. However, traditional siloed approaches to education no longer adequately prepare students for these multifaceted tasks. In contrast, cooperative, collaborative, and interdisciplinary learning environments offer a compelling alternative, providing students with opportunities to broaden their perspectives and develop new ways of thinking. By engaging with peers from other disciplines, students are exposed to fresh insights and different viewpoints, enriching their understanding of complex and

interdisciplinary topics. Furthermore, collaborative learning environments foster the appreciation of diverse skill sets, personalities, and social dynamics within a team-based setting.

Hackathons are a promising setting for such a cooperative learning environment. Originating in the field of software development in the early 2000s (openBSD, 2024), hackathons are innovation-promoting and problem-oriented brainstorming events where people come together to rapidly develop prototype applications in a brief period (Falk et al., 2022). This format has proven effective for both refining commercial products and exploring creative solutions to existing problems. While such collaborative efforts were once rare in legal circles, the advent of Legal Tech—marked by the increasing automation and digitalization of legal processes—has catalyzed a rise in similar events within the legal context. These gatherings aim to generate novel ideas within the legal information market and swiftly assess the legal implications and potential of new concepts. These gatherings serve to foster creativity within the legal information market, facilitating the rapid assessment of legal implications and the exploration of new concepts.

To promote previously mentioned skill sets in an engaging learning environment, a cross-university course concept in the field of Legal Tech was developed as a cooperation between the University of Vienna and the FH Campus Vienna. The “Legal Tech Hackathon” has been held annually since 2018, at which law students from the University of Vienna and Computer Science students from FH Campus Vienna work on digital solutions to legal problems. During the course, students work in interdisciplinary teams on interdisciplinary issues, supervised by scientific experts and private sector experts.

The learning environment “Legal Tech Hackathon” pursues the following goals: To promote interdisciplinary and project-based learning, the practical application and consolidation of acquired theoretical knowledge and technological skills, entrepreneurial thinking in students, the combination of basic scientific and application-oriented skills, and an understanding of the Austrian and European legal information market.

The results and evaluations of this course show a prominent level of commitment and satisfaction among the students at both universities. Notably, the course has catalyzed the establishment of numerous start-ups. Furthermore, its innovative concept has been adopted in several other academic programs.

2. Design and didactic setting

The joint “Legal Tech Hackathon” is intended to strengthen the perception of Legal Tech among Computer Science students and to create awareness of the associated potential for cooperation between prospective lawyers and computer scientists. The following subchapters present the corresponding design and didactical setting of the “Legal Tech Hackathon” providing a brief overview of course learning objectives, course structure and implementation of the course.

2.1. Learning objectives

The course's learning objectives were developed aligned with the curriculum guidelines established by ACM and IEEE (ACM & IEEE, 2020). The acquisition of skills in this course focuses on the ability to work goal-oriented and cooperatively within interdisciplinary teams. This includes proficiency in organized planning, effective time management, facilitating communication among team members, and transferring knowledge across domains to collaboratively develop a usable product. The students will also gain competence in conducting an initial legal assessment of the legal opportunities and risks associated with a product idea. Furthermore, students will learn to record, document, and analyze interdisciplinary requirements, as well as translate these requirements into an implementable design within a structured process. Additionally, they will develop the capability to merge basic scientific skills with application-oriented skills. Moreover, students will gain insights into and be able to explain the dynamics of the Austrian and European legal information market. They will also comprehend and elucidate the cross-domain implications of the implementation process. Finally, students will be equipped to classify final projects within a multi-professional industry environment and present them to an interdisciplinary jury.

2.2. Course structure

Due to the interdisciplinary and inter-university character of this course, it is held at two locations, the University of Vienna, and the University of Applied Sciences FH Campus Vienna, and divided into four phases. It starts with a Kick-off event at which students from both universities meet for the first time, followed by the online collaboration phase characterized by activities such as brainstorming and team building. The actual hackathon lasts 2 days, each day from 9:00-21:00 or until the tasks are completed and is concluded with the final presentations (pitching) approximately one to two weeks after the hackathon.

In addition to the participating students, numerous interested representatives from companies, start-up initiatives and institutions with a focus on Legal Tech are always invited and actively engaged at the Kick-off event. Due to Covid-19 regulations in 2020 and 2021, the complete Legal Tech Hackathon event transitioned to an online format. To continue to enable the lowest possible threshold for access by external experts, the Kick-off event has since been held in hybrid form. This format allows for both onsite attendance and remote participation, accommodating individuals unable to attend in person due to scheduling constraints or other reasons. However, Happonen, Tikka et al. (Happonen et al., 2021) and our own observations showed that a hackathon in an online format has disadvantages compared to an on-site format. Therefore, after the end of Covid-19 restrictions, we moved the actual hackathon back to an in-person format.

During the Kick-off event, external company representatives provide concise overviews of implemented Legal Tech projects and suggest potential project ideas for the hackathon. This brings clarity to the abstract term "Legal Tech", which is often still vague for students. Subsequently, dedicated time is allocated for interactive discussions among students, company representatives, and lecturers. This collaborative exchange facilitates the exploration of first project ideas and the formation of project teams. The project tasks assigned to students are intentionally designed to be open-ended. They are tasked with addressing key questions related to their Legal Tech ideas, such as: *How can technology enhance legal processes beyond current capabilities? In what ways and platforms can technology improve accessibility to legal services? What innovative startup concepts have the potential for realization within this domain?* After the Kick-off, the online collaboration phase begins. All participants of the hackathon will be provided with access to an online platform dedicated to sharing project ideas and forming groups. This virtual phase typically lasts five to eight weeks (depending on the timetables of the University of Vienna and FH Campus Vienna). Throughout this period, students can engage with external experts and lecturers from both institutions via the online platform. Before the hackathon starts, students must form interdisciplinary teams comprising lawyers and computer scientists. Each team may consist of a maximum of four computer scientists, with an equitable distribution of law students across all teams. The final team allocations are determined at the outset of the hackathon.

Presently, participation is limited to 20 law students and 20 computer science students. However, in response to increasing demand, plans are underway to increase participant numbers in the coming years. The hackathon spans two full days and commences with a collaborative brainstorming session. During this session, students present project ideas, with opportunities for additional input from lecturers and external experts as needed. Experience has shown that most teams have already grouped around specific project ideas at this point. The presentation and brief discussion of project ideas ensure each team pursues a distinct project with sufficient innovation. Besides that, there are no constraints imposed on the development of project ideas or the associated functional prototypes, including the technologies employed.

Each team operates akin to a startup entity. Consequently, teams are tasked with developing business cases for their project ideas, conducting market research to assess existing, similar implementations on the market, and conducting legal evaluations of their projects.

In addition to potential competition from existing products on the market, teams must consider and address all legal implications of their solutions, such as trademark protection law and compliance with the General Data Protection Regulation (GDPR). Throughout both days of the hackathon, students regularly present and defend their projects' status. Furthermore, to promote cross-domain knowledge transfer, a role reversal occurs during one of these presentations, wherein students from one domain present the other aspect of the project; for example, law students may explain the technical aspects, while computer science students expound on the legal facets. The external experts and lecturers accompany the hackathon both on site and asynchronously online via the collaboration tool to provide guidance and support.

After the two hackathon days, the students have one to two weeks (depending on the timetables of the two universities) to consolidate their projects and presentations.

The course ends with the final presentations (pitching) and defenses of the project teams in front of a cross-domain jury made up of lecturers from both universities and selected external experts. The students present their projects within a specified time frame. The pitch needs to encompass various aspects of the project. This includes discussing the business model, addressing all relevant legal implications, presenting the technological implementation which should include a demonstration of the implemented prototype, and providing an outlook on the potential real-world implementation in the market, considering aspects such as feasibility, legal compliance, and technological extensibility as well as scalability.

Afterwards, the project pitches are evaluated based on several criteria. These include the level of innovation demonstrated, the viability of the proposed business model, the thoroughness of all relevant legal aspects, the degree of technological complexity and the maturity of the prototype.

The learning outcomes are assessed separately for each domain or university. The winning team will be given the opportunity to present the project at specialist conferences and/or interviews on social media channels (Forgo 2022). In addition, start-up support will be offered by the University of Vienna and FH Campus Vienna for any planned implementations. Three projects (2018: "RIS+", 2020: "NetzBeweis", 2022: "myLegalMatch") have so far been continued as start-ups after the "Legal Tech Hackathon" (Eberstaller, 2024; Bisset, 2020).

3. Course evaluation

A total of 258 students have taken part in the "Legal Tech Hackathon" since it was first held in 2018. Of these, 118 were Computer Science students and 140 were law students. Each year the course was evaluated by the students using the standard evaluation tools available at both universities. In addition, in 2018 the Teaching Support Centre at FH Campus Vienna conducted a survey among the participants. In the survey, the points "I was able to improve my problem-solving skills", "The task promoted collegial cooperation" and "The task promoted my understanding of interdisciplinary work" were rated particularly high. The overall assessment at FH Campus Vienna, i.e., the mean value across all questions, except for the question on personal commitment, was 91% (excluding the year 2024, as the course had not been completed at the time this paper was finalized). The basic idea of the course was particularly emphasized in the evaluations. *"It was motivating and inspiring because it was innovative and interesting. It was fun to work together with students from other universities and programs. The diversity of backgrounds and perspectives has enriched the collaboration and led to an interdisciplinary learning environment."*

The feedback from both students and industry experts is used to continuously improve and develop the hackathon so that it is adapted to the changing needs of the participants, but also to new technological challenges.

By involving company representatives and external experts from the legal tech sector, the course also serves as a direct interface to the job market. The concept of the hackathon can be done on site, hybrid or online. In the summer semesters of 2020 and 2021, the "Legal Tech Hackathon" was held exclusively online due to existing lockdowns. The knowledge gained from this was incorporated into the hybrid format in 2022. Although a hybrid mode allows more flexibility for all participants, in the last two years it was again limited to the participation of legal experts. The dynamics and interdisciplinary exchange among the students are significantly higher when they are present at the hackathon on site. Nevertheless, the provision of collaborative online tools enables interdisciplinary exchange between students, lecturers, and external experts, regardless of location and time.

We are particularly pleased that the "Legal Tech Hackathon" has also been recognized beyond the two universities and was awarded the Ars Docendi State Prize for Excellence in Teaching by the Austrian Federal Ministry of Education, Science and Research in 2023 (BMBWF, 2023).

4. Conclusion and future work

The intersection in form of a hackathon between computer science and legal sciences presents an evolving landscape where traditional silos are being dissolved to make way for interdisciplinary collaboration and innovation. As the demands of contemporary industries evolve, so must the skills and competencies of graduate students. The "Legal Tech Hackathon" emerges as an innovative approach, to bridge the gap between law and technology by fostering a collaborative learning environment. Through the hackathon, students from diverse backgrounds converge to tackle real-world challenges, leveraging their respective expertise to develop innovative solutions in the sector of Legal Tech.

The success of the "Legal Tech Hackathon" inspired the inception of similar hackathons in other courses. Recognizing the transformative potential of collaborative learning environments, faculty members from various disciplines have embraced the hackathon model to foster interdisciplinary collaboration. The "Advanced Software Development" course in our master program "Software Design and Engineering" uses a hackathon event supplanting traditional examination methodologies. Similarly, the "Mobile App Development" course in the bachelor program "Computer Science and Digital Communications" has integrated a condensed iteration of the hackathon format, functioning as a design thinking workshop to expedite the ideation phase of mobile app projects, subsequently facilitating their implementation over the duration of the course. Additional events have already been successfully executed, such as a "GameJam" where students developed a complete game within two days. The "GameJam" also featured workshops and support from industry experts who provided invaluable insights and assistance to the students. Another notable event was a "Makerthon" conducted in collaboration with the bachelor program "High Tech Manufacturing". This event focused on using embedded devices, 3D printing and other rapid prototyping methods to create functional prototypes. These events not only enhance technical and creative skills but

also promote practical problem-solving and teamwork, reflecting the interdisciplinary approach initiated by the "Legal Tech Hackathon."

For future work, there are several possibilities for further development and enhancement of the "Legal Tech Hackathon". Firstly, scalability and broader engagement could be considered. As interest in interdisciplinary learning grows, there is a need to expand the hackathon to accommodate a larger cohort of students. Exploring opportunities for international collaborations and exchange programs represent another promising avenue for future development. By forging partnerships with institutions abroad, the hackathon can offer students the opportunity to engage with diverse perspectives and legal systems, enriching their learning experience and broadening their global outlook.

The success of the "Legal Tech Hackathon" is evident not only in the satisfaction of participating students but also in the tangible outcomes, including the establishment of numerous start-ups and the adoption of the hackathon model in other academic courses and programs.

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MECHANICS AND THE HUMAN BODY: HANDS ON AND SIMULATION APPROACH TO MEASURE DELTOID FORCE

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Abstract

We report the combined use of hands-on activities and the effective use of simulations in physics education. The importance of this work is more significant than other research done in the past as this is focused on mechanics and the human body, a less explored field in college-level physics courses. While physics and mechanics typically find more prominent applications in well-established areas like engineering, they play a crucial role in elucidating the physics governing human body motion. Nevertheless, interactive physical models of the human body that help in physics education are not widely available. Our long-term goal is to create less sophisticated, more accessible demonstrations and dynamic animations to fill this gap in pedagogical tools relating to the human body. This study focused on forces applied to the deltoid muscle when lifting a load. We examined these forces in static equilibrium by combining animations and a life-sized model arm. The model was printed out mainly using PLA in a 3D printer. Given the intricate nature of the human arm, we made necessary approximations to understand the associated torque and rotational dynamics around the shoulder joint. Our study involved measuring the response force of the deltoid muscle as a function of the load force. In order to validate our experimental data, we created an animation using GeoGebra. The link to the animation was shared with the students, and they were encouraged to explore the simulation by changing the parameters: length of the arm, the weight of the person, and the weight of the lifting load. In a two-semester study with control groups, we evaluated the effectiveness of the physical arm model and the animation on students' understanding of torque. Positive user feedback and successful results were obtained from classes where both tools were tested.

Keywords: *Physics education, pedagogy, mechanics and human body, deltoid force.*

1. Introduction

In physics education, exploring effective instructional methodologies has always been a driving force for educators and researchers alike. As we navigate the complexities of disseminating knowledge in physics, it becomes increasingly evident that a multifaceted approach - including hands-on activities, in-class demonstrations, integrating other pedagogical tools like interactive simulations and animations - is necessary to unlock more a profound understanding and engagement among students. In this paper, we briefly discuss the critical role played by these educational strategies and try to fix the disparities in their accessibility, particularly in diverse areas in physics.

Hands-on activities provide students with a tangible and experiential understanding of abstract concepts, fostering a connection between theory and the physical world. In-class demonstrations, on the other hand, serve as powerful visual aids, allowing students to witness complex phenomena in real-time and enhance their comprehension and retention of subject matter. Not limited to physics, integrating interactive simulations and animations as discussed in [Price et al. (2019); Perkins (2020); Adams et al. (2008)] to any field of study amplifies the learning experience. They provide a virtual laboratory experience for students to explore concepts that may be challenging to replicate in real-life settings. We note that they were immensely beneficial during, and immediately after, the COVID era.

However, the availability of these pedagogical resources is not uniform across all branches of physics. Engineering physics often enjoys a plethora of hands-on tools and simulations (Mohottala et al., 2023; Phet, 2008; Ophysics, 2002) that cater to the specific needs of their curriculum. In contrast, areas like medical physics, face unique challenges. The lack of resources - both physical and digital - tailored to these specialized fields hinders the ability of educators to equip students with comprehensive and immersive learning experiences.

In this paper, we examine one of the problems we discuss, related to the deltoid force, in a Mechanics and Human Body course. We highlight the significance of bridging gaps and ensuring that every student, regardless of their chosen field within physics, can benefit from the rich tapestry of educational resources available. The role of technology in enhancing learning is emphasized, and we discuss its potential advantages. However, we approach its integration cautiously. Despite the positive advantages, we are mindful of the potential drawbacks, such as the risk of becoming a costly distraction or obstructing effective education. Our experience so far has been to take a hybrid approach, and this study is an extension of it.

2. Background

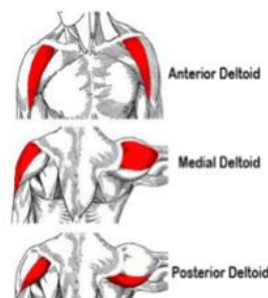
The primary objective of this paper is to enhance students' comprehension of the connection between the force applied to the deltoid muscle during object lifting and the equilibrium dynamics of the human arm. While the human arm constitutes a complex system, our emphasis, as physics instructors concentrating on the mechanical aspects, does not extend to delving into intricate anatomical details. Nevertheless, we offer a brief overview of the human arm's structure to facilitate a broader readership understanding.

2.1. Deltoid muscle structure and function

The deltoid muscle is the superficial muscle of the shoulder, which gives its characteristic shape and contour. It is called the deltoid muscle because of its triangular shape that resembles the upside-down capital Greek letter Delta. The deltoid muscle is divided into three parts based on their origin: the anterior (clavicular) fibers, the lateral (acromial) fibers, and the posterior (spinal) fibers, as shown in *Figure 1*. The deltoid's anterior fibers (anterior head) originate from the superior aspect of the lateral third of the clavicle. The medial fibers (medial head) originate from the acromion process of the scapula, while the posterior fibers (posterior head) originate from the inferior edge of the spine of the scapula. All deltoid fibers converge (join), forming a short tendon that inserts at the deltoid tuberosity of the lateral aspect of the humeral bone.

The anterior fibers cause shoulder flexion and medial rotation of the humerus, whose fibers work synergistically with the pectoralis major muscle in arm flexion during walking. The posterior fibers cause the arm's extension and the humerus's external rotation; they work together with the latissimus dorsi in arm extension when walking. The deltoid muscle does not initiate the shoulder abduction due to the pulling force being parallel to the humeral axis; the supraspinatus muscle initiates that movement. The medial fibers of the deltoid muscles arising from the acromion are powerful abductors and assist in shoulder abduction from angles measured from the vertical ranging 15° to 100° in the counterclockwise direction (Elzanie, & Varacallo, 2023). In this study we focused on the force of deltoid medial fibers.

Figure 1. The deltoid muscle is divided into three parts, based on their origin: the anterior (clavicular) fibers, the lateral (acromial) fibers, and the posterior (spinal) fiber (Socratic Q&A, 2023).



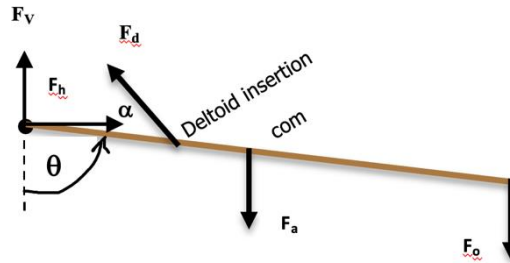
2.2. Physics equations

The Figure 2 shows the arm making an angle of θ with respect to the vertical as shown in the diagram. The forces, F_d , F_a and F_o represent the force on the deltoid muscle, weight of the arm and the weight of the lifting object. The F_h and F_v are the horizontal and vertical force components acting on the rotating cuff of the shoulder.

At a given angle θ , where $15^\circ < \theta < 90^\circ$, we consider the static equilibrium of the arm, where net force and torque are zero. That is, $\Sigma F = 0$ and $\Sigma \tau = 0$. The angle of the deltoid force with the arm is taken as α .

$$\begin{aligned} \Sigma F &= 0 \text{ and } \Sigma \tau = 0 \\ \Sigma F_x &= 0 \text{ (by taking the arm as the x axis)} \\ F_h \cos(90 - \theta) - F_d \cos(\alpha) + F_a \cos(\theta) + F_o \cos(\theta) &= 0 \\ F_h \sin\theta - F_d \cos(\alpha) + F_a \cos(\theta) + F_o \cos(\theta) &= 0 \\ F_h &= \frac{F_d \cos(\alpha) - F_a \cos(\theta) - F_o \cos(\theta)}{\sin\theta} \quad \text{---- (1)} \end{aligned}$$

Figure 2. shows the force diagram of the arm at equilibrium.
The angle θ is measured with the vertical and for this study, it was set at 90° .



Also,

$$\begin{aligned} \Sigma F_y &= 0 \\ F_v - F_a - F_o + F_d \sin(90 - \theta + \alpha) &= 0 \\ F_v &= F_a + F_o - F_d \sin(90 - \theta + \alpha) \quad \text{---- (2)} \end{aligned}$$

Considering the rotational motion, with static equilibrium conditions.

$$\Sigma \tau = 0$$

Here we consider the shoulder cuff as the axis of rotation.

$$\Sigma \tau = \tau_{F_h} + \tau_{F_v} + \tau_{F_d} + \tau_{F_a} + \tau_{F_o}$$

As both F_h and F_v pass through the axis of rotation they do not contribute to the net torque, leaving us with the rest of the forces. Note: Clockwise torques are taken as negative and the Counterclockwise torques are taken positive.

$$\Sigma \tau = + F_d r_d \sin(\alpha) - r_a F_a \sin(\theta) - r_o F_o \sin(\theta)$$

Where, r_d , r_a , and r_o are the distances from the axis of rotation to deltoid muscle (insertion), center of mass of the arm, and the fist (where the lifting weight, F_o , is held), respectively.

Considering the equilibrium, $F_d r_d \sin(\alpha) - r_a F_a \sin(\theta) - r_o F_o \sin(\theta) = 0$

$$\begin{aligned} \frac{r_a F_a \sin(\theta) + r_o F_o \sin(\theta)}{r_d \sin(\alpha)} &= F_d \\ F_d &= \frac{r_o F_o \sin \theta}{r_d \sin(\alpha)} + \frac{r_a F_a \sin \theta}{r_d \sin(\alpha)} \quad \text{---- (3)} \end{aligned}$$

Given that F_o is the independent variable, and the F_d is the dependent variable, for a given angle θ , The above equation follows $y = mx + c$ type linear behavior.

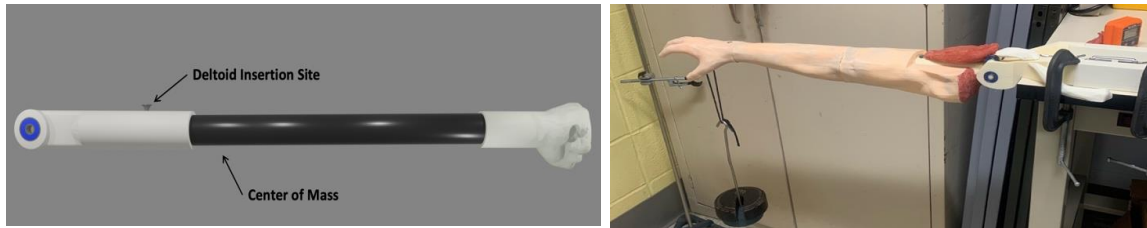
2. Design: 3D model and animation

The focus of this study is to teach the torque and equilibrium of a given system and help students become comfortable with applying linear and rotational Newton's Laws to a closed system. Given the absence of readily available demonstrations of the forces at the deltoid muscle, we opted to employ a hands-on approach. We developed a simulation, allowing students to conduct virtual experiments and thoroughly comprehend the forces at play and the associated calculations. We used 3D printing to craft an anatomically accurate arm model, subjecting it to different weights for practical testing. Figure 3 shows a picture of the 3D model we printed out using the PLA material.

Life size skeleton model bones of a scapula and a humerus were obtained and measured, and the relative locations of the deltoid tuberosity and the acromion insertion point were recorded. Using

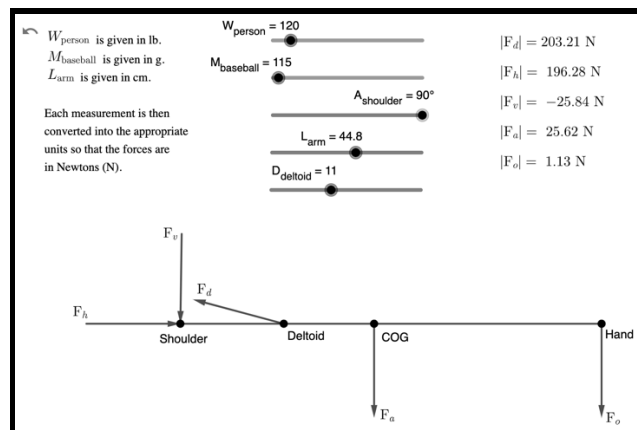
Embodi3D web application, an “stl” file representing the scapula and humerus were downloaded. These models were then scaled to the measurements taken from the life-sized bones. The Visible Body Suite web application was used to determine the correct orientation between the scapula and humerus, as well as the space and angle of orientation between these bones. Using these measurements and the Fusion 360 program, a 3D printed model was generated. The three pieces of this model included the acromion, humerus, and a fixation piece. A Newton meter was attached to measure the tension of the deltoid muscle, between the deltoid tuberosity and the acromion insertion point. We used a series of masses on the hand and recorded the corresponding force, F_d , using the Newton meter.

Figure 3. The first figure (left) shows the first arm model, and the second diagram (Right) shows the completed version of the 3D-printed arm. We used a metal rod to add weight to the arm.



The Interactive Arm simulation was created using GeoGebra [https://www.geogebra.org/calculator/qbu43e9j]. It is a dynamic visual representation of an arm that displays various forces acting on the arm, and their magnitudes, for example, when lifting an object. The users are given the weblink of the simulation, along with the access to all the equations used to calculate the deltoid force. There the user starts by inputting the following parameters: the weight of the person, the mass of the baseball (in grams), the angle that the arm makes from the side or vertical (in degrees), the angle that the deltoid makes at the point of insertion, and the length of the subject’s arm (in centimeters). As discussed in (Goldick, 2010), et al, the weight of the arm is 4.8% of the total body weight. Figure. 4 shows the interface of the animation. We used the length of the arm to be 0.52 m and changed the mass of the object from 10 g to 1000 g. The F_d was recorded as a function of the weight of the hanging object, F_o .

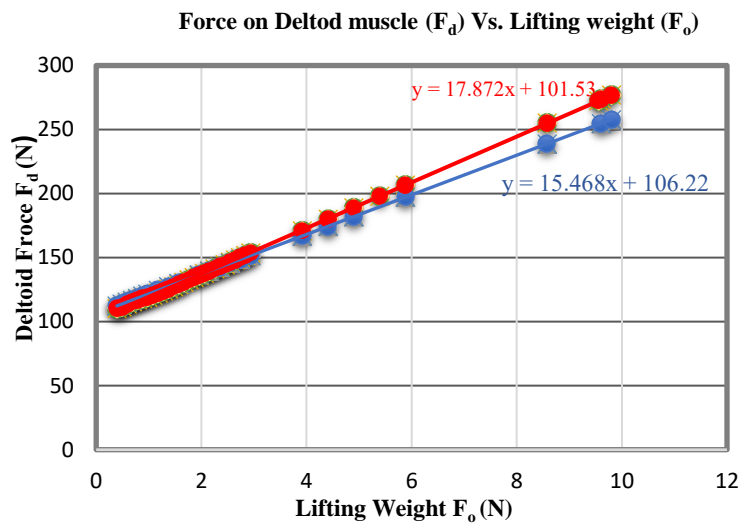
Figure 4. The interface of the GeoGebra simulation. There we used five sliders to input the weight of the person, mass of the lifting object, angle of the arm, angle between arm and deltoid, and the length of the arm.



3. Results and discussion

Using the data retrieved from the physical model and the animation, we plotted a graph of F_d vs. F_o . Fig. 5 shows the linear relationship, $y = mx + c$ type, between F_d and F_o . This linear behavior agrees with the expectations as shown in our calculations, equation (3). The angle that the deltoid force made with the arm was taken as 5° as stated in (Goldick, 2010). The prototype data follow a linear trend throughout the range of data collected and are in perfect agreement with theory (data retrieved from the animation). The data points from both models align consistently up to 4 N, with a slight deviation observed thereafter. We suspect this deviation may be attributed to an issue around the shoulder cuff of the prototype. Currently, we are actively addressing these issues. Additionally, we plan to repeat the experiment by varying the arm angle and then compare this new data with the animation results.

Figure. 5 shows the graph of F_d vs. F_o obtained from the physical prototype (blue data points) and the animation (red data points).



4. Conclusion

We utilized the animation and the physical prototype in two course sections (*Mechanics and Human body*), with one controlled group, and compared the results obtained for problems relating to rotational motion. Students exposed to both the prototype and animation performed significantly better than those without exposure to either. At the end of the semester, students particularly appreciated the opportunity to work with the simulation, manipulate variables, and confirm solutions on the web platform. In conclusion, we successfully completed the initial phase of our experiment, and we plan to improve the prototype to illustrate various angles for better student comprehension, integrating NASA's mission on space suits.

Acknowledgement

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UNDERSTANDING THE IMPACT OF INTERCULTURAL PROJECT-BASED LEARNING ON STUDENTS, STAFF AND HIGHER EDUCATION INSTITUTIONS

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Abstract

This paper discusses the experiences of a distributed interdisciplinary project-based learning program for students across continents. For the years 2020 until 2023, we received seed-funding for four annual projects to engage students from Germany (Europe), Namibia (Africa), Indonesia (Asia), and Peru (Latin-America) to collaborate over one semester on interdisciplinary projects contributing to the solution of some real-life client's problems in the partner countries. During this period, more than 150 students embarked on these projects with 116 of them being selected for a scholarship for an international mobility. With the guidance and support by academics from all partner universities, the students successfully completed each project expressing deep appreciation for the learning opportunities while overcoming challenges of working across widespread time zones, different cultures, changing requirements, and various technical difficulties. While the primary aim of this distributed interdisciplinary and intercultural project-based learning program was to provide students with a truly Global Intercultural Project Experience (GIPE), in this paper we investigate on its impact in a broader sense as it was observed that this program also had a significant impact on both academic and administrative staff at all partner universities. Finally, we also reveal the impact of this four-year-program on the participating institutions themselves and conclude that the invaluable returns of such interdisciplinary project-based learning extend far beyond financial metrics. It encompasses enhanced student learning experiences, strengthened cooperation and mutual learning between academics and administrative staff, as well as institutional reputation, and societal impact.

Keywords: *Project-based learning, collaborative online international learning, intercultural collaboration, interdisciplinary students project.*

1. Introduction

Globalization demands that Higher Education Institutions (HEIs) adapt rapidly to provide students with the relevant 21st-century skills and knowledge essential for navigating an increasingly interconnected world. As economies and societies become more interlinked, the workforce faces complex, global challenges that require not only technological proficiency but also critical thinking, adaptability, and cross-cultural communication skills (Wilson, 2010).

In the ever-evolving landscape of higher education, traditional lecture-based methods are increasingly being supplemented or replaced by more interactive and student-centered approaches. Among these, Project-Based Learning (PBL) stands out as a particularly effective pedagogical strategy emphasizing experiential learning through real-world challenges (Bender, 2012). This educational approach encourages students to engage actively in projects that reflect genuine professional scenarios, fostering a deeper understanding and application of knowledge (Bell, 2010). PBL not only equips students with critical thinking, problem-solving, and collaborative skills but also prepares them for the dynamics of the modern workplace (Krajcik & Shin, 2014).

In today's increasingly interconnected world, complex global challenges such as climate change, public health, and technological innovation cannot be solved within the silo of a single discipline or cultural perspective. Instead, they require collaborative efforts that transcend traditional boundaries. Thus, Warr and West (2020) revealed that intercultural and interdisciplinary project-based learning (IPBL) is a key educational approach to address both, the interdisciplinary approach needed for solving real-world problems and the intercultural setting that fosters understanding, respect, and effective communication among diverse cultural groups (Gregersen-Hermans, 2017).

Collaborative Online International Learning (COIL) is nowadays receiving increased attention as an innovative, cost-effective instructional method that promotes intercultural learning through online collaboration between faculty and students residing in different countries or locations within the context of a course (Rubin, 2017). Although the idea of distributed student projects with online collaboration among different HEIs dates back to the late 1990s where it has already been successfully applied at least in the field of Software Engineering (Brereton, Gumbley & Lees, 1998), the international and intercultural aspect came into focus only during the last decade (Appiah-Kubi & Annan, 2020).

In order to respond to the before-mentioned challenges of globalization for higher education and based on prior successfully completed bilateral student software development projects between German and Namibian students, we designed a framework combining IPBL by solving some real-life client's problems with the international and intercultural setting of COIL extended by phases for short-term physical mobility to focus on a much denser intercultural exposure of students and staff in preparation for a successful online collaboration across continents and cultures.

Over four years, from 2020 until 2023, we have now run four annual student projects with intercultural and interdisciplinary mixed student groups collaboratively solving real-world problems for clients from Namibia, Indonesia, Peru and finally for a global client. Although this combined approach comes with increased complexity as regards governance, project management and administrative support, it did not only have the intended impact on the participating students, but has also shown significant impact on both academic and administrative staff, their collaboration and personal growth as well as the participating HEIs as such.

2. Related work

There are several notable studies and initiatives that highlight the impact of interdisciplinary PBL in intercultural settings. These works emphasize the value of integrating diverse perspectives and disciplines to address complex problems, showing how such educational approaches prepare students for global challenges.

Hart (2019) explores how IPBL in intercultural groups enhances students' intercultural competence. It underscores the importance of reflective practice and structured interaction in developing the ability to navigate and appreciate cultural differences. The findings suggest that PBL environments, where students engage with real-world issues from multiple disciplinary perspectives, can significantly improve their intercultural skills alongside their academic learning.

Oladiran, Uziak, Eisenberg, and Scheffer (2011) report on the Global Engineering Teams (GET) program that promotes project-oriented tasks in virtual student teams working in collaboration with industry partners. Students from different countries and disciplines collaborate on engineering design projects. It illustrates how technology can facilitate international collaboration among students, allowing them to apply their diverse knowledge and cultural perspectives to create innovative solutions.

The UNESCO Chair in Problem Based Learning (UCPBL) established at Aalborg University in 2007 represents a concerted effort to promote PBL in engineering education across different cultural contexts. It focuses on developing pedagogical frameworks and resources that facilitate the implementation of PBL in a way that encourages intercultural exchange and understanding.

Focusing on sustainability challenges, Sulkowski, Kowalczyk, Ahrendsen, Kowalski, and Majewski (2020) highlight a program where students from various disciplines and countries collaborate on projects aimed at promoting sustainable development. The initiative showcases how combining PBL with an intercultural and interdisciplinary focus can lead to innovative approaches to sustainability, encouraging students to think critically about environmental, economic, and social issues from a global perspective.

These related works collectively underscore the effectiveness of interdisciplinary problem-based learning in fostering not just academic growth, but also intercultural competence and collaborative skills (Brassler & Dettmers, 2017). Thus, there is no lack of evidence that by bringing together students from different backgrounds and disciplines to work on real-world problems, educators can create rich, transformative learning experiences that prepare students for the complexities of the modern world. However, as Saubert and Cooper (2023) have reported, there is only little research yet on how IPBL in an international yet intercultural context benefits academic and administrative staff involved in such programs or the HEIs as such, e.g., by Elam (2018) or Chang et al. (2022).

3. The GIPE framework (Global Intercultural Project Experience)

In an effort to strengthen internationalization efforts at German Universities of Applied Sciences, the German Academic Exchange Service (DAAD) awarded a four year (2019-2023) funding for the GIPE framework program offering selected students from participating institutions in Germany (Westfälische

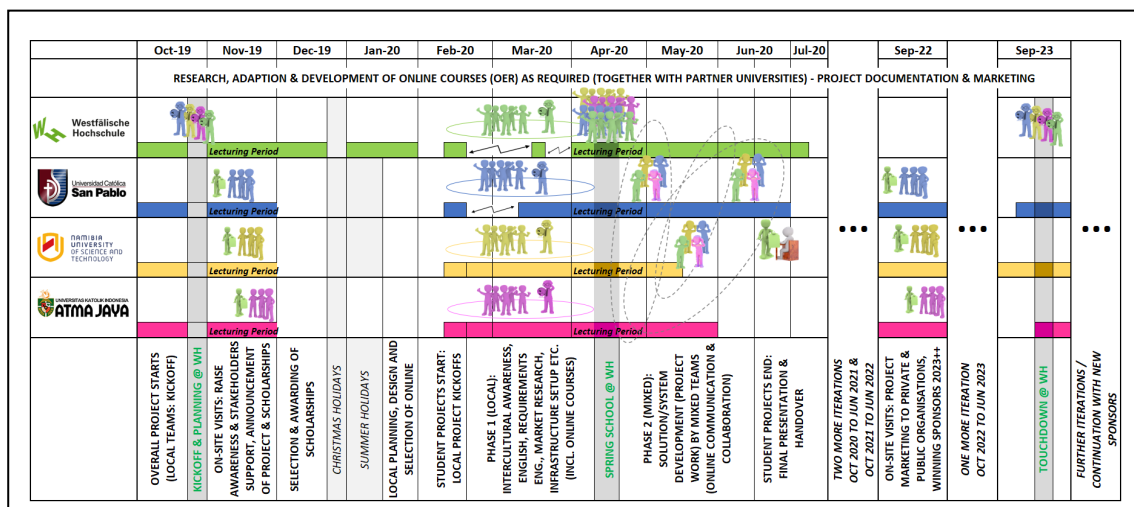
Hochschule), Indonesia (Atma Jaya Catholic University of Indonesia, Jakarta), Namibia (Namibia University of Science and Technology, Windhoek), and Peru (Universidad Católica San Pablo, Arequipa) the opportunity to gain a truly Global Intercultural Project Experience (GIPE) by working in a multicultural team on an international project for a real client (Meyer et. al., 2022a).

3.1. Project overview

The annual student projects took place from February to June/July (subject to different academic calendars and lecturing periods) proceeded by client and project selection, evaluation of students' applications and awarding scholarships as well as requirements gathering and detailed project planning together with the selected client. They were run in four phases (see Figure 1):

1. On-line collaboration preparation: A virtual global kick-off event brings all stakeholders together. Students then get prepared for the various project tasks through targeted trainings. Students join the project in intervals depending on the home universities lecturing schedules.
2. Two-week face-to-face phase: All participating students and one representative lecturer from each university meet in Germany for team-building, intercultural exposure and mixed-team-setup ('Spring School').
3. On-line collaboration: the students continue working on their project tasks in mixed teams using various on-line collaboration tools. They are instructed ('guided') by academic staff from all partner institutions and different disciplines, e.g., in the 2021 project, a business sub-project ('stream') was guided by a lecturer/researcher team from Peru and Indonesia while another stream focusing on the developing of an educational adventure game was guided by a German academic together with a colleague from Namibia.
4. One-week project-touchdown and hand-over: The German students travel to the client situated in Namibia, Peru or Indonesia (alternating) offering true international exposure.

Figure 1. The Masterplan for the GIPE Framework 2019-2023.



Due to travel restrictions during the Covid-19 pandemic, the 2020 students project was held entirely online ('pure COIL') while in 2021 at least the hand-over to the client in Indonesia could take place later the year and with only a few students travelling. Nevertheless, even without any meeting in person, both student projects were completed successfully and the results appreciated by the respective clients. However, in (Meyer et. al., 2022b) we explicitly discuss the importance of physical meetings during the two-week Spring School which is essential for our approach.

3.2. Impact on students

Summarizing from the students' perspective, the Global Intercultural Project Experience (GIPE) was enriching in many ways: culturally, academically, and professionally. Reviewing the sentiments expressed by the students confirms observations made by the guides, that though the students experienced many new challenges they equally appreciated the learning and the multicultural context. Working in an interdisciplinary team on a project for a real client required a steep learning curve in a short time. The students received structured technical training and were exposed to new tools and techniques, and learned good project management practices using professional tools. GIPE thus exhibits similar impact on the participating students as observed by other researchers before, e.g. (Hart, 2019). Student engagement was significantly enhanced as students are actively involved in the learning process. By working on projects

that are meaningful and relevant to their interests, students are more likely to find the material and tasks engaging and motivating. This increased engagement not only makes the learning experience more enjoyable but also improves retention and comprehension of the material.

The IPBL approach underlying GIPE has also shown to be particularly effective in fostering critical thinking and problem-solving skills. As students were presented with complex, real-world problems that do not have straightforward solutions, this required them to think critically, analyze various aspects of the problem, and devise innovative solutions. To succeed, students must integrate knowledge from multiple disciplines, evaluate different design options, and consider practical constraints such as cost and materials. This process mirrors real-world engineering challenges, thereby equipping students with the skills necessary to tackle similar problems in their professional careers.

Another significant impact we have observed is the development of collaboration and communication skills as students have to work together to achieve common goals. This collaborative approach helps students develop essential teamwork skills, such as effective communication, conflict resolution, and the ability to work with diverse groups of people, especially in the intercultural GIPE setup. Our findings confirm earlier research, e.g. by Hmelo-Silver (2004), indicating that students who engage in PBL demonstrate improved interpersonal skills, showed greater proficiency in collaborative problem-solving and were better at articulating their ideas compared to those in traditional learning environments. These skills are invaluable in the modern workforce, where teamwork and communication are often key to success.

Furthermore, GIPE encourages self-directed learning and autonomy requiring students to take greater responsibility for their own learning. They must manage their time, set goals, conduct research, and make decisions about how to proceed with their projects. This increased autonomy helps students develop important self-management skills, such as time management, and independent problem-solving.

3.3. Impact on staff

IPBL within higher education institutions as implemented in GIPE poses significant challenges but also opportunities for both academic and administrative staff.

Academic staff must often venture beyond their traditional disciplinary boundaries, necessitating a proactive engagement with unfamiliar content, teaching methods and rubrics, which stimulates professional growth but also demands substantial adaptability and commitment to interdisciplinary collaboration. The cooperation of academics from different continents when guiding and finally also grading the students, resulted in further and deeper cooperation, joint research and publications lasting much beyond the individual projects.

The international group of students and staff to be handled formed a challenge also for administrative staff in the international offices and departments, but also offered opportunities for personal growth and professional development. The adoption of IPBL requires the development of new frameworks for curriculum design, assessment, and resource allocation, pushing staff to innovate and potentially reconfigure institutional policies and practices to support these holistic education models. Ultimately, while IPBL may burden staff with initial hurdles, it also promotes a dynamic educational environment that encourages continuous learning, adaptability, and innovation, potentially leading to enhanced job satisfaction and a more cohesive institutional culture.

3.4. Impact on higher education institutions

IPBL within higher education institutions as implemented in GIPE is a transformative approach that fosters collaboration across various disciplines and cultures, enriching the educational experience not only for the students but everyone involved. Additionally, having students from around the world on the campus for two weeks and inviting local students to join in for some open sessions and social events offered a low-threshold international and intercultural experience for all, helped promoting internationalization and exchange and finally led to an increased interest in student exchanges not only to the participating partner universities. As higher education continues to evolve, integrating PBL into the curriculum can not only provide a more enriching, relevant, and effective learning experience for students and staff. It can also contribute to the profile of the institution and result in a competitive advantage when attracting the best students and also staff.

4. Conclusions

Interdisciplinary Project-Based Learning as implemented in GIPE offers numerous advantages in higher education, from enhancing student engagement to developing critical thinking, collaboration, and real-world application skills. By fostering a more active and student-centered learning environment, IPBL prepares students not only to succeed academically but also to excel in their future careers. Moreover, it has shown significant impact also on administrative and academic staff as well as on HEIs themselves.

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LEARNER EMPOWERMENT: THE CASE FOR TEACHERS DEPLOYING DEMOCRATIC LEADERSHIP

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Abstract

This paper is centred on how 5th grade teachers in schools in Cali, Colombia (Latin America) exercise power and authority in their classrooms. Findings from a multi-case study draw out the challenges and the complexity of cultivating democratic climates in primary school classrooms, and how teachers conceive of, and deploy, their power and authority through a range of mechanisms. This includes evangelical and heteronormative discourses, and authoritarianism and punitive discipline management, which do not support democratic classroom climates. In contrast, the study also sheds light on markedly different teacher practices based on the deployment of democratic leadership. This type of leadership, arguably rare, presents teachers substituting dialogue for dominance; cooperation and collegiality for hierarchy; and active learning and problem solving for passivity. In doing so, teachers succeed in constructing democratic classroom climates and spaces that enable learner empowerment.

Keywords: *Democratic leadership, learner empowerment, teachers.*

1. Introduction

At a convoluted juncture and increasing challenges stemming from multiple global dynamics – forced migration, economic instability, wars, violences, famines, energy and water shortages, a climate crisis, a mental health crisis with more persons of all ages suffering from anxiety and depression, and rising inequalities to name a few – what happens in schools and classrooms acquires particular importance. These challenges are direct or indirectly tied to democracy, and in particular to the relationship between democracy and education. This relationship becomes particularly significant when schools have been described as having the same social functions as prisons as well as institutions for those who are mentally challenged and require some form of treatment. These social functions include defining, classifying, controlling, and regulating people. This begs the question, do schools and classrooms also perform these “social” functions? If so, how? What are the immediate, but also broader implications, of this modus operandi in an increasingly fragile and polarised world?

As a researcher of Southeast Asian descent who at the time had been working in private universities in Colombia for eleven years, mostly serving students from upper middle- and upper-income groups, I embarked on exploring school and classroom life in marginalized neighbourhoods in Cali. Cali is the capital of the Valle del Cauca department and one of three major cities in Colombia. While this was an opportunity to take distance from the privileged settings I had taught in, and better understand the complex and vastly diverse Colombian educational system, the study undertaken focused on 5th grade classroom teachers: how did they conceive “democracy”, “citizenship” and “education”? How did they make sense of their own teaching practices? Were their conceptions aligned to their classroom practices? Were they promoting or inhibiting *student voice*? *Decision-making capacity*? *Equality of respect and recognition*? *Equality of power*? *Critical thinking*? These features (italicised), not exhaustive but critical, were identified as some of the distinctive features of democratic citizenship education. This particular paper stems from part of the data that shed light on how teachers conceive of power and authority (in particular their own power and authority), and how they deployed these in their classrooms through their practices. This is closely connected to a nascent exploration of how (a) teachers exercise leadership, and (b) if, and how, democratic forms of leadership may contribute to not only academic but also social, emotional, and civic development.

Admittedly, this paper raises a number of questions and does not provide definitive answers, partly due to the sheer complexity of thinking about teachers deploying democratic forms of leadership in school structures that are usually overly rigid, hierarchical, and authoritarian; and partly due to not wanting to fall into the trap of ignoring that each cultural context demands its own set of answers, and not prescriptive and simplistic answers from the “outside”. Those with-*in* the respective context and culture may be best situated to reflect on possible paths to consider, and deploy, democratic leadership in their respective teaching and learning processes *if* this perspective and course of action is deemed of value.

Nonetheless, some of the questions that this paper reflects on are the following: if schools and classrooms are social and political sites, to what extent do they reflect societies and nations at large? Assuming they do reflect societies and nations at large, to what extent can they be social microcosms and spaces in their own right that counter those dynamics that are undemocratic - or that at the very least weaken the social (and political) fabric of societies? Is it unrealistic for schools and classrooms to make a substantive effort to cultivate democratically skilled and disposed learners? If so, how would this be done? What is the role (if any) of primary schooling to begin to cultivate persons who contribute to democratically robust, socially just, multiracial societies? What practices may teachers deliberately, and intentionally, adopt to accomplish this, and how? Should educational systems address the cultivation of democratically skilled and disposed learners holistically, and not atomistically? Would this require considering a learning continuum of some sort where primary, secondary, and tertiary education are not isolated parts but subsystems of a larger machinery or project that contributes to robust democracies?

2. Power: What is it, and what does it have to do with democratic leadership?

How to democratize school relations inevitably intersects with the notion of power. Power et al. (1989) and Power & Higgins-D’Alessandro (2008) contend that organizational climates like a classroom climate, shape individual perceptions and social behaviour. Narvaez (2010) refers to the specific role played by educators within these organizational climates, pointing to educators’ capacity to foster good intuitions, promoting mastery learning, prosocial relationships, and citizenship development (Narvaez, 2010). Teachers then are vital socialization agents within the educational spaces they work in, socializing and exposing learners to ideas, languages, behaviours, and ways of thinking, acting, and feeling. In this sense, the classroom as a social learning space becomes a research setting to explore teachers’ leadership styles; and particularly if, and how, they deploy democratic leadership through conceptions of power.

Power is at play in many forms in the educational domain including through curricula, assessment, pedagogy, and teacher-student interactions. Lynch & Baker (2005) add that these forms - manifested in both subtle and explicit ways - are embedded within processes of exclusion, marginalization, trivialization, misrepresentation, and I would add subordination. These forms often overlap with, and equate to, a lack of respect and recognition that some groups in particular, experience through status-related inequalities relating to age, sexuality, religious beliefs, disability, language, gender, class, race, or ethnicity.

The need to democratize school relations for no other reason than because of its intrinsic educational value is foundational to cultivating democratically skilled and disposed learners. Moreover, the above forms in which power is adversely at play provides additional reasons for considering deploying democratic leadership. A basic, yet useful, point of departure may be acknowledging how power has emerged from a purely static entity - possessed by some and exercised over others - to one that is fluid, dynamic, relational, situated, circulated, endlessly negotiated, and constructed (Bahou, 2011). Janeway (1980) underscores the dynamic nature of power, amidst ceaseless shifts and tensions, thrusts and responses, hope, and frustration, and by practical outcomes that derive from compromises and confrontations. Manke (2008) acknowledges how power can operate both centrally and peripherally, potentially leading to conflict:

“I imagine students and teachers as building rooms or spaces in which they can interact independently or influence the actions of others, building areas off to the side of the main structure where they can live and work without conflict with others, and sometimes seeking to build in areas where their plans and actions conflict with those of other members” (p. 6).

Power disposed within a democratic leadership style is particularly challenging. While it is not explicitly visible or observable, power has profound egalitarian implications. Waller (1932) refers to how children are defenceless “against the machinery with which the adult world is able to enforce its decisions: the result of the battle [between teachers and students] is foreordained” (in Manke, 2008, p. 1). Bartolomé (1994) refers to how school personnel uncritically, and unknowingly, hold the deficit view of minority students - particularly in reference to students who have been historically oppressed and whose

academic achievement has been questioned. This points to asymmetrical power relations reproduced in schools and classrooms as an important, yet less visible, reason for their performance.

Relating to asymmetrical power relations, Starhawk (1988) distinguishes between three types of power: (1) “power over”, which refers to a hierarchical relation of domination and control; (2) “power-from-within”, referring to one’s sense of personal ability and deep connectedness with other human beings and the environment; and (3) “power with”, which suggests influence in a group of equals. For De los Reyes and Gozemba (2002), the power to influence rests on having the skills, dispositions, and knowledge to cultivate the “power-from-within” and the “power with” through dialogue and alliances between teacher and students (and among students).

How power is conceived and exercised is at the heart of teachers deploying democratic leadership. Teacher practices and their interactions with children can be framed within a capacity-based, a deficit-based, or a combination of both, perspectives. The capacity-based perspective may open possibilities for the exercise of democratic leadership, emphasizing ‘working with’ students and creating opportunities for them to become aware of, and appreciate, their “power-from-within”. A deficit-based perspective is contrary to the exercise of a democratic leadership, emphasizing ‘doing to’ or ‘doing for’ students.

3. Methods

Thematic analysis was conducted in a qualitative multi-case study to explore teachers’ conceptions and practices relating to democracy and education. This paper specifically focuses on their conceptions of power in an attempt to make sense of their leadership styles. The multi-case study method allowed drawing out the complexity and diversity of cultivating democratic or other, more authoritarian, or negligent leadership styles. Cohen et al. (2005) describe contexts as unique and dynamic, and case studies serve to “investigate and report the complex dynamic and unfolding interactions of events, human relationships and other factors in a unique instance” (p. 181).

Two main instruments were used to collect data: classroom observations and semi-structured interviews. A student questionnaire was also used at the onset of the study to get a sense of students’ perceptions regarding their respective teacher’s practices in the classroom. This questionnaire was then used to obtain scores relating to how democratic teacher practices were based on student perceptions. The questionnaire also sought to identify classrooms characterized by particularly strong, average, and weak, democratic climates. Two of the classrooms selected scored high, two scored low, and one scored average. This paper focuses on one of the five classrooms, where the teacher deployed democratic leadership that seemed to stem from a radical conception of democracy.

Both the questionnaire and the classroom observation matrix employed were inspired by two instruments: the DCCED (Democratic Climate of Civic Education Classroom Scale), designed by Mappiasse (2006), and CLASS (Classroom Assessment Scoring System, Upper Elementary) designed by Pianta et al. (2012). CLASS is a scoring system empirically tested across large samples of standardized observations in preschool and elementary classrooms. Both the DCCED and CLASS were used as guidelines to identify behavioural markers to make sense of teacher practices. In the broader study, classroom observations and semi-structured interviews focused on making sense of teachers’ practices relating to participation, equality, and critical thinking. However, this paper focuses on what some of these practices reveal on teachers’ conceptions of power. It also seeks to better understand the implications of deploying democratic leadership in the 5th grade classroom in schools in marginalized neighbourhoods in the city of Cali. While the study was undertaken in Colombia, it has implications for considering deploying democratic forms of leadership in other contexts, cultures, and countries.

4. Results

This section refers to a specific event in one of the 5th grade classrooms observed in the broader study: a student asks the teacher for her permission to go to the bathroom, to which the teacher replies, “My love, I don’t control your bladder” (In Spanish, “Mi amor, yo no controlo tu vejiga”). Weeks later, I interview this teacher, seeking to make sense of her conception of power and possible implications on her leadership style. Based on the event observed in the classroom, I ask the teacher what “control” means to her. I also ask her, “where does control reside in your classroom?” I deliberately use the word “control” – and not “power” to make use of the same word and idea she used in replying to her student when the latter asked her for permission to go to the bathroom. The teacher’s response is as follows:

Teacher: The thing is, I believe that this is part of democracy, and I would believe that it is part of critical thinking. It seems to me that in a society, that in a school environment... where I have to tell an adult who is there as an authority, that I have to ask permission to go urinate, to go to defecate, to go to expel what is

inside my body that is suffocating me at that moment, when I have a full bladder, my intestine; It seems humiliating to me. And then how come I want to form critical thinking, but I have to humiliate myself in front of an adult who must ask permission to go to the bathroom? For me it is humiliating, and how to do it, how to make me have free thought, that I can strive for freedom of thought when I have to ask permission even for the most basic thing, which is going to the bathroom.

The teacher, in explaining the event, also adds what she relates the classroom event to (i.e., a student asking her for permission to go to the bathroom):

Teacher: *I do not understand it; when a child does this to me [asks for permission to go to the bathroom], I think of a movie I saw called “maids and ladies”, which was during the time when in the United States black ladies worked in white people’s homes. So the [white] lady would count the sheets of toilet paper that she gave her [the black maid] who as an employee had a separate toilet outside. So that seemed so humiliating to me and I always take that to my classroom. Having to ask permission for you to go to the bathroom seems humiliating to me. And then how do I form [support the development of] free-thinking people who can decide... because critical thinking is related to the decisions that I make for my life... when I have been subjected by power to the point that someone else decides for me? When they ask me for permission, I tell them: my love, I can’t control your bladder.*

The teacher adds the following:

Teacher: *What I try to make him [the student] understand are two things: at that moment, you have a desire to go to the bathroom, and at that moment you have an assignment, an assigned task; At that moment, with your thoughts, choose in a second what is most important at that moment and if there is something that cannot wait. I can hold on for a moment and finish the task, or I can’t hold on and the task can wait, because my health is at stake. That is what I meant.*

5. Discussion

The response of a teacher to her student, “my love, I don’t control your bladder”, in a 5th grade classroom when asked for permission to go to the bathroom, denotes a conception of power within a larger conception of democracy. First, the teacher believes that physiological needs are, and ought to be, self-controlled and self-regulated. Second, the teacher thinks that being in a position where she as the teacher decides if a student can go to the bathroom is a form of control that represses students’ agency. Also, from the teacher’s perspective, it does not help cultivate democracy and critical thinking. The fact that the teacher associates a student asking for her permission to go to the bathroom with the racial inequality and segregation of the 60s in the U.S, is interesting: both events, albeit distinct, share the common feature of exerting forms of control over others, regulating their actions, while repressing their own self-regulation, freedom of movement, autonomy, and in essence, their decision-making capacity. This can happen, and happens, in a classroom setting within a larger institutional school structure as well as at a broader societal level. Both settings, in their own ways and terms, denote forms of control – *not* forms of democratic leadership.

The teacher’s conception of power emerges from how she explains what “control” is as described in relation to her interaction with her 5th grade learners. Her conception of control inherently relates to her conception of power. Within these conceptions there are at least four discourses at play: first, employing control as a way of nullifying one’s sense of self-respect and one’s dignity as a human being; second, seeing control *over* a student as the absence of democracy insofar as one’s own decision-making is overridden by others deciding for them; third, conceiving control as absence of critical thinking; fourth, equating the use of control as the absence of free thinking and freedom of thought.

What is also interesting is how the statement the teacher uses to reply to her student when the latter asks to be given permission to go to the bathroom - “My love, I *don’t* control your bladder” – becomes “My love, I *can’t* control your bladder” during the subsequent interview held between the researcher and the teacher weeks later. The implications of realising one’s limitations as the teacher in the classroom vis a vis her students and acknowledging them in the way she does, opens spaces to not only recognise the physical presence of students: it enables learners’ cognitive and emotional capacities for agency and self-regulation. Learners are entrusted and empowered to take control and responsibility of their learning in a proactive manner, and not through coerced and coercive mechanisms.

6. Conclusions

The teacher whose practices are discussed in this paper are based on her conceptions. Both conceptions and practices seem to be aligned, creating conditions, structures, and spaces (physically and psychologically) where students are encouraged to think freely and critically whilst self-regulating and

exercising autonomy. These practices challenge a schooling system that has served dominant social institutions that are not only largely hierarchical and authoritarian but also homophobic, racist, and that continue to perpetuate inequalities (Nanwani, 2023). The way in which power is deployed by the teacher through her practices is a form of democratic leadership within the complex microcosm of classrooms.

Democratic forms of leadership create opportunities for classrooms and schools to become political sites of social reform – and not social reproduction. In essence, democratic leadership may serve to not only teaching and learning *about* democracy but teaching and learning *in* democracy; stated differently, it opens spaces to teach democracy democratically.

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In Composition II, they are confronted with an Indian professor, born in Africa, and raised in a number of countries, who continues to grow through them. With the “cultural baggage” this professor brings, he sometimes confuses his students (albeit deliberately at times). These students confront the confusion so valiant and beautifully, as they choose a topic of their own interest and grapple with “wicked” problems that, direct or indirectly, have implications on the kind of world we are building and the kind of people who will inhabit it. My gratitude for their inspiration: María Luisa Méndez Méndez; Massimiliano Serna Guzmán; Oscar Centeno Arias; Ilse Daniela López Garza; Luisa Fernanda Díaz Nepote; Christian Jesús Espinoza Minjarez; Mariano Mateos Cárdenas; Eduardo Ríos Rodríguez; Iker Solorzano; and Natalia Valdez Ávila.

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CREATIVITY IN EDUCATION: BITE-SIZE VIDEO'S IMPACT ON STUDENT ENGAGEMENT AND SATISFACTION

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Abstract

This paper explores the impact of creative methods within active learning frameworks on student engagement, knowledge acquisition, and satisfaction. It suggests that adopting creativity into course design can significantly enhance learning outcomes, particularly in complex subject areas such as Supply Chain Management. To support this claim, a survey of 300 students in a UK higher education institution received 160 responses. Furthermore, I analysed engagement metrics from the course's Canvas module page. The findings reveal that creative design strategies not only improve understanding but also increase student engagement and satisfaction. This paper will discuss specific creative techniques that can be easily adopted by educators across various disciplines, demonstrating creativity's role as a crucial component in enhancing educational effectiveness.

Keywords: *Higher education, creativity, knowledge, engagement, satisfaction.*

1. Introduction

In the dynamic landscape of global education, the imperative to adapt teaching methodologies to engage students better and enhance their learning experience has become increasingly apparent. Amidst these shifts, creativity in education emerges as a pivotal force in transforming traditional pedagogy to meet the complexities of modern academic and professional demands, particularly within higher education and business studies.

Integrating creative methods, such as bite-size videos, into educational frameworks has shown promising potential to impact student engagement, understanding, and overall satisfaction significantly. This is especially relevant in disciplines involving intricate subject matter, such as supply chain management, where traditional teaching methods often fail to convey the dynamic and detailed nature of the field fully.

This paper explores the impact of these creative teaching methods on student satisfaction within master's level supply chain management courses. Our central research question is: How do creative bite-size videos influence master students' satisfaction and their ability to grasp complex concepts?

The objectives of this study are twofold: to evaluate the effectiveness of bite-size videos in enhancing student engagement and satisfaction, and to understand how these methods affect comprehension and retention of complex course material. By addressing these aims, this paper contributes to the broader discourse on educational innovation, highlighting the potential of creative methodologies to revolutionize teaching and learning in higher education.

The structure of this paper is as follows: after this introduction, a comprehensive review of literature on active learning and creativity in education is presented, followed by an overview of the methodology employed, a discussion of findings from a survey of 300 master's students, and the conclusions drawn from this study, along with implications for educators and future research directions.

2. Literature review

Theoretical Foundations of Active Learning, grounded in the constructivist education theory, posits that students construct knowledge through active engagement rather than passive reception (Zimmerman, 1990; Mattar, 2018). Pioneers such as Jean-Jacques Rousseau, Maria Montessori, and John Dewey have historically emphasized that education should captivate students' interests and encourage active participation (Barak, 2017; Mattar, 2018). This approach has been particularly effective in business

curricula, where it shifts the traditional lecture-based paradigm to one that involves students in discussions, problem-solving, and case analyses (Kirschner, Sweller, & Clark, 2008; Middleton et al., 2021).

Linking Creativity to Enhanced Learning Outcomes Research has consistently shown that incorporating creative methods like problem-based learning, multimedia, and interactive sessions significantly boosts student engagement and satisfaction (Thorsteinsson & Page, 2007; Behnamnia et al., 2020). These methods are particularly impactful in complex disciplines such as supply chain management, where creative approaches like simulations and video content can demystify and elucidate challenging concepts (Christopoulos & Mystakidis, 2023).

Challenges and Criticisms Despite the proven benefits of active learning, it faces criticisms regarding its implementation. Critics argue that passive learning can also be engaging if properly structured and that not all students find active learning methods appealing (Mayer, 1989; Drake, 2012). Furthermore, reduced instructor guidance in active learning scenarios may hinder some students' ability to independently process information (Kirschner, Sweller, & Clark, 2008).

Balancing Act Educators must navigate the delicate balance between fostering creativity and adhering to stringent academic standards. The challenge lies in integrating innovative teaching methods while ensuring that curriculum requirements are met and that all students are supported in their learning journeys.

As a creative method, we used atomic and bite-size videos to summarise lengthy case studies from Harvard editing and my case studies. Each case study was split into 3, 5 minutes short videos. The videos were published on the module canvas page to allow students to watch them and take notes. Once in class, the videos were watched one last time, followed by a discussion and assessed by a quiz.

3. Methodology

This study was conducted within the Anglia Ruskin University Business School at the Cambridge campus, focusing on 350 postgraduate students enrolled in the Supply Chain Management program. Due to logistical considerations including distance and ease of student management, only students from this campus were invited to participate.

The survey, designed to gauge the impact of creative educational methods on student satisfaction, comprised 26 Likert-scale questions and 3 open-ended questions. It was distributed via the Canvas Learning Management System to enhance accessibility. Accompanying the survey, an ethical consent form and a student information sheet were provided, informing students about the voluntary nature of the survey, the anonymity of their responses, and their right to withdraw at any time. The survey successfully captured responses from 160 students, with age distributions as follows: 66% aged 18-24, 52.5% aged 25-34, and 6.3% aged 35 and over.

Quantitative data from the Likert-scale questions were initially explored using descriptive statistics to understand the central tendencies and dispersions. Given preliminary analyses suggested the potential for underlying relationships between constructs, regression analysis was employed to investigate these relationships and understand the impact of specific educational interventions on student satisfaction and engagement.

For the qualitative data from the three open-ended questions, thematic analysis was used to identify key themes and patterns, providing depth and context to the quantitative findings. Word clouds were also generated to visually summarize the most frequently occurring terms, offering insights into common perceptions and attitudes among the participants.

Complementary to the survey, analytics from the YuJa platform on the Canvas module page were collected. These analytics provided objective measures of student engagement with the bite-size video content, including metrics such as view counts, average watch time, and interaction rates. This data allowed for a comparative year-over-year analysis of engagement, elucidating the effects of the newly integrated video materials.

The study adhered to strict ethical guidelines approved by the university's review board. Confidentiality of participant data was ensured, and all participants were informed about the purpose of the research and their rights within it, reinforcing the ethical integrity of the study.

This study's geographical and demographic limitations are acknowledged, as only students from one campus and within certain age groups were surveyed. These factors may affect the generalizability of the findings to other contexts or populations.

The 5 survey questions are listed in table 1 for reference.

Table 1. Survey questions.

Survey Q1	Survey Q2	Survey Q3	Survey Q4	Survey Q5
Has the new teaching Method improved your engagement and interaction with the content?	How effectively provided resources facilitate and support your learning?	Reflect on whether the teaching methods (Video+Discussion+Quizzes) promote critical thinking and active participation.	Evaluate how the teaching method (V+D+Q) used in the course impacted your learning experience.	Videos and Quizzes align with the Learning Outcomes.

4. Results

The analysis of survey data revealed that creative teaching methods employing bite-size videos have a significant positive correlation with student satisfaction and engagement in supply chain management courses. Key findings include

Table 2. Frequency (mean, Median and Standard deviation for the 5 survey questions).

		SQ1	SQ2	SQ3	SQ4	SQ5
N	Valid	160	160	160	160	160
	Missing	0	0	0	0	0
Mean		4.27	4.59	4.42	4.14	4.06
Median		4.00	5.00	5.00	4.00	4.00
Std. Deviation		.852	.638	.756	.731	.750

Alignment with Learning Outcomes (SQ1): The mean rating of 4.27 suggests that students generally feel that videos and quizzes align well with learning outcomes, although some variability in responses was observed (SD = 0.85).

Impact on Learning Experience (SQ2): With a higher mean of 4.59 and a lower standard deviation of 0.64, the teaching methods were perceived as having a more consistent positive impact across respondents.

Critical Thinking and Participation (SQ3): The promotion of critical thinking and active participation was positively viewed with a mean of 4.11, but showed some variability (SD = 0.74).

Effectiveness of Resources (SQ4): Resources were considered effective with a mean of 4.14, indicating positive feedback from students.

Improvement in Engagement (SQ5): The new teaching methods are perceived to have improved engagement and interaction, with a mean score of 4.06 and a standard deviation of 0.75."

The third table provided (Table 3) presents the correlation matrix, highlighting the strength of relationships between different survey questions.

Table 3. Heat map for correlation Matrix.

	Method improved your engagement and interaction with the content?	provided resources facilitate and support your learning	teaching methods (Video+Discussion+Quizzes) promote critical thinking and active	Evaluate how the teaching method (V+D+Q) used in the course impacted your learnin experience	Videos and Quizzes align with the Learning Outcomes
Have the new teaching Method improved your engagement and interaction with the content?	1	0.651	0.608	0.475	0.436
How effectively provided resources facilitate and support your learning	0.651	1	0.612	0.473	0.385
methods (Video+Discussion+Quizzes) promote critical thinking and	0.608	0.612	1	0.582	0.507
Evaluate how the teaching method (V+D+Q) used in the course impacted your learnin experience	0.475	0.473	0.582	1	0.471
Videos and Quizzes align with the Learning Outcomes	0.436	0.385	0.507	0.471	1

All Correlations are significant at the 0.01 level (2-tailed).

5. Discussion

The positive correlations observed between the use of creative methods and student engagement and satisfaction suggest that such pedagogical approaches may be effective in higher education settings, particularly within complex and specialized fields like supply chain management. These findings support the theoretical underpinnings of constructivist learning theories, which advocate for active engagement and real-world applicability in learning processes (Barak, 2017; Mattar, 2018). The consistent positive feedback across different aspects of the course indicates that the integration of bite-size videos and interactive quizzes can enhance the overall educational experience for students (Getachew, 2024). It's important to note, however, that while the overall trend is positive, variability in responses indicates that individual student experiences can differ significantly.

6. Conclusion and future research direction. Discussion

In conclusion, this study provides evidence that creative teaching methods, such as the use of bite-size videos, positively influence student satisfaction and engagement in learning complex subjects. These methods foster an active learning environment that can lead to enhanced understanding and retention of course material. While the study results are promising, future research should investigate the long-term impact of these methods on student outcomes and explore the potential for scalability across different subjects and institutions. Additionally, qualitative data from open-ended survey questions could be analyzed further to provide a more nuanced understanding of student perceptions and experiences.

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THE IMPACT OF DIGITAL LITERACY DEVELOPED DURING THE PANDEMIC ON TEACHERS' POST-PANDEMIC BELIEFS

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Abstract

This study attempts to verify the impact of digital literacy developed during the pandemic on university professors' beliefs. If before the pandemic most of my fellow university professors used digital technologies very little, with the pandemic this picture has completely changed. However, the pandemic made it clear that in addition to the digital exclusion on the part of students who did not have financial conditions to access technologies, there was also teachers' exclusion, as most of them did not know how to use these technologies in their practice. As there was no other form of communication during the time when we had to work from home, the university provided equipment for some learners. We also offered training on how to use a web conferencing platform and the institutional virtual learning environment (VLE). Now, after the pandemic, it is possible to notice a greater interest from colleagues in maintaining their spaces in the institutional VLE and a still frequent use of web conferencing platforms, especially for orientations, presentations, or events. This participatory action research seeks to understand whether there have really been changes in their professors' beliefs regarding the use of digital technology for teaching. To do so, a questionnaire was sent to all the institute professors. The theoretical background of the research includes topics such as beliefs, Emergency Remote Teaching, cyberculture, digital literacy, interactive classroom and multiliteracies. The results show that there has been a positive transformation in teachers' attitudes in relation to applying digital technologies to language teaching. Participants confirmed that before the pandemic, only a few colleagues used digital technology, while nowadays more teachers use virtual learning environments and web-conference platforms. However, they mentioned some important points to be considered, such as the lack of appropriate access to digital technology and the internet by learners and teachers at university, the importance of face-to-face classes for interaction and the importance of reflecting critically on their practice.

Keywords: *Digital literacy, teachers' beliefs, post-pandemic, teacher development.*

1. Introduction

This presentation has as its main objective to verify the impact of digital literacy developed during the pandemic on university professor's beliefs. If before the pandemic most of my fellow university professors used digital technologies very little, with the pandemic this picture has completely changed. However, the pandemic made it clear that in addition to the digital exclusion on the part of students who did not have financial conditions to access technologies, there was also teachers' exclusion, as most of them did not know how to use these technologies in their practice.

As there was no other form of communication during the time when we had to work from home, the university provided equipment for some learners. We also offered training on how to use a web conferencing platform and the institutional virtual learning environment (VLE). With my post-graduate students who had been researching digital technology in education, we offered workshops to discuss gamification (Cardoso, 2022; Cardoso; Correa & Leão-Junqueira, 2020), cyberculture and the use of applications (Torrentes & Vergano, 2021) to facilitate remote classes and turn them into lighter activities.

The results of the study show that there have been some changes in these teachers' beliefs as now feel more positive towards the use of digital technology in education.

2. Objectives

The main objective: To verify the impact of digital literacy developed during the pandemic on university professors' beliefs.

Specific objectives: (a) to verify to what extent where these specific teachers and their students were digital excluded; (b) to understand how digital literacy developed during the pandemic may have impacted in the solutions these teachers have taken during and after the pandemic; (c) to reflect on changes in these teachers' beliefs in relation to the use of technology in their teaching (strategies).

3. Theoretical background

The theoretical background includes different concepts, such as beliefs (Fonseca & Cardoso, 2021; Silva & Barcelos, 2021), Emergency Remote Teaching (Cardoso, 2021; Fonseca & Cardoso, 2021; Rabello & Cardoso, 2022), cyberculture (Santos, 2014), digital literacy (Dudeney; Hockly & Pegrum, 2016; Pegrum & Cardoso, 2019), and multiliteracies (Kalantzis; Cope & Pinheiro, 2020; Kalantzis et al., 2016). However, this article does not focus on the definition of these topics, but on their use in the better understanding of the results.

4. The study

This participatory action research (Kemmis & Wilkinson, 2011) seeks to understand whether there have really been changes in their professors' beliefs regarding the use of digital technology for teaching. The discussion is based on the answers to a questionnaire which had 31 respondents.

4.1. The questionnaire

The questionnaire consisted of 20 questions, being 16 multiple choice questions and 4 open questions (11, 18, 19 and 20). The first section of the questionnaire was to understand these teachers' more general profile, including their names, the kind of institutions they work and their experience in the area (teaching languages). The second section of the questionnaire had to do with the use of digital technology before, during and after the pandemic. Questions 2 to 11 and question 17 are related to teachers' experience using digital technology and questions 12 to 15 focus on learners' experience. Question 16 asks about the kind of teacher training they got involved during the pandemic. As for the last three open questions the topics are the following: teachers' perceptions concerning digital technology during the pandemic (18); changes after the pandemic (including reasons) (19) and comments on the themes approached in the study (20).

In a future study, we intend to invite four of these teachers to be interviewed. Two of them will be selected because they continue to use the VLE and the other two because no longer uses it, in order to understand why they position themselves in such a way.

4.2. The participants and the context

The questionnaire was sent to all the institute professors, about 172 altogether, but only 31 answered the questionnaire. All the respondents work at UERJ, and one of them also work in two other high schools one private and another public. They are all experienced teachers, 42 % of them has been a language teacher from 10 to 20 years; about 27% from 20 to 30 years; and 23% have more than 30 years of experience. Only about 8% of them had less than 10 years of experience (from 5 to 10 years).

5. Results and discussion

The first thing that must be considered is that this study deals with a group of teachers' perceptions about what has been happening. It cannot be generalized. We are not interested in searching for a general reality, but to reflect on our specific experience. This reflection will be partly presented here, divided in four aspects: the learners' exclusion; the teachers' exclusion, emergency solutions and (teachers') changes of beliefs.

5.1. Learners' exclusion

The new cultural relations, which associates digital technologies to our social lives, creates a new way of understanding, feeling and being in the world. We are all in this complex hybrid relation between the cyberspace, the city and different educational networks, named by Santos as *cyberculture* (Santos 2014). Different daily activities have been transformed by this new culture.

However, the pandemic showed that not everybody has the same opportunities, or have the same conditions, to participate in this new style of society. Before the pandemic, even if you didn't have access to the Internet at home, it was easy to find free Internet in shops, at school, at work or even in the streets. However, with the lockdown, which forced us to stay at home, the digital exclusion became more evident.

In this study, learners' digital exclusion is confirmed in the answer to at least two questions: when we ask whether learners had adequate resources to study during the pandemic and reasons for them to keep the cameras off.

Twenty-seven teachers answered the question about technological adequacy, and from this group, ten respondents (37%) believed that most learners had adequate access, eight (30%) believed that few learners had access, six (22%) believed that part of them had access and three (11%) believed that almost none of them had adequate resources. Another way of looking at this data is to show that while 37% of teachers believe that most students had access to technology, 63% believed that only a few learners had access to adequate technology.

When questioned why learners kept their cameras off during remote classes, there were 31 respondents. According to 21 of these teachers, the main reason was problems with connectivity. The second reason pointed out by 16 of them was to avoid expose their home or place of work. Other aspects were also mentioned, such as shyness (11 respondents) lack of confidence (8 respondents), four mentioned that probably learners were doing something else (not actively participating in class) and two mentioned sadness.

These results are confirmed by other studies conducted during the pandemic, which mentioned between learners' difficulties for studying and or participating in remote classes, emotional reasons (sadness, shyness, loss of concentration) and inadequate equipment or connectiveness (Fonseca & Cardoso, 2021; Rebello & Cardoso, 2021). One question that I asked myself several times during the pandemic is whether we all really live in the cyberculture.

The pandemic also helped to reinforce the importance of considering the two multis of multiliteracies, when we refer to meaning (multicontextual and multimodal). We cannot only consider the question of multimodality (multiform transpositions of communication – written, visual, spatial, tactile, oral, etc.) if we do not consider the social diversity (symbolic, embodied and material differences, such as community setting, social role, identity, etc.). To sum up, we should consider how social contexts, and not only modality, affect the construction of knowledge (Kalantzis et al, 2016).

5.2. Teachers' exclusion

When we consider teachers' digital literacy, we often think more in the higher levels of technology awareness, such as knowledge on how to learn and teach using these digital technologies in a creative and critical way. However, the pandemic showed us that even the basic access to technology was inadequate to most teachers and another problem is when the equipment was available, they are not ready to use them appropriately.

Twenty-eight teachers answered the question about resources adequacy. A little different from learners, from this group, 16 mentioned that the resources available for teaching during the pandemic was enough (57%). However, about 43% mentioned that their resources were inadequate. From this second group, seven mentioned that they had some resources, but they weren't adequate, three mentioned that they did not have them and two mentioned that they bought what was needed when the classes began.

As the only way to work and communicate with others was through web-conference and social networks, teachers had to find ways of acquiring computers and accessing Internet in a way or another. Most of us had to include in our economies, the acquisition of new computers, special chairs, more access to the Internet, not to mention, the increase in energy expenses. Besides the financial problems, teachers had to learn very quickly how to use some technologies which were new to them, like web-conferences and virtual learning environments and at the same time how to deal with the disease. Emotional problems, such as insecurity, unpreparedness, disability and sadness, were part of difficulties faced by teachers.

5.3. Emergency solutions

Freire (2018 [1968], p. 149) mentions that in limit situations, we must apply what he named as the "unprecedented viable", what is possible to be done in extreme situations. Here we will consider the emergency solutions the ones we had to adopt during the pandemic. In relations to learners, after a long time of negotiations, by the end of 2020, they received chips to access the Internet (most of them using cell phones) and in the beginning of 2021, the university distributed tablets to who did not have conditions of buying appropriate digital equipment (such as computers and tablets) for studying.

One of the questions in the questionnaire investigated how much the distribution of tablets and internet chips to learners impacted on the classes. Most teachers believed that there was much impact (19% totally and 31% much), 27% believes that the impact was partial, 19% that it was little and only 4% believed that there was no impact. Only after the distribution of the tablet, were almost all learners able to participate of the classes. The lockdown began in March 2020, and at our university the "regular" classes began in September 2020. During those seven months, in my institute, we offered teacher training on how to use a web conferencing platform and our virtual learning environment (VLE). We also offered

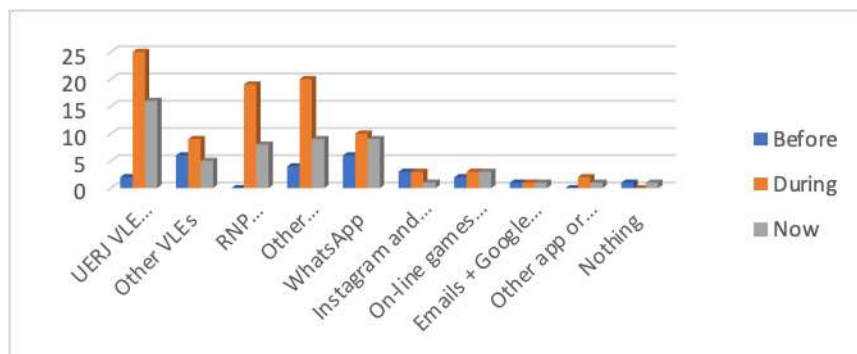
workshops to discuss cyberculture, gamification, and the use of technology to facilitate remote classes (Cardoso, 2021; Cardoso & Velozo, 2020). The use of gamification (Cardoso, 2021) was essential to make the learning process lighter and more enjoyable. We believed that teachers could learn while teaching, so we invite these teachers to prepare remote activities in groups, using a collaborative virtual learning environment (*VLE Integrated Space*), and a common web-conference space (RNP). To organize and publicize these activities, we created a collaborative calendar of activities, using the Padlet app.

When asked which teacher development activities they had taken during the pandemic these 18 of these professors mentioned RNP web-conference workshops or videos and 18 mentioned VLE workshops or videos, nine mentioned workshops and videos on how to use our new administrative system (SEI) and seven mentioned events, lectures or workshops about Emergency Remote Teaching (ERT), seven mentioned workshops and lectures on use of technology for teaching, while three mentioned other activities.

5.4. Changes of beliefs

When we compare the kind of digital technology used before, during and after the pandemic by this group of teachers, it possible to notice that the biggest change was in relation to VLEs and web-conferences. Before the pandemic, only two of them used the university VLE and four used other web-conference platforms (Figure 1).

Figure 1. Teachers' digital technology use before, during and after the pandemic.



There has been some change also in the frequency of use of these digital technologies. Before the pandemic, only 8 used them very frequently and 12 mentioned that sometimes they used them. During the pandemic, almost all of them (24) used technology every class and three used very frequently. After the pandemic, at least 16 of them have used digital technology more frequent, three mentioned that they use it every class and 13 mentioned very frequent use. And one that never used, now (s)he is using it.

The answers to the open questions confirm this positive feeling towards technology by most of these teachers. Below there are two examples.

Yes, it has changed. I started to see that it is possible to do everything online. Nowadays, despite being in the face-to-face classroom, I continue to use the activities I created for the pandemic period, especially the ones related to the procedural evaluation. Everything happens in the VLE. Face-to-face classroom is for exchanging ideas, ...

Digital technologies have allowed me to rethink my role as a teacher. Through the concept of online education, I understood myself no longer as a holder of knowledge, but a "teacher-curator", who searched the internet for materials to contribute to students' learning. I also understood that it was important to bring to class practices that students already had on social networks, such as sharing productions, commenting on each other's production, use of technologies to make mind maps, gamification of assessment, etc.

It is not that the in-person classes are being substituted by on-line classes, but they have noticed that both can be used. However, there is still some resistance, especially when they try to compare teachers and technology, as if it was possible or necessary.

I continue to believe that - for emotional development and emotional balance, as well as learning - there is nothing more important than the face-to-face teacher/student relationship.

It hasn't changed. Technology, by itself, does not guarantee learning. Mediation/Interaction is needed, that is, the teaching profession is fundamental.

It seems that in these cases, teachers still feel afraid of being substituted by technology. Another negative point mentioned by them is the lack of appropriate technology at the university. Only 31% of

them mentioned that they have enough technology for teaching. The same percentage (31%) stated that they would like to have better access to the Internet, 22% would like to use more equipment, 9% would like to buy more equipment and 5% do not have enough technology to work. As for the equipment that they would like to have available at UERJ, seven mentioned more efficient access to the Internet in the classrooms and four of them mentioned e-boards, three mentioned that there should be more projectors and computers, and nine mentioned some other kind of technology.

6. Conclusion and future actions

The results show that there has been a positive transformation in teachers' attitudes in relation to applying digital technologies to language teaching. Participants confirmed that before the pandemic, only a few colleagues used digital technology, while nowadays more teachers use virtual learning environments and web-conference platforms. They also mentioned some important points to be considered, such as the lack of appropriate access to digital technology and the Internet by learners and teachers at university, the importance of face-to-face classes for interaction and the importance of reflecting critically on their practice. Most of the teachers who answered the questionnaire liked the study and felt it was a good way of reflecting on their practice. As a teacher-researcher, but also director of the institute, my next steps will be to interview four selected teachers, to understand better their perceptions, organize more teacher development activities, try to provide more equipment and to improve the access to the Internet.

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NAVIGATING THE HYBRID PH.D. EXPERIENCE: NEW INSIGHTS FROM STUDENT VOICES

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Abstract

This qualitative study explored graduate students' experiences in a hybrid instructional technology Ph.D. program. Seventeen current and former students completed an open-ended survey informed by the Community of Inquiry (CoI) framework. Content analysis revealed four themes, each linked to a CoI element: (1) a flexible, accessible program supporting degree completion (Teaching Presence); (2) self-direction as crucial for the rigorous curriculum (Cognitive Presence); (3) a collaborative peer community enhancing motivation and progress (Social Presence); and (4) consistent faculty guidance as critical for meeting demands (Teaching Presence). Findings suggest prioritizing CoI elements in hybrid doctoral program design can effectively support learning, motivation, and success. Recommendations include developing a flexible curriculum, fostering community, supporting self-directed learning, and ensuring timely faculty guidance.

Keywords: *Hybrid learning, online learning, doctoral education, graduate students, student experience.*

1. Introduction

Hybrid programs, with 30-79% online content (Müller & Mildenerger, 2021), have grown as a flexible alternative (Allen et al., 2007; Nuruddin, 2024). However, in-depth qualitative studies on students' perceptions of hybrid Ph.D.s are needed. This study used the CoI framework (Garrison et al., 2001) to evaluate a hybrid Ph.D.'s challenges and benefits. The research question was: "What are students' experiences and opinions about a hybrid Ph.D. program?"

2. Methods

A qualitative approach captured 17 current and former hybrid Ph.D. students' subjective experiences through an open-ended CoI-based survey. Content analysis followed Creswell and Poth's (2018) process: preparing data, defining analysis units, reading responses, initial coding, refining codes into themes, evaluating theme coherence, and presenting findings with supporting excerpts. The CoI guided analysis.

3. Findings

Four themes emerged, each tied to a CoI element (Table 1). Flexibility and accessibility supported degree completion (Teaching Presence). Self-direction was key for the rigorous curriculum (Cognitive Presence). A collaborative peer community enhanced motivation and progress (Social Presence). Consistent faculty guidance was critical for meeting demands (Teaching Presence). Limited peer interaction could hinder engagement.

Table 1. Themes and Related CoI Elements.

Theme	CoI Element
A Flexible, Accessible Program Supports Degree Completion	Teaching Presence
Self-Direction is Necessary for Rigorous Hybrid Curriculum	Cognitive Presence
A Collaborative Peer Community Enhances Motivation and Academic Progress	Social Presence
Consistent Faculty Guidance is Critical for Meeting Program Demands	Teaching Presence

4. Discussion

Findings showed the CoI's Teaching, Cognitive, and Social Presence contributed to students' hybrid Ph.D. experiences, aligning with prior research on their benefits (Garrison, 2009; Henriksen et al., 2014; Rovai & Jordan, 2004).

The flexible, accessible design exemplified Teaching Presence, considering learner needs (Anderson et al., 2001). Self-direction, tied to Cognitive Presence, was crucial for constructing meaning (Garrison et al., 2001). The importance of peer community reflected Social Presence, enabling collaboration (Stavredes, 2011). Consistent faculty guidance and responsiveness supported Teaching Presence.

However, challenges emerged, like unclear expectations and limited peer interaction, potentially impeding Cognitive and Social Presence. Future research should explore faculty and administrator perspectives and compare formats.

5. Conclusion

This study found a hybrid Ph.D. program's Teaching, Cognitive, and Social Presence elements supported student learning, motivation, and success. Key benefits were flexibility, self-directed learning, peer collaboration, and faculty guidance. Challenges included expectation clarity and peer interaction.

6. Recommendations

1. Provide orientation and training
2. Regularly assess the program
3. Invest in technology infrastructure
4. Foster cross-departmental collaboration
5. Address equity and accessibility
6. Prepare students for diverse careers

With thoughtful CoI-based design, hybrid Ph.D. programs can effectively support student growth and success.

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SERIOUS FUN WITH MATHS: GAMES THAT ENGAGE AND TEACH

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Abstract

Play is a natural way to develop thinking and is part of children's daily lives in their early years. In this sense, the adoption of gamification strategies by pre- and primary school teachers has become increasingly common. Several studies highlight the positive impact of adopting this teaching/learning strategy. Recognizing the advantages of using games as a pedagogical strategy and understanding that children have a high predisposition to develop mathematical skills in their early years, the first author of this article organized a workshop intended for both pre-service and in-service pre- and primary school teachers. The workshop aimed to explore the use of non-digital games as educational tools for teaching and learning mathematics. Considering various research indicating that one of the reasons for gaps in mathematical knowledge is the lack of connection between formal learning and the child's informal and intuitive knowledge, which is especially harmful when informal knowledge is poorly developed, the games explored were designed to be used both in the classroom and at home with the family. Participants had the opportunity to experience a variety of games designed to make the teaching of mathematics more engaging, interactive, and enjoyable for children. The benefits of using games as a pedagogical strategy were also discussed. To assess how workshop participants perceived the use of gamification in the mathematics teaching-learning process, a survey was conducted. Our findings suggest that the participants recognized the potential of using games in the mathematics teaching-learning process and intend to incorporate this resource in their pedagogical practices.

Keywords: *Educational games, game-based learning, non-digital games, gamification, mathematics education.*

1. Introduction

Exploring through play, an intrinsic aspect of children's daily routines, comes naturally and contributes to the cognitive development of children (NCTM, 2008). Children develop mathematical thinking and reasoning in various contexts, especially when they have sufficient knowledge about the materials they are using (such as toys and games), when the activity is motivating and arouses their curiosity, and when the context is familiar to them (Alexander, White & Daugherty, 1997). Hence, children's everyday experiences while playing and exploring are extremely powerful. According to Baroody, Clements & Sarama (2019) "there is no reason why early mathematics instruction must be joyless or crowd out non-academic instruction" (p. 330). In this sense, the adoption of gamification strategies by pre- and primary school teachers has become increasingly common. Several studies (Kapp, 2012; Baroody et al., 2019; Dinata, 2021) highlight the positive impact of adopting this teaching/learning strategy. "Games can provide an engaging opportunity to practice and extend skills. If children have fun playing the games, they are more likely to be motivated to practice math. For maximum benefit, teachers should select specific games to match current math objectives" (Frye et al., 2013, p. 54). Structured play in the form of well-chosen games can provide high quality educative experiences (Baroody et al., 2019).

One of the many reasons given by several authors (Frye et al, 2013; Bassok, Latham & Rorem, 2016; Baroody et al., 2019) for involving young children in mathematics instruction is that early informal (everyday and largely verbal and manipulative) knowledge of mathematics provides an important basis for learning school (and largely written) mathematics and other academic content. Authors such as Frye et al. (2013) and English (2016) argue that it is the responsibility of educators/teachers to promote

enriching mathematical experiences for their students. They can and should plan and design both formal and informal experiences with intentional purpose, creating learning opportunities that align with the interests and needs of the children. Thus, early childhood teachers must “dedicate time that targets mathematics each day and look for opportunities to integrate mathematics throughout the school day and across the curriculum” (Baroody et al, 2019, p. 330).

Recognizing the advantages of using games as a pedagogical strategy and understanding that children have a high predisposition to develop mathematical skills in their early years (Perry and Dockett, 2002; Clement, Sarama & DiBiase, 2004; Baroodi, Lai & Mix, 2006; Bassok et al., 2016), the first author of this paper organized a workshop intended for both pre-service and in-service pre- and primary school teachers. The workshop aimed to explore the use of non-digital games as educational tools for teaching and learning mathematics.

The authors have intentionally opted for non-digital rather than digital games since the former do not require technological resources which many schools and children do not possess. The games proposed only require accessible materials such as paper and dice. Additionally, they also wanted to avoid contributing to the increase in time that young children already spend on screens.

Taking into account multiple research findings that highlight the lack of connection between formal learning and a child’s informal and intuitive mathematical knowledge as a contributing factor to knowledge gaps, particularly when the informal knowledge is underdeveloped (Hiebert, 1986; Griffin, Case & Siegler, 1994; Frye et al., 2013), the games explored were created to be used both in the classroom and at home with the family.

2. Methodology

The aim of this study is to understand how both pre-service and in-service pre- and primary school teachers perceive the use of non-digital games as educational tools for teaching and learning mathematics to young children.

In this case study, inquiry techniques and direct observation were used, employing the following instruments: field notes and questionnaire. During the workshop, the teacher (first author of this article) adopted the participant observation technique. The questionnaire aimed to gather information about both pre-service and in-service pre- and primary school teachers’ perceptions concerning the use of gamification in the mathematics teaching-learning process. After data collection, qualitative analyses were carried out, quantified whenever necessary and possible. Statistical analysis was performed using Excel.

2.1. Respondents

The respondents of this case study were 12 participants of the workshop. This was a convenience sample, as participants were easily accessible to researchers.

With reference to the profile of the respondents, ten participants (83.3%) were in-service school teachers, and only two (10%) were students - pre-service pre- and primary school teachers. Among the in-service teachers, six (60%) were pre-school teachers, three (30%) were primary school teachers and one (10%) didn’t teach mathematics. Most respondents were female (91.7%), whereas only one (8.3%) was male. Regarding their teaching experience, among respondents who are already teaching, eight (80%) had more than 20 years of service, one (10%) between 11 and 20 years of service and another (10%) between 5 and 10 years of service.

2.2. Description of the workshop

The workshop, entitled “Fun Family Mathematics: Games that Captivate and Teach” occurred within the VII CICA (International Interdisciplinary Congress on Children and Adolescents) that took place at the University of Azores, in October 2023. It was a two-hour workshop and had 14 participants.

The goals of the workshop were to explore the use of non-digital games as educational tools for teaching and learning mathematics, in formal or informal contexts (with family); show that it is possible to reconcile the benefits of the game environment with the learning process, whether in the classroom or in the family environment; introduce some concrete games that can be adapted by participants to their specific contexts.

The workshop started with a discussion about the benefits of playing games in childhood and the use of educational games in the classroom. Afterwards the participants had the opportunity to experience three games chosen due to their varied game rules and high potential to be adapted to different mathematics contents. In the end the participants answered an opinion survey.

3. Results

3.1. The games played

In this section we briefly describe the games played at the workshop. They were created by the authors of this paper and one of them was specifically adapted to the Azorean context. The last two authors of this paper have a long experience in mathematical games design for formal and informal contexts, and have dynamized several workshops in conferences and professional development courses for mathematics teachers in the last years (La Fortuna, Morando & Spreafico, 2022; Morando & Spreafico, 2023; Morando & Turconi, 2022). The games are easy to reproduce and only require accessible material such as paper, dice, and timers. Figure 1 (left) shows the materials used for the three games, four copies of each.

In the first game, Garden Animals, there are two decks of cards: one with images of sets of garden animals (combining bees, snails, ladybirds, and caterpillars) and the other with numeric conditions (for instance: there are more snails and bees together than there are caterpillars). In turns, each team takes a card from the conditions deck and has a limited time to identify from a set of four image cards those that satisfy the condition. Those image cards are collected by the team and replaced by new image cards. When the game finishes (no more image cards available) the team who collected more image cards wins. Figure 1 (right) shows two teams playing the game, using the mobile phone as a timer.

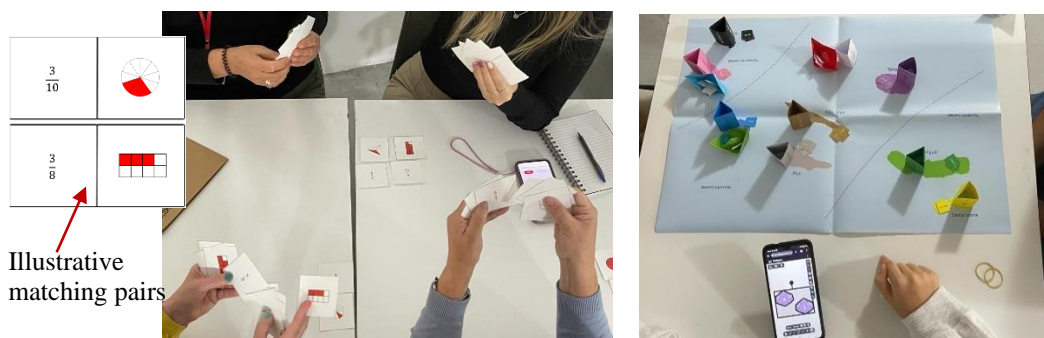
Figure 1. Game materials (left) and participants playing Garden animals (right).



In the second game, Math Twins, there is a deck of pairs of cards, each pair consisting of a fraction and a corresponding diagram (see example in Figure 2, left). The total number of cards must be an even multiple of the number of players. The cards are shuffled, and the deck is evenly distributed by all players. The game starts by allowing players to look for pairs in their cards and put them aside. Afterwards, all at the same time, players randomly remove one card from their left-hand neighbour and check if a new pair can be formed. This step is repeated until one player runs out of cards. At this point the game ends and this player is the winner. Figure 2 (left) shows four players playing the game and two matching pairs of cards.

In the third game, Arithmetic Tour of the Azores, there is a board with the nine Azorean islands, each one with a tower of selected numbers and points to be collected by the teams. Each team has a boat to travel between islands. In turns, each team draws a pair of dice, numbered 1 to 10, and to travel to an island the team must obtain one of the numbers of the island tower by adding, subtracting, multiplying or dividing the dice results. If an island is occupied by a team, no other team can dock there. The first team to collect one point from each island wins the game. Figure 2 (right) shows the game being played using digital dice available at <https://polypad.amplify.com/p#polyhedral-dice>.

Figure 2. Participants playing Math twins (left) and Arithmetic Tour of the Azores (right).



3.2. Analysis of questionnaires

The first section of the questionnaire concerned the characterization of the respondents, summarized in Section 2.1. The main section of the questionnaire had 5 questions. In the first question, participants were asked to rate, through a five-point Likert scale (1-very negative; 5-very positive), their general evaluation of the workshop (first line of the heatmap in Figure 3). In the next two questions, they were asked to rate their agreement, on a five-point Likert scale (1-total disagreement; 5-total agreement), over two sets of statements about the workshop. As can be seen from the heatmap of responses and corresponding statistics of these three questions (**Error! Reference source not found.**), the course was well evaluated and the general opinion about the use of gamification in mathematics classes was positive.

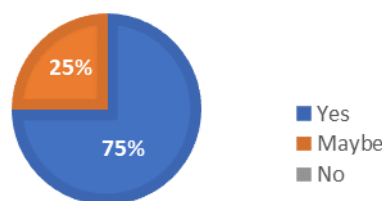
Although all the global evaluations of the workshop were positive, there were four negative opinions (level 2 of agreement) and several neutral opinions (level 3 of agreement) in the remaining questions. The questionnaire was made using Google forms and we have noticed later that keeping the mobile phone in vertical position, for questions 2 and 3, only the first 2 or 3 choices of the Likert scale are visible, and the user has to scroll the bar to the right to see the remaining options. It is possible that some participants did not realize this and that would explain the apparent contradiction between answers.

Figure 3. Heatmap of responses with corresponding mean and standard deviations.

	1	2	3	4	5	Mean	Std.Dev.
Overall, how do you rate this workshop?	0	0	0	4	8	4,7	0,5
The topic was relevant.	0	1	2	0	9	4,4	1,1
The workshop met my expectations.	0	1	2	0	9	4,4	1,1
The activities were interesting.	0	1	2	0	8	4,4	1,1
I think that using gamification in mathematics classes:							
is important.	0	1	2	4	5	4,1	1
provides a more interesting learning method.	0	0	3	4	5	4,2	0,8
makes learning more interactive.	0	0	3	2	7	4,3	0,9
makes the classes more stimulating.	0	0	3	2	7	4,3	0,9
contributes to a more positive view of mathematics.	0	0	4	2	6	4,2	0,9
involves the students in the learning process.	0	0	4	3	5	4,1	0,9
increases students' motivation.	0	0	4	2	6	4,2	0,9
contributes to achieving better results.	0	0	4	2	6	4,2	0,9

Participants were asked if, after this workshop, they intended to use gamification in their classes. Figure 4 shows that most participants intend to use gamification and there were no negative responses.

Figure 4. Pie chart of responses to the question "Do you intend to use gamification in your classes?"



Finally, the participants were asked to write further comments on the workshop. Three respondents provided comments which we transcribe next:

Excellent!

I found it very interesting and relevant since today's students are so-called "digital natives".

Very practical and functional. I have to make some adaptations for preschool. Thanks!

This last very positive comment was given by a pre-school teacher who had a neutral opinion in all statements, except for the overall evaluation of the workshop which was "Very good". As mentioned previously, this contradiction is likely to be the result of wrong choices due to the mobile phone layout.

Direct observation during the workshop revealed that participants were enthusiastically involved in the games, and many expressed their intention to use the games (or adaptations) with their students.

4. Conclusions

In this work we analyze the use of mathematical educational games for pre- and primary school children by showing three games that can be used both in school context and at home with the family. The selected games are easily adaptable to other topics and thus constitute new materials for teachers to

use in their practice. The results of this study are clearly positive, with teachers expressing enthusiasm for this type of experience, recognizing the potential of using games in the teaching-learning process, and showing interest in incorporating this resource into their pedagogical practices.

Acknowledgments

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BRIDGING PLAY AND INCLUSION: A QUALITATIVE INVESTIGATION INTO ACCESSIBILITY CHALLENGES AND INNOVATIONS IN BOARD GAME DESIGN

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Abstract

Contemporary educational research increasingly emphasises the educational and learning potential of games, with a particular focus on board games, given their ability to promote meaningful experiences, including engagement, satisfaction, flexibility, or freedom of experimentation. Considering these potentialities, it becomes imperative to align the design of board games with the current needs and particularities of a more inclusive education. In this regard, the present study explores game design practices, focusing on the critical aspects of inclusivity, namely the players' and learners' specific accessibility needs. Through a qualitative approach, it engages with 26 board game designers, from various backgrounds and geographical locations, to understand their inclusive design views and attitudes. By employing content and critical discourse analysis, the research reports and contextualises multifaceted barriers and innovative solutions that designers employ to create inclusive gaming experiences. Key findings reveal that economic constraints significantly delay the pursuit of accessibility in board game design, requiring innovative solutions like supportive policies and cost-effective technologies. Moreover, designers are employing various strategies, such as digital aids and sensory adaptations, demonstrating the prevalence of a proactive approach to enhancing accessibility. Despite these efforts, challenges like sexism, racism, and accessibility issues persist, highlighting the need for ongoing education and awareness-raising initiatives within the community.

Keywords: *Inclusive education, board games, game-based learning, accessibility.*

1. Introduction

Games have been studied as differentiated and effective educational approaches for learning a wide range of skills (de Freitas, 2018). However, the focus of research has been more on the results of Game-Based Learning (GBL) approaches, exploring whether they work or not, and less on the intrinsic characteristics of these games that stimulate them. Accordingly, to better understand GBL as a pedagogical approach implies the understanding of game design aspects and game features, including “perceived usefulness, ease of use, and goal clarity, could increase student engagement and improve the enjoyment of games, which should be stressed by game designers” (Yu et al., 2021, p. 571).

While there is a predominance of digital games in GBL research, board games have been approached as feasible educational alternatives that should be valued for three fundamental reasons. Firstly, their value for operationalising abstract concepts, given that the player's understanding of the game system is fundamental for it to work (Maratou et al., 2023). Secondly, its economic accessibility presents itself as a solution to digital access barriers that are still very present in educational contexts (Sousa et al., 2023a). Finally, their tangibility, or the way touching physical objects is, to this extent, not only a source of entertainment but also a way of promoting holistic human development, which is essential for a balanced and healthy educational process (Sousa, in press).

Therefore, board games have been documented as having positive impacts on engagement, satisfaction, flexibility, or freedom of experimentation, due to their ability to promote meaningful experiences (Sousa et al., 2023b). In recent years, and more in terms of the themes addressed, board games have also been very relevant to learning themes related to environmental sustainability (Tsai et al., 2021), news literacy (Maze et al., 2020), and social power relations (Au, 2021).

1.1. Board games and learning: inclusion or exclusion?

As immersive and interactive environments, board games become spaces for creating meaning and conveying values par excellence (Booth, 2016). As such, their potential can reinforce social exclusion if inclusive design and accessibility principles are not adopted in their conceptualisation (Chakraborty, 2017). Moreover, its broad pedagogical potential, which has been explored previously, can only be accessed by all students if they have ways of accommodating the different support needs of players in their gameplay (Rye, & Sousa, 2023). In other words, the inclusive potential of GBL depends on the accessibility of the games produced and the way they consider the specific needs of each learner.

Considering this context, the present study explores the domain of board game design, focusing on the critical aspects of inclusivity, namely the players' and learners' specific accessibility needs. Through a qualitative approach, it engages with 26 board game designers, from various backgrounds and geographical locations, to understand their perceptions, current practices, challenges, and strategies concerning the integration of accessibility considerations into the design process.

2. Method

2.1. Participants

The study involved 26 female and male game designers aged between 20 and 63 years old. Among the participants, a significant portion ($n = 11$) were from Portugal, with additional representation from Germany ($n = 6$), Brazil ($n = 3$), USA ($n = 3$), France ($n = 2$), and Finland ($n = 1$). The participants showed a range of professional game design experience. A dynamic cross-section of comparatively early and mid-career professionals, 15 people had tenures ranging from 3 to 10 years. The remaining 11 players contributed a wealth of knowledge, having designed games for anywhere from 11 to 40 years. The sample was selected by convenience and therefore intentionally and non-probabilistically, based on the game designers present at a Portuguese board game convention.

2.2. Interviews and procedure

The interviews followed a semi-structured script, considering the aim of the research. Therefore, throughout the interviews, a flexible and participant-centric approach was adopted, with participants being encouraged to elaborate on their thoughts freely. Both the questions and the subsequent data coding process were designed considering the accessibility components of board games, as defined by Heron et al. (2018), guaranteeing a holistic and integral view of the potential needs of players.

To ensure accuracy and comprehensive analysis, all interviews, whether conducted online or in person, were recorded. Following the interviews, each recording underwent a thorough transcription process. Transcripts served as the primary textual data for analysis, providing a detailed and *verbatim* account of the participants' responses. Informed consent was obtained from all participants, ensuring they were aware of the research objectives, the recording process, and the subsequent use of the data. To uphold the privacy and confidentiality of the participants, names were anonymized during the analysis phase.

2.3. Coding and data analysis

It is important to note that a two-step method was adopted to analyse the interviews. Firstly, a mixed approach to content analysis (Castro et al., 2022), in which the textual units of analysis are quantified and categorised, according to the accessibility model of Heron et al. (2018), mentioned above, using NVIVO software, version 14. Afterwards, the content of each category was reviewed according to the principles of critical discourse analysis (Van Dijk, 2015), specifically adapted to understand how the power relations of the empowered society impact the perceptions and practices of these game designers.

In addition, it is important to note that the top-down approach, in which the categories were based on this conceptual model of accessibility (Heron et al., 2018), also adopted bottom-up content analysis procedures. Thus, the subcategories analysed emerged from what was most relevant in the game designers' interviews.

It is also important to emphasise that this work reports a preliminary approach to the results of the analysis of this extensive *corpus*, namely the "Inclusive Design Views and Attitudes" category.

The content analysis validity was based on an Inter Coder Reliability (ICR) procedure, with 10.00% of the corpus being coded by two independent researchers, to reveal a high level of agreement (97.63%).

3. Preliminary results

From the bottom-up coding of the interviews, and considering the category “Inclusive Design Views and Attitudes”, the following subcategories emerged from the game designers’ interviews: (1) Barriers and challenges to create accessible games; (2) Strategies implemented to create accessible games; (3) Perceptions about game genres and accessibility; (4) Perceptions about game mechanics and accessibility; (5) Age rating and definition; and (6) Inclusivity in the board games community. The full content analysis process resulted in the coding of 3849 units. The main category was present in all the analysed interviews ($N = 24$; 100.00%) and represented 23.02% ($n = 886$) of those coded units. The subcategories are quantitatively and critically analysed below. As we will explore, 24 sources/interviews were analysed, despite the inclusion of 26 game designers in the sample. This is because one interview was excluded due to the technical impossibility of transcribing the audio and another interview was with a pair of participants.

3.1. Barriers and challenges to create accessible games

The barriers and challenges to creating accessible games include all the hindrances encountered during the game design, prototyping stage and all the other creative phases, and represented 2.42% of the coded units ($n = 93$). The analysed discourses reflect a significant tension between the desire to make games more accessible and the practical economic constraints faced by producers. While there is a clear recognition of the importance of accessibility, the economic implications often lead to compromises that hinder inclusivity. This analysis suggests a need for innovative solutions that can balance cost and accessibility, perhaps through policy changes, economic support, or new technologies that reduce production costs while enhancing game accessibility.

3.2. Strategies implemented to create accessible games

The strategies implemented to create accessible games represented 3.87% of the total coded material ($n = 149$), being the second most coded subcategory. The strategies outlined in the interviews represent a diverse range of approaches to tackling the challenges of accessibility in game design. There is a clear trend towards integrating technological solutions, like digital aids and videos, and a strong emphasis on sensory adaptations to accommodate visual impairments. These strategies not only aim to make games more inclusive but also attempt to broaden the market reach by addressing the varied needs of a global and diverse player base. This analysis underlines the proactive measures being taken within the gaming industry to ensure that fun and engagement in gaming are accessible to all, regardless of physical limitations.

3.3. Perceptions about game genres and accessibility

The perceptions about game genres and their relationship with accessibility possibilities represented 3.79% of the total coded units ($n = 146$), being the third most coded subcategory within “Inclusive Design Views and Attitudes”. To this extent, the discourse around game genres and accessibility reveals a nuanced understanding among designers about the trade-offs between game complexity, economic factors, and market demands. While family-friendly and party games are generally seen as more accessible, the economic burden of production and the specific needs of diverse player bases pose ongoing challenges. The industry's responses to these challenges, such as adopting multilingual support and designing with universal accessibility principles in mind, highlight a growing commitment to inclusivity in game design.

3.4. Perceptions about game mechanics and accessibility

The perceptions regarding the relationship between game accessibility and game mechanics represented the most discussed topic in the game designers’ interviews (5.98% of the coded units; $n = 230$). Different relevant aspects were discussed. More specifically, the discourses stress the balance designers must attain between creating engaging, challenging games and ensuring they are accessible and enjoyable for diverse audiences. The findings suggest that while some mechanics can enhance accessibility by simplifying gameplay or reducing the stigma of poor decision-making, others may inadvertently exclude or discourage players – as random events, or player elimination.

3.5. Age rating and definition

This covered a variety of topics regarding the evaluation and assigning of appropriate age ratings for board games, and represented 3.61% ($n = 139$) of the total coded material. Through the interviews, it is possible to note that the discourse on age rating in the board game industry is characterised by a blend of objective criteria and subjective decision-making. While the complexity of the game and its content play critical roles, economic factors and regulatory environments also significantly influence age ratings. The findings underline the need for a more standardised approach to age ratings that considers developmental psychology, educational theories, and cultural contexts, aiming to serve the best interests of children and families more accurately and consistently.

3.6. Inclusivity in the board game community

This subcategory covers a range of topics regarding the state of accessibility in the community including challenges and opportunities in fostering diversity and inclusivity, and it represented 129 coded units (3.35%). The discourse on inclusivity within the board game community illustrates a complex landscape where progress and challenges coexist. While many express a strong sense of community and efforts towards inclusiveness, issues such as sexism, racism, and accessibility continue to require attention. The community's self-awareness and proactive stance are promising, yet the need for continuous improvement is clear.

4. Core insights and future directions

The obtained results reveal several key insights into the current state of inclusive design in board games. Firstly, economic constraints significantly delay the pursuit of accessibility, since designers acknowledge the importance of inclusivity but often face financial challenges. This tension between accessibility goals and economic realities underscores the need for innovative solutions, such as supportive policies, financial incentives, and cost-effective technologies.

Secondly, designers are already employing various strategies to enhance accessibility, including digital aids and sensory adaptations, highlighting a proactive approach within the industry and a willingness to innovate and adapt.

Thirdly, balancing engaging gameplay with accessibility is another critical consideration. Some mechanics enhance accessibility by simplifying gameplay, while others, such as random events or player elimination, may inadvertently exclude players. Another relevant identified aspects of the analysis include how assigning appropriate age ratings involves a blend of objective criteria and subjective decision-making. It highlights the need for a more standardised approach to age ratings that incorporates developmental psychology, educational theories, and cultural contexts.

According to this study, the board game community shows a strong sense of awareness and proactive efforts towards inclusiveness, as previously hypothesised by Booth (2021). However, challenges such as sexism, racism, and accessibility issues persist, highlighting the importance of ongoing education and awareness-raising initiatives within the community, namely to more equity-driven uses of GBL in education. To support such an aim, future directions of this study include a thorough analysis of the remaining categories and subcategories of the conducted interviews, as well as the development of strategies to support the industry and educators in implementing accessibility-driven practices, both in commercial and educational projects.

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LEARNING VIDEOS FROM A STUDENT'S PERSPECTIVE

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Abstract

Videos support different learning strategies. Numerous publications have explored the possibilities of using video, from short introductory clips to the flipped classroom approach, recorded descriptions of situations and activities, recordings of traditional classes, and remote, interactive teaching. Our objective is to understand how and why students use videos. We aim to determine their purpose and how they utilize the prepared videos. Some educators suggest that students use video primarily as a study tool before tests and exams and do not utilize the materials in other contexts. Some students prefer written materials and use video to a small extent. Other challenges relate to the technical aspects of using video, particularly in finding the expected information and using videos effectively. Addressing these issues can help in better and more effective preparation at the level of video creation. This article presents observations from teachers across different departments, literature reviews, and student survey results. The findings show that the students use mostly teacher-made videos in their learning and that the content is the most important, not the technical quality. The videos do not have to be short, and they do not have to be subtitled if the sound is satisfactory. Students do not wish to make videos themselves as hand-ins.

Keywords: *Flipped classroom, blended learning, instructional videos, video production.*

1. Introduction

The pandemic caused massive disruption to the academic field, and the work to quickly move to electronic learning (e-learning) has affected universities, teachers, and students at all levels. The number of colleges and universities worldwide offering distance learning programs has increased drastically (Pollen, 2022). During the pandemic, everyone had to acquire knowledge to use digital media in teaching. In retrospect, you can evaluate what worked well or not. Over some years, digital learning resources have been produced for use in teaching, and investigating whether such resources have positively affected students' learning is interesting. The development of learning resources can help lift the knowledge database to promote better learning for students in higher education.

It is still not the case that video in teaching guarantees better learning outcomes. The medium itself does not provide learning; it is crucial how you design the video and include it as a teaching method (NTNU, 2024). Real-time videos mean live transmission/streaming between campuses or locations. There are several reasons for streaming, such as a lack of teachers, reduced costs, and avoiding travel.

At Western Norway University of Applied Sciences (HVL), it is normal for compulsory student work to be delivered as a PDF file in the learning platform or by e-mail. Alternatively, can student work be handed in as a video? Could video feedback from teachers be an alternative for our students? Can this be used as guidance in bachelor theses or similar work? Text and words can give a better understanding of the feedback. By posting a video on the learning platform ahead of the teaching session, you can “flip” the classroom (Fojcik et al., 2020). In dialogue with the students, you can arrange for them to watch relevant videos on a topic ahead of the lesson and use the time for homework or solving various problems. Other reasons for using video in teaching and learning are to motivate, provide variety, and encourage repetition. The videos must be adapted for the students so they can watch them at their own pace, rewind, stop, play, and make notes to understand difficult theories more easily.

This article discusses a survey of the students' video use to enhance their knowledge in various subjects at WNUAS. The article is organized as follows: Part 2 presents related work, part 3 describes the survey's methodology, part 4 results, part 5 discussion, and part 6 conclusion.

2. Related work

There has been a rapid development and increase in the use of available video material in many areas of society, including higher education. Today's infrastructure and transmission systems for data transfer have been better developed, and capacity has increased. This has meant that the quality and speed of video transmission have improved, and the quality of the data material received is satisfactory.

Due to the demands of modern technology-savvy students and the availability of technology, higher education institutions feel the need to reshape traditional teaching methods (Moussiades et al., 2019). Videos are increasingly gaining a foothold in the educational landscape. It is recognized that videos can enliven sterile theoretical concepts with vivid images and spark students' imaginations (Abdous & Yoshimura, 2010; Chan, 2010; Pelton, 2013). Therefore, teachers in schools and universities are increasingly encouraged to use video instruction in their teaching and develop students' learning skills through videos. Empirical studies on the use of videos report that video is a powerful medium for presenting educational material, expert demonstrations, giving and repeating lectures, and exploring complex scenarios (Berk, 2009; Moussiades et al., 2019). As a result, most universities have started mixing live teaching with various digital approaches, which is a blended or hybrid learning perspective (Higgins, 2003). Video-based learning (VBL) is an important part of blended learning, especially in flipped classrooms and Massive Open Online Courses (MOOCs).

According to de Boer (2013, p. 17), the emergence of digital networks, such as the Internet, has made it possible to watch videos at any time, regardless of time. It has also led to the teaching being somewhat detached from a specific location (i.e., the classroom). The video can be viewed on any computer connected to the internet. Siemens, Gasevic, and Dawson (2015, p. 205) refer to this as "the idea of classroom constraints where teachers can now use a variety of technologies and interact with students and content worldwide". This has led to opportunities outside the classroom with the rise of MOOCs (Fox, 2013; Baggaley, 2014), transforming the educational landscape (Bates, 2015). It is difficult to imagine modern teaching without the video elements (Andrist et al., 2014) that allow students to engage with the material before class in their free time. On the other hand, using digital elements such as video content is not limited to students conducting self-study, i.e., watching a particular video at their own time and pace. Digital elements are also used for formal learning. The fact that videos can also be integrated into face-to-face sessions means that the use of video is by no means limited to a supplementary element (Andrist et al., 2014).

Within the education sector, many different videos have been produced, each with its own aspects and functions. Categorizing, describing, and defining the differences between the various forms is a challenging process, and due to the dynamic nature of the field, it is a process that is constantly evolving. Changes are required for lecturers who switch from face-to-face teaching to video teaching with screen processing. Doing this efficiently while maintaining a spotlight on the teaching process without getting lost in the complexity of new technologies is an ongoing challenge. For some lecturers, it may seem controversial to record their teaching on social media and make it available to a larger audience. Nevertheless, the probability is high that video teaching will become more standard over time (Woolfitt, 2015).

Shephard (2003, p. 295) pointed out over twenty years ago that "video has been used in various ways for many years to support student learning in all branches of education". Access to websites such as YouTube, Facebook, TeacherTube, and others has improved a lot recently, and most of them are freely available to students and lecturers. There are also many specific videos made for our educational purposes, made by academics, which have had the same purpose as us in investigating the use of self-produced video material for students. There are examples of video use evaluation in higher education's learning and teaching field, as Shephard (2003) has pointed out. The research in this area has often focused on the lecturer's views and experiences on correctly using the technology (Cook-Sather, 2003; Lee & Sharma, 2008). Guo, Kim, and Rubin (2014) found that videos should be short, about 6 minutes and that the content was the most important thing for the students, not the technical quality.

3. Method

3.1. Study description

The survey was conducted among HVL students, and the questionnaire was given to engineering students on two HVL campuses. The survey aims to assess how videos are used in teaching, examine the students' experiences with different backgrounds and perspectives, and determine whether opinions coincide. The goal is to facilitate change and development.

3.2. Collection of data

Students were asked about using videos in their learning process, whether they enhanced their knowledge, and details about their usage. The data was collected from two of the university's five campuses, Førde and Bergen. Most students are on the Bergen campus, divided into IT (computer engineering) and Electronics (electrical engineering). In the IT program, 34 out of 41 students responded; in the electrical program, we received 51 responses out of 64 students surveyed. Overall, we received a response rate of 81% for the two study programs. The survey was conducted in the spring of 2024. The survey includes first-, second-, and third-year students pursuing a bachelor's degree in electronics and IT/computer engineering at our university.

3.3. Survey

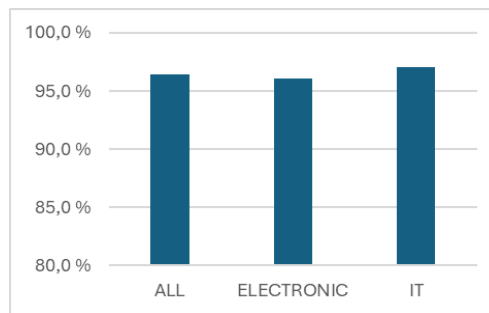
The survey consists of a questionnaire with 16 closed questions. Closed questions mean yes/no answers or to what extent. The lecturer will never fully know what type of students are following the class; they can be full-time students, distance students, or students who combine work and study.

Questions such as “What type of videos do you prefer?” may be of interest as we, as teachers, spend much time creating video resources. Is our work useful? Students have many opportunities to find relevant video resources online. Should videos be added to the learning platform before or after the lesson? Here, teachers tend to practice differently because those who post resources in advance of teaching often get answers from students, such as, “No, we have not had time to watch the video.” We ask, “How do you experience the technical quality of the videos?” and “What is important to you when you start a video?” On this last question, we give the student several options.

The survey was anonymous and voluntary and was considered non-reporting and non-sensitive. No personal information was collected about the participants. The entire questionnaire, including space for the answers, was given on one A4 sheet printed on both sides. This was done to indicate that short and precise answers were expected. The questions in the survey lead to quantitative analysis.

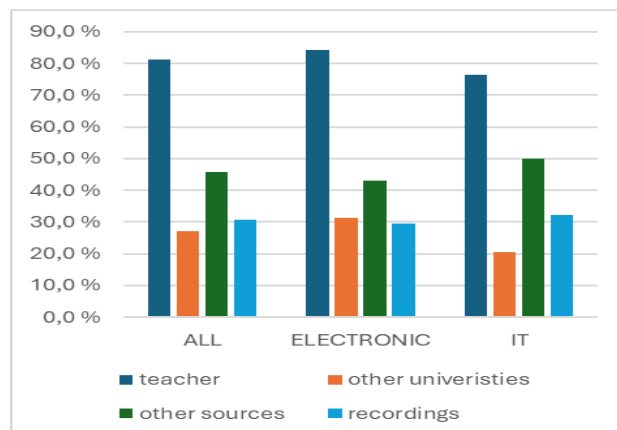
4. Results

Figure 1. Are you using videos in your learning?



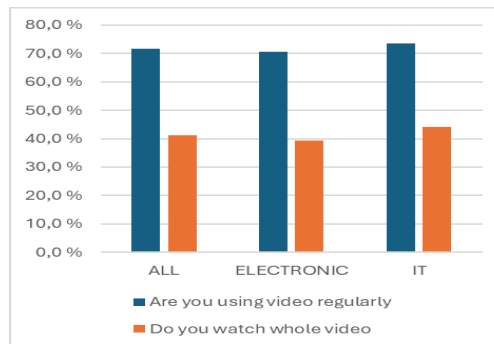
Almost all students (average 96%) are using videos, and there are very small differences between the two student groups.

Figure 2. What kind of videos do you use?



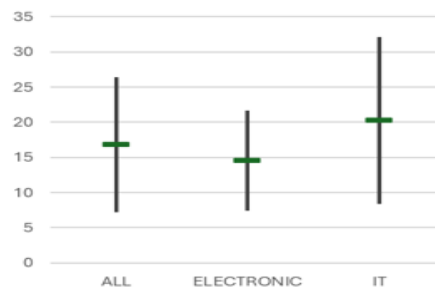
Most students use videos prepared by their lecturer (approx. 80%). Electronics students watch slightly more videos than IT students.

Figure 3. a) Are you using videos regularly during the whole semester, and b) are you watching the whole video without moving forward and back?



On average, 70% of students watch videos regularly. However, statistics from YouTube and Canvas show that most students watch videos only before exams. Students use videos mostly to find useful information (60%). Only 40% of them will watch the whole video.

Figure 4. Preferred video length.



The preferred video length varies from about 5 minutes to more than 30 minutes. Another question was about videos as student hand-ins. Most students (80%) do not want to make videos themselves.

Table 1. What is the most important in a video? Likert scale from 1 (most important) to 6 (least important).

1.	Content	1.4
2.	Availability (easy access)	2.8
3.	Form (design)	3.4
4.	Size	3.9
5.	Subtitling	4.5
6.	Fitting to display on mobile device	5,2

We can see that content and availability are the most important factors and that size and subtitling are less important. Some students answered that subtitling is unnecessary if the sound is satisfactory. However, 60% of the students want subtitling.

5. Discussion

The meta-survey (Guo et al., 2014) carried out 10 years ago showed that students wanted short video clips and that relevant content was the most important thing, not the technical quality. This was before the pandemic, and a lot has changed since then. At the time, there were not many lecturers making videos at our university; now, there are many more. Students today expect videos to be available to support their learning, and it is an important part of the flipped classroom (Baig & Yadegaridehkordi, 2023; Fojcik et al., 2020). Our survey shows that almost all students use videos but to varying extents. They prefer videos made by subject teachers, but some watch videos on other channels, such as YouTube. Students are happy to watch videos longer than the recommended length of 6 minutes (Guo et al., 2014). In higher education, you must not only acquire subject competence but also so-called soft skills, such as creativity, the ability to communicate, the ability to collaborate, the ability to exercise source criticism, and persistence (Poláková

et al., 2023). Learning takes time, and how long it takes to acquire new skills is individual. You must spend the time you need using different sources, not just videos. You can stop long videos and take breaks when needed. Our survey shows that the length of the video is not decisive; it is the content and accessibility that are most important; everyone is pretty much in agreement there. It coincides with Guo's study. Videos must have relevant content, but it can be easy to forget that if you try to make them technically perfect. However, the students do not want to submit work requirements on video, and they do not want to make videos themselves.

6. Conclusion

The survey shows that the students use videos and that the content is the most important, which means that we do not need to spend much time trying to create technically perfect videos. The first version is often good enough if you speak clearly and have a good microphone. We have emphasized making short videos, but it is not as important as we thought. This survey is a great inspiration for continuing to facilitate learning by creating digital learning resources.

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DIGITAL TECHNOLOGIES IN ACTIVE AND SELF-DIRECTED LEARNING

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Abstract

Digital technologies are increasingly recognized for their potential to significantly enhance both active and self-directed learning. However, the extent and manner in which educators in higher education harness these technologies to achieve such educational objectives is still in its nascent stages. This study investigates the techno-pedagogical of college educators, specifically focusing on their ability to facilitate active and self-directed learning through digital technologies. Additionally, it scrutinizes their insights into the role of digital technologies in fostering self-directed learning processes. The study encompasses a sample of 156 educators from a wide range of academic fields across five Israeli teaching colleges. Employing a hybrid research design that combines both quantitative and qualitative methodologies. An online questionnaire enabled educators to thoroughly evaluate their acquaintance with and application of digital technologies. The semi-structured interviews were conducted to gain deeper insights into the educators' perceptions of digital and self-directed learning. Findings from the study reveal that educators predominantly utilize digital technologies to augment their teaching practices and promote active learning and student collaboration. Notably, only a select group of educators demonstrated advanced techno-pedagogical skills necessary for actively endorsing self-directed learning through student engagement in the selection and adaptation of digital resources. Interviews highlighted a generally superficial understanding of self-directed learning among educators, who often failed to offer students meaningful choices in their learning journeys. Despite this, there was a consensus on the importance of group and collaborative learning within digital contexts. The study concludes that the integration of digital technologies into educational practices, aimed at fostering active and self-directed learning, is still in its infancy. There is a pressing need for educators to not only refine their technological proficiency but also to cultivate a pedagogical appreciation for actively involving learners in the selection and utilization of digital tools tailored to their educational pursuits. Embracing this dual-faceted approach is essential for advancing active and self-directed learning strategies in the realm of digital education.

Keywords: *Digital learning and teaching, active learning, self-directed learning, techno-pedagogical competencies.*

1. Introduction

Active learning and self-directed learning (SDL) embody intertwined, complementary pedagogical frameworks that cultivate autonomous, engaged learners. Active learning, a learner-centered approach, engages individuals deeply in their educational journeys, employing strategic methods to enhance learning (Morris, 2019). SDL relies on a learner's ability to autonomously initiate and manage learning activities, which includes planning, needs assessment, and evaluation (Gureckis & Markant, 2012). Both methodologies aim to deepen learning and critical thinking by transitioning learners from passive recipients to active participants. The integration of active learning strategies bolsters SDL, offering learners varied, engaging interactions with educational content, thereby enhancing their application of SDL skills across diverse contexts (Morris & Rohs, 2021; Wang & Wegerif, 2019; Hua, Wang, & Li, 2024).

Post-pandemic, there has been an accelerated adoption of digital technologies in higher education (Lockee, 2021), which hold the potential to promote both active and SDL across varied educational landscapes, thereby enhancing students' learning processes and academic outcomes (Morris & Rohs, 2021). Despite widespread student use, digital technologies remain underutilized by educators, often sidelined for pedagogical integration, highlighting the necessity for robust pedagogical support to facilitate effective digital instruction (Mercader & Gairin, 2020; Amhag et al., 2019; Pinto & Leite, 2020). These technologies afford flexibility and choice, empowering students to tailor their learning experiences, which fosters their SDL abilities (Morris & Rohs, 2021). Research indicates a positive correlation between active use of digital tools and enhanced SDL capabilities (Rashid & Asghar, 2016; Hyland & Kranzow, 2011).

2. Purpose and research questions

This study investigates the impact of digital technologies on active and SDL, specifically examining the techno-pedagogical competencies of college educators in facilitating these learning modes. Further, it explores how educators conceptualize SDL within digital contexts to understand their perceptions and attitudes. The research addresses the following questions:

1. What are the primary purposes for which the educators deploy digital technologies in their teaching, and to what extent can such integration be observed?
2. To what extent do the educators engage learners in the selection and utilization of digital technologies to cultivate active and self-directed learning?
3. How is SDL defined by the educators, and is its realization feasible? If so, how can it be effectively promoted through the integration of digital technologies into the educational environment?

3. Methodology

3.1. The research population

The study encompasses 156 educators across five Israeli teaching colleges with diverse academic disciplines, religious affiliations, and cultural demographics. Most participants possess extensive teaching experience, generally exceeding six years, and typically teach at least five courses annually.

3.2. The research tools

A. Questionnaire: An 18-item questionnaire, crafted specifically for this study and grounded in the SELFIE framework (Kampylis, Punie, & Devine, 2015), was administered online to gauge educators' familiarity and usage of digital technologies across various professional scenarios.

B. Semi-structured Interviews: Ten educators, noted for their consistent technology integration, were selected for semi-structured interviews conducted either face-to-face or via Zoom, focusing on digital learning dynamics, SDL definitions, and facilitative teaching strategies.

4. Findings

Our research highlighted that a significant majority of educators (76.1%) utilized communication tools such as email, online forums, and WhatsApp to enhance learner interactions. A notable 66.1% of educators employed digital platforms for creating educational materials like presentations and videos. Additionally, about 65% of participants engaged with distance learning technologies, predominantly using platforms like Zoom. However, only a smaller percentage of educators utilized digital resources to address learner diversity (25.0%). Notably, a considerable portion of the educators were minimally familiar or unfamiliar with advanced technological tools.

A select group of educators demonstrated high techno-pedagogical skills and effectively promoted SDL. These educators not only utilized a broad range of digital tools but also actively involved learners in selecting and using these tools. This participatory approach significantly enhanced SDL and fostered higher levels of cooperation and active engagement among students. Yet, such practices were relatively rare, marking a clear disparity compared to those educators who did not involve learners directly.

Interview analysis revealed educators' complex views on the critical technological, pedagogical, and personal elements essential for effective learning with digital technologies. Technological proficiency was universally regarded as crucial for effective learning, highlighting a consensus on the necessity for strong digital skills. When asked to define SDL, 90% of educators described it as the ability to study independently, navigate and critically assess information, and effectively organize and synthesize data. Furthermore, 80% emphasized the importance of cooperative learning, suggesting that collaborative tasks significantly contribute to the successful implementation of SDL strategies.

5. Discussion

This study evaluated the techno-pedagogical capabilities of faculty members within teaching colleges, with a specific focus on promoting active learning and self-directed learning (SDL). While the primary goal of utilizing digital tools was to enhance instructional practices and foster an environment conducive to active and collaborative learning, the integration of students in the selection and use of these tools remained limited. Such limited involvement underscores the need for a deeper engagement in student-driven SDL, suggesting significant room for improvement in facilitating meaningful student participation in educational decision-making processes.

Challenges identified in this study include the instructors' relatively narrow perception of SDL, predominantly seen as the ability to independently engage with educational materials. This perspective often overlooks essential skills such as the identification and selection of appropriate learning strategies, which are crucial for fostering comprehensive SDL capabilities. This gap may contribute to the observed deficiency in incorporating students' input in selecting digital tools, which is a critical aspect of fostering an inclusive and adaptive learning environment.

The findings further indicate that the development of enhanced techno-pedagogical skills among educators correlates with more effective promotion of active and self-directed digital learning. Educators highlighted the essential role of mastering technological tools, which are integral to modern educational strategies. Therefore, ongoing support, guidance, and specialized training are crucial to develop these competencies. Moreover, to truly empower educators to advocate and implement SDL, it is vital to offer targeted training programs that not only focus on flexible teaching methods but also emphasize the importance of involving students in the decision-making process concerning their learning pathways.

This comprehensive approach would not only address the current limitations but also enhance the overall educational experience by aligning technological proficiency with pedagogical needs, thereby supporting a more dynamic and participative learning environment.

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METaverse EDUCATION: IMMERSIVE VR EXPLORATION OF MOUNTAIN HERITAGE AND CULTURE

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Abstract

The rapid technological progress has led to a profound digital overhaul across sectors, notably in education. VR technologies and the metaverse offer novel avenues for disseminating knowledge, promising immersive, flexible, scalable, diverse, and interactive learning environments (Baynat & Lopez, 2020; López-Belmonte et al., 2022). Incorporating gamification within the metaverse enriches learning experiences, providing engaging content delivery methods (Khan et al., 2022). This study assesses the metaverse's potential in VR applications to enhance learning outcomes and user engagement, emphasizing content accessibility and immersive educational experiences through gamification. Authors created an open virtual platform within the metaverse, inviting users to explore a mountain area blending historical, cultural, and environmental elements. The experience unfolds within an interactive three-dimensional reconstruction of the valley, featuring a virtual mountain trail walk and a tour of a historic mountain village. Application development involved data acquisition for modeling and interaction design using Unity3D, with online deployment facilitated by the Spatial Creator Toolkit. For project evaluation, users complete a post-experience survey, providing quantitative data on engagement, motivation, content understanding, and interaction quality (López-Belmonte et al., 2022). Survey results indicate high engagement and positive feedback, implying enhanced accessibility via the metaverse. The project fosters real-time interaction, dialogue, and collaboration on educational topics, promoting community involvement. This dynamic virtual environment transcends traditional limits, allowing diverse users to actively interact, share knowledge, and engage.

Keywords: *Metaverse, gamification, Virtual Reality (VR), engagement, learning environments.*

1. Introduction

Metaverse is a combination of “meta” (meaning beyond) and the stem “verse” from “universe”, denoting the next-generation Internet in which the users, as avatars, can interact with each other and software applications in a three-dimensional virtual space (Duan et al., 2021). The term comes from author Neal Stephenson's dystopian sci-fi novel *Snow Crash*, which imagined a gigantic 3D playground where people escaped the struggles of the real world (Jaung, 2022). Rather than considering the metaverse a mere escape into a videogame-like virtual reality, we believe it is worth exploring its potential as an innovative tool for communicating, interacting and learning.

Metaverse education offers several advantages over traditional teaching methods, for instance it provides the possibility of incorporating gamification techniques into the learning experience, introducing gaming strategies and elements into non-gaming settings. It is an effective tool for overcoming difficulties related to students' lack of interest or capturing visitors' attention (Khan et al., 2022) as it creates a richer and more engaging experience. A further advantage of metaverse education is the potential to create immersive experiences through VR technologies, which enables learners to access distant or difficult-to-reach places at any given moment. Users can gain a comprehensive understanding of the subject matter and engage with the learning content with the autonomy to explore the virtual world at their own pace (Marougkas et al., 2023).

The capacity of the metaverse to engage users in immersive and memorable learning experiences extends its potential for utilisation beyond school education, for example in the context of museums, exhibitions and virtual tourism. Such virtual reality experiences could facilitate the sharing of cultural heritage and, in the case of fragile environments, prove useful in raising awareness of sustainable visitation or living, encouraging pro-environmental attitudes (Jaung, 2022).

This article presents an innovative approach to education about mountain heritage and environment through immersive VR exploration in a mountain valley metaverse.

2. Methodology

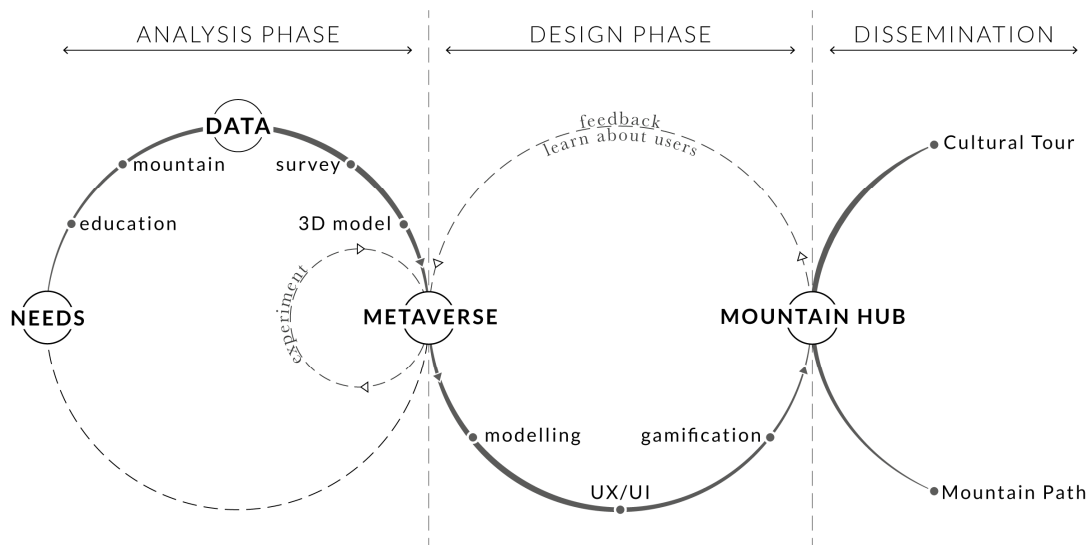
This project employs a methodological approach based on Design Thinking (Lewrick et al., 2018), a structured method for solving complex problems. The focus of the project is the mountain context, in line with the NODES (Northwest Digital and Sustainable) project initiative, which aims to improve the performance and sustainability of enterprises in mountain areas through the use of digital technologies. The metaverse was designed as an open virtual platform, creating the Collaborative Innovative Mountain Areas Living Lab (CIMAL2). This environment provides a space for developing and sharing knowledge of mountain areas.

2.1. Workflow

The initial phase of the workflow involved identifying current needs and challenges in the field of education and in the mountain context, outlining user requirements and the content to be disseminated. Subsequently, the focus shifted to the development of the metaverse, starting with virtual modelling and extensive study of the user experience (UX). The development of the user interface (UI) was guided by gamification techniques. The experience was then tested to assess the value and potential of the project. The feedback from these tests was essential in optimising the workflow and further improving the user experience. Finally, the project was completed and revised through new experiments, ensuring continuous improvement to meet emerging needs.

The chosen case study is the Cervo Valley in Piedmont, Italy. The first experience explores Rosazza village, known for its history and unique architecture. The second focuses on a mountain path to Piane di Piedicavallo, profuse in flora and fauna at 1320 meters above sea level. The region's rich cultural heritage renders these settings optimal for educating on sustainability and involving the local community (Scarzella, 1983). Given their sparse population, innovative projects like these are crucial for rural area conservation and development, potentially driving social and economic regeneration in the region.

Figure 1. Workflow.



2.1.1. Rosazza Tour Virtual Experience. Rosazza, a small village in the Biella mountains, boasts a rich historical and cultural legacy, characterized by unique architecture predominantly crafted from local stone.

The main aim of the proposed experience is to immerse visitors in the beauty of Rosazza through an interactive journey, exploring virtual platforms suspended above the valley, allowing for complete exploration of its iconic buildings.

The initial phase involved data acquisition from historical archives and surveys, capturing photographs, 360-degree panoramas, and measurements. Furthermore, the utilisation of laser scans for the buildings and drone-based scans for the valley model contributed to the comprehensive documentation of architectural elements and the physical landscape, respectively. This data was used to create a virtual representation of the valley and its structures with InfraWorks and Blender software, emphasizing architectural details of key landmarks such as the church, castle, and town hall.

The next stage of the project involved the design of a virtual space that would provide an immersive experience for users. This was achieved by introducing virtual platforms placed on top of the

buildings, which offered an innovative perspective of Rosazza. Graphics were designed to emphasize key buildings, aiding environmental comprehension rather than detailed replication. Standard data formats facilitated easy navigation and accessibility across web platforms.

Finally, the design of the interactions has been optimized to enhance the user experience during the virtual tour. This is achieved using images, 3D models, an audio guide, and 360-degree panoramic photographs, which offer a realistic and immersive view of the most interesting features.

The experience comprises a series of interactions developed with the Unity3D game engine software. (i) orbiting and zooming in on space models and images; (ii) realistic immersion in spherical photos; (iii) audio guidance that accompanies the user along the way; (iv) teleportation for moving between platforms; (v) photographs and text on historical monuments; (vi) a full-scale 3D model of the valley and buildings; and (vii) social connection between avatars through the use of the online platform Spatial.

Figure 2. User experience tests for Rosazza Tour Virtual Experience.



2.1.2. Mountain Path Virtual Experience. This virtual reality experience has been developed in the context of an evocative mountain path aiming to educate through engaging activities. Focused on the route from Piedicavallo village to the scenic Piane area by the Cervo stream, the project aims to teach sustainability in mountain environments while offering recreational fun. Data collection involved archival research and field surveys, capturing photos, panoramas, and laser scans via drone for a detailed route representation. The virtual space includes two activities: mushroom picking and animal searching. In the mushroom-picking activity, the user is introduced to the main types of mushrooms present, learning how to distinguish poisonous from edible ones. The game takes place inside the forest, and to increase immersion, VR visors and joysticks are used, allowing users to carry a virtual basket and a mushroom collection card in order to collect 12 edible specimens. The animal spotting activity aims to familiarize users with the valley's fauna and promote awareness of proper behaviour when encountering wildlife. Along the route, users encounter flora and fauna specimens, encouraged to photograph animals without disturbing them.

The trail was modelled using scan data and Blender modelling software, instead interaction design focused on user spatial perception, employing simplified graphics to mitigate navigation issues. The development of interactions was conducted using Unity3D software, combined with Spatial's Creator Toolkit plug-in, which enabled the following functionalities to be implemented. (i) The manipulation of objects in the hands, such as the basket, mushroom board and camera; (ii) The collection of mushrooms and the updating of the number on the board; (iii) The display of information on flora and fauna; (iv) The taking of photographs and the collection of images; (v) The provision of audio guidance along the way; (vi) The feedback on actions taken in the game; and (vii) The connection with other users in the experience.

Figure 3. User experience tests for Mountain Path Virtual Experience.



3. Results

Combining the metaverse and virtual reality with the mountain environment is a challenge, but it can be an aid to tourism and mountain repopulation as well as being an excellent means of knowledge and education accessible to all. Furthermore, combining education with gamification applications is a challenge that will enrich the user's awareness of sustainability issues, an extremely topical subject.

The project was tested on many people during the 'Virtual Reality and the Digital Mountain Metaverse' event, held during the 2024 Technology Biennale at Politecnico di Torino. On April 18, the doors of Drawing to the Future Lab, in the Department of Structural, Construction and Geotechnical Engineering (DISEG) were opened to the public.

The project was tested at the 'Virtual Reality and the Digital Mountain Metaverse' event during the 2024 Technology Biennale at Politecnico di Torino. The event, held at the Drawing to the Future Lab in the Department of Structural, Construction, and Geotechnical Engineering (DISEG) on April 18, featured presentations on the project and its technologies, followed by practical experiences with web and VR platforms. Participants explored one or both experiences and provided feedback via questionnaires, evaluating the metaverse's educational efficacy in such contexts.

Figure 4. Feedback on the user experience.

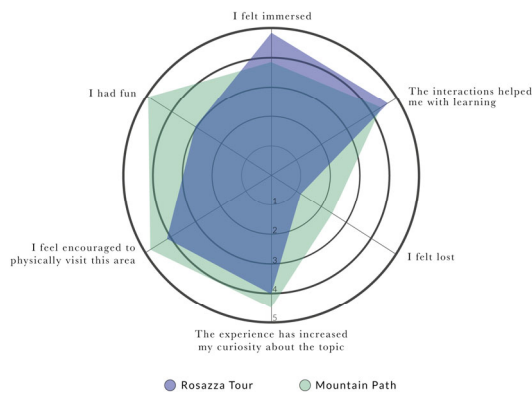
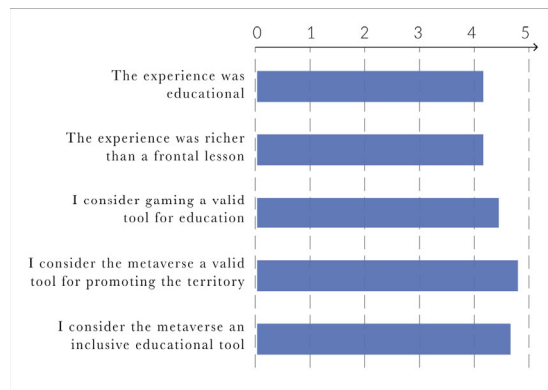


Figure 5. Feedback on the educational method.



The questionnaire was compiled by a heterogeneous sample of 87 participants, distributed equally between the two activities. The majority of users are in the age group of 13 to 30 years, characterised mainly by high school diploma and master's degree level education. The questionnaire required users to assess their perception of the experience in terms of immersion in the virtual space and the educational content, as well as the use of gamification and the metaverse as educational tools.

The results presented in Fig. 4. demonstrate that, in the Rosazza experience, the integration of audio guides and 360-degree panoramic images has significantly enhanced the immersion of the experience and stimulated interest in virtual space interactions, making the route and proposed content clear. With regard to the mountain path experience, the graph serves to illustrate the enjoyment and fun that users derived from this experience. Furthermore, it indicates a subsequent increase in curiosity and intention to further investigate the topic at hand.

Finally, the analysis of the data illustrated in Fig. 5. indicates a positive assessment of the use of the metaverse in the field of education, highlighting a preference for the gaming experience over traditional frontal learning. Moreover, the graph depicts the potential of the metaverse as a communication tool for the promotion the territory, due to its inclusivity and the possibility of wider spatial and temporal access.

4. Conclusion

The widespread use of the metaverse and VR technologies can lead to some interesting developments in the field of education and culture, increasing users' interest and active involvement.

The success achieved in this initial experiment with the mountain metaverse paves the way for the future use of this technology in scenarios related to cultural and natural education, as well as for the dissemination of information about the region linked to the NODES project.

The feedback obtained from the questionnaires enables the enhancement of the virtual experiences, leading for example to increasing the gamification-related interactions which have been particularly successful in engaging and entertaining the public.

These tests are just the first phase of a journey to better understand the potential of the metaverse for sharing knowledge in a captivating and immersive way, researching new learning techniques.

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UNLEASHING PERSONALIZED EDUCATION USING LARGE LANGUAGE MODELS IN ONLINE COLLABORATIVE SETTINGS

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Abstract

The Artificial Intelligence community has long pursued personalized education. Over the past decades, efforts have ranged from automated advisors to Intelligent Tutoring Systems, all aimed at tailoring learning experiences to students' individual needs and interests. Unfortunately, many of these endeavors remained largely theoretical or proposed solutions challenging to implement in real-world scenarios. However, we are now in the era of Large Language Models (LLMs) like ChatGPT, Mistral, or Claude, which exhibit promising capabilities with significant potential to impact personalized education. For instance, ChatGPT 4 can assist students in using the Socratic method in their learning process. Despite the immense possibilities these technologies offer, limited significant results are showcasing the impact of LLMs in educational settings. Therefore, this paper aims to present tools and strategies based on LLMs to address personalized education within online collaborative learning settings. To do so, we propose RAGs (Retrieval-Augmented Generation) agents that could be added to online collaborative learning platforms: a) the Oracle agent, capable of answering questions related to topics and materials uploaded to the platform.; b) the Summary agent, which can summarize and present content based on students' profiles.; c) the Socratic agent, , guiding students in learning topics through close interaction.; d) the Forum agent, analyzing students' forum posts to identify challenging topics and suggest ways to overcome difficulties or foster peer collaboration.; e) the Assessment agent, presenting personalized challenges based on students' needs. f) the Proactive agent, analyzing student activity and suggesting learning paths as needed. Importantly, each RAG agent can leverage historical student data to personalize the learning experience effectively. To assess the effectiveness of this personalized approach, we plan to evaluate the use of RAGs in online collaborative learning platforms compared to previous online learning courses conducted in previous years.

Keywords: *Personalized education, large language model, generative AI, collaborative learning.*

1. Introduction

Personalized education has been extensively researched by the Artificial Intelligence (AI) community during the last decades (Kamalov, Santandreu-Calonge, & Gurrib, 2023). It is worth mentioning several proposals of tutoring and personalized systems that were capable of guiding students to achieve true learning using several paradigms. Unfortunately, the real-world applications of those systems were limited to case studies. This was mainly due to the difficulties faced by intelligent systems to represent knowledge and reasoning. Even, modern Machine Learning algorithms were limited to inferring and making predictions for specific tasks, and natural language understanding interfaces were only useful recently (Luan & Tsai, 2021).

Nowadays, we are in the era of Large Language Models (LLMs) such as ChatGPT, Claude, Llama, Mistral, and Gemini, among others. In particular, when ChatGPT arrived, it showed several possibilities and opportunities for real-world applications in almost every industry. In education, those LLMs have shown promising capabilities that could impact how the learning process has been traditionally addressed with technology. These LLMs have capabilities that directly can be applied to learning. For instance, it is possible to create exercises, answer questions about any topic, learning using role-playing and according to several styles. It is worth noting the capabilities of ChatGPT4 to apply the Socratic method for learning. However, this kind of technology is still under development and has several drawbacks being the most relevant hallucination, i.e., LLMs outputs answers that seem plausible and well-written but are actually false or misleading (Yao et al., 2023). Hopefully, to cope with hallucinations

a technique called RAG (Retrieval-Augmented Generation) through carefully designed mechanisms allows one to obtain precise answers. A RAG system aims to interact with LLMs by sending proper context (PDFs, HTML, CSV) to obtain up-to-date, and natural language answers. Given that RAG is based on information retrieval methods, as well as clever indexing and storing, it is possible to provide richer search experiences combined with the power of LLMs. Currently, LLMs can handle multiple modalities, allowing for the search and analysis of papers, images, audio, and video. This capability enhances the learning experience, often through engaging conversations facilitated by RAGs. The integration and adoption of RAGs have driven the advancement of chatbots in real-world applications (Gao et al., 2024).

While various educational experiences using LLMs have been documented across different levels (elementary, high school, and university), there is minimal work incorporating RAGs in this context (Kamalov et al., 2023). We aim to address this gap by demonstrating how these emerging technologies can be applied in real-world scenarios, specifically within collaborative online learning courses. Our plan involves implementing multiple RAG agents to facilitate personalized education and enhance learning experiences. To do so, the agents are designed with specific functionalities: a) the Oracle agent, capable of answering questions related to the uploaded topics and materials on the platform.; b) the Summary agent, which summarizes and presents content tailored to individual student profiles; c) the Socratic agent, guiding students in learning topics through interactive engagement.; d) the Forum agent, analyzing students' forum posts to identify challenging topics and suggest ways to overcome difficulties or encourage peer collaboration.; e) the Assessment agent, presenting personalized challenges to students based on their needs.; f) the Proactive agent, analyzing student activity and suggesting learning paths as necessary. It is worth noting that every RAG agent can share historical student data that allows them to profile and personalize the learning experience.

2. Related works

A comprehensive analysis of AI in education by Kamalov et al. (2023) highlights four crucial applications: (1) Personalized Learning, (2) Intelligent Tutoring Systems, (3) Assessment Automation, and (4) Teacher–Student Collaboration. Our focus in this paper primarily centers on applications (1) and (2).s. Personalized Learning: This approach allows students to learn at their own pace, enhancing their engagement and improving overall learning outcomes (Luan & Tsai, 2021). AI algorithms and adaptive learning systems can analyze student data, identify patterns, and recommend personalized content and resources to optimize the learning experience. Additionally, AI can drive virtual tutors that offer one-on-one education tailored to each student's unique learning and emotional needs (Jonnalagadda et al., 2023). Intelligent Tutoring Systems (ITS): these systems can offer instant feedback, answer questions, and guide students through complex concepts, supplementing or even replacing traditional tutoring services. AI's capabilities can enhance learning experiences by incorporating gamification elements such as rewards, challenges, and competition. By tailoring these components to individual students, engaging and personalized learning environments can be created, boosting motivation and active participation (Mousavinasab et al., 2021). ITSs use advanced algorithms and machine learning techniques to understand students' learning needs and tailor their teaching methods accordingly. Natural language processing (NLP) allows AI to comprehend and interpret students' written or spoken input, enabling ITSs to engage in meaningful dialogues, answer questions, and deliver instruction across various subjects. It is important to mention that there are currently no reported results regarding the application of RAGs to personalized learning and ITS. We aim to address this gap by presenting a proposal within a collaborative online learning setting.

3. Background

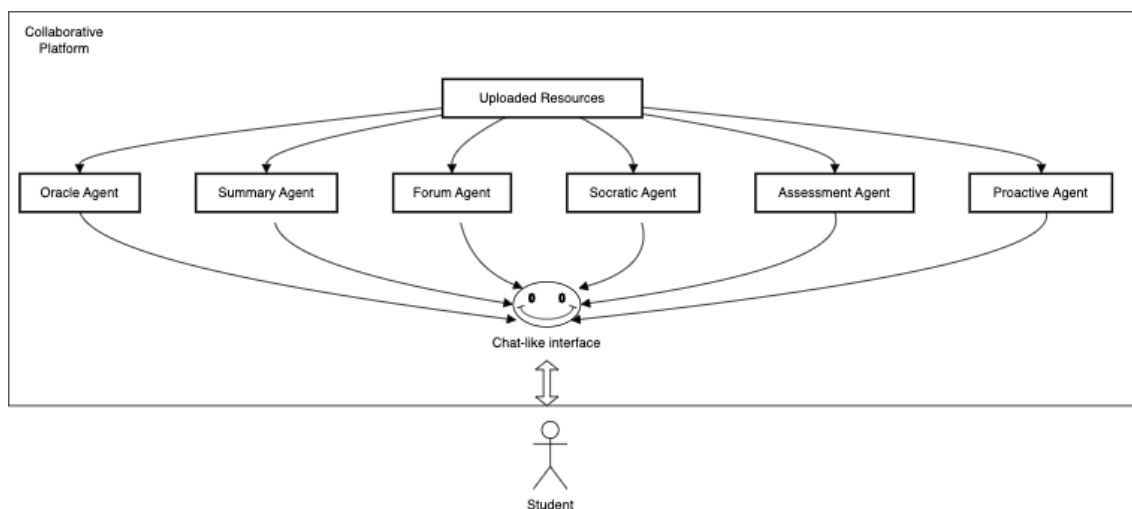
Retrieval-Augmented Generation (RAG) is an architecture that augments the capabilities of LLMs like ChatGPT or Mistral, by combining the power of information retrieval techniques with generative AI (Gao et al., 2024). One of the key advantages of implementing RAG is the ability to control generative AI output, making it focus on specific content from documents, images, audio, and video. This means RAGs can ensure that the AI-driven responses generated by LLMs are based on accurate and relevant information from their content repositories, which is valuable in educational settings. To create a basic RAG system, five stages are necessary: i) Document loading: Within a collaborative learning platform, this involves uploading various resources like PDFs, HTML files, audio, video transcriptions, and more. ii) Data splitting: The uploaded data undergoes splitting, encoding using embeddings, and indexing to make it interpretable by Large Language Models (LLMs) such as ChatGPT, LLama 2, or Mistral. iii) Storage: The encoded and indexed information is stored in vector databases like Chroma for

more efficient retrieval during the generation phase. iv) Retrieval: During generation, relevant contextual information is selected from the vector database and sent to the LLM. v) Output: The LLM then generates corresponding questions and answers based on the contextual information obtained in stage iv, i.e., from the contextual data. We intend to create RAG agents, which are software entities designed to reason and act based on environmental changes (Yao et al., 2023). Specifically, our focus lies on the ReACT agent model, a framework that merges the reasoning abilities of large language models (LLMs) with the capacity to take actionable steps. This leads to an advanced system capable of understanding and processing information, evaluating situations, taking suitable actions, communicating responses, and monitoring ongoing developments. This model holds particular relevance in the education sector, where agents are engineered to respond dynamically rather than following pre-set scripts.

4. Educational RAG agents

Our proposal involves educational agents that collaborate with students and help them achieve their learning objectives. To demonstrate this, we have designed the architecture illustrated in Figure 1 within a learning collaborative platform serving as a testbed.

Figure 1. Collaborative RAG agents.



In summary, a social collaborative online platform is ideal for our proposal due to its ease of integrating agents in this digital environment. Students are accustomed to this learning format through platforms like Moodle and others. Typically, these platforms offer various tools that promote student collaboration on tasks and exercises, along with access to documents, quizzes, and live or recorded sessions. However, these tools and resources generally lack personalized learning features. Our proposal addresses this gap by introducing specialized RAG agents that leverage Artificial Intelligence capabilities to customize students' learning experiences in a real-world context. Using a straightforward chatbot-like interface, multiple agents will engage with each other to offer advice, suggestions, and assistance to students. Based on resources available within a collaborative platform (such as PDFs, HTML files, video transcriptions, forum messages, etc.), the Oracle and Summary agents curate information sources that can provide specific answers and summaries. For self-directed learning, the Socratic agent poses guiding questions that help students explore a given topic without directly giving away the answers. Additionally, the Assessment agent presents challenges that encourage students to master a topic through hands-on experimentation. In terms of peer collaboration, the Forum and Proactive agents highlight collaboration opportunities and proactively suggest potential learning paths based on students' preferences and usage patterns. Each agent's role is elaborated as follows.

4.1. Oracle agent

This agent can answer questions regarding any topic uploaded to the collaborative learning platform. It is crucial that this agent can provide concise, relevant, and reliable information regarding the material and resources that have been uploaded to the collaborative platform. The main challenge is to avoid hallucinations which are common in LLMs but we can prevent this through careful design of the advanced RAG that allows us to stick to the context given.

4.2. Summary agent

LLMs can provide summarizations from general documents, as well as explanations using learning styles so as to improve students' topics understanding. The Summary agent aims to personalize the learning experience via summarization of resources previously uploaded to the collaborative platform. The challenge here is to provide concise and personalized summaries that can easily adapt to the student's learning preferences.

4.3. Socratic agent

The Socratic agent aims to guide the student to master a topic through questions without explicitly providing him/her with the answers. The idea is the student can manage to pose questions that denote understanding of a topic and can discover, guided by the agent, his/her learning path. To avoid loss of focus and LLM hallucinations we are limiting the Socratic method to resources available only through the collaborative platform. While there has been such functionality since ChatGPT4, the challenge is to tailor it to specific resources.

4.4. Forum agent

Collaborative learning implies establishing connections among peers to jointly cope with challenges posed by teachers and mentors. In this context, students are encouraged to pose questions about exercises, and topics that were hard to understand and therefore to solve. The Forum agent automatically recognizes questions and messages that could be solved through collaboration and promotes linking peers who have previously solved and are keen to share their solutions.

4.5. Assessment agent

To evaluate the effectiveness of the online learning experience, the Assessment agent encourages students to constantly check whether they understood a topic or resource. To do so, it poses challenges and exercises to students, according to the personalized skills and abilities gained and the learning outcomes pursued.

4.6. Proactive agent

The Proactive agent encourages the use of collaborative and Artificial Intelligence resources that can improve the students' learning experience. According to the student's activity, the agent can suggest personalized paths that can boost his/her learning. This functionality goes beyond simpler notifications and implies profiling students and matching resources regarding their learning styles.

5. Implementation and preliminary results

Unlike previous reported works on intelligent tutoring systems, we envision creating a framework with RAG agents that can be applied to real-world scenarios. Thus, we describe implementations, preliminary results, and ongoing work addressed to this end, in particular, we focus on the collaborative platform, the implemented RAG agents, and the evaluation procedure.

5.1. The Collaborative platform

Currently, there are several initiatives to extend popular Learning management systems (LMS) with AI capabilities, however, this is still ongoing work. For instance, the popular Moodle LMS contains Artificial Intelligence plug-ins but with limited functionalities. In this sense, we plan to construct a new collaborative platform that has social and Artificial Intelligence capabilities at its core. This platform will have the basic features of any content management system, it will allow access to documents, quizzes, forums, videos, etc. but those resources will be available through natural language interfaces, enhanced by the use of RAG agents.

5.2. Implemented RAG agents

Utilizing the LlamaIndex framework (accessible at <https://docs.llamaindex.ai/en/stable/>) and the Mistral LLM, we have integrated RAG techniques into the Oracle and Summary agents (the other agents are still under development). This integration allows us to effectively respond to queries related to specific resources and topics, thereby minimizing hallucinations and providing contextually appropriate answers. To achieve this, we have leveraged advanced RAG techniques during both the pre-retrieval and post-retrieval phases (Gao et al., 2024). During the pre-retrieval phase, our focus has been on optimizing the indexing structure and refining the original query. We have employed techniques to improve data granularity, optimize index structures, and implement mixed retrieval methods. Furthermore, to enhance

optimization, we have explored query transformation and expansion techniques. In the post-retrieval phase, our primary methods include reranking chunks and compressing context to refine results. It is important to acknowledge the challenges encountered when developing agents using open-source resources.

5.3. Evaluation methodology

For the past four years, the Department of Computer Science at UCSP has offered fully online diploma courses to groups of 30 individuals, focusing on Machine Learning for industry. The courses provided access to learning materials and exercises through Moodle, with real-time online classes. Despite implementing various teaching strategies, the success rate has remained low, with only 50% of students completing the Machine Learning project by the end of the diploma program. This serves as our baseline. Moving forward, we plan to introduce a revised version of the diploma course utilizing the proposed collaborative platform and incorporating RAG agents to personalize student learning experiences. Upon completion of this updated version of the diploma program, we will assess new success rates and objective achievement metrics, which we can then compare to those of previous versions.

6. Conclusion

Online courses have become widespread globally and are now a well-established learning resource, a trend that became particularly evident during pandemics. In this work, we propose methods to make online learning more enriching through peer collaboration and, primarily, through personalization. To achieve this, we explore the use of Artificial Intelligence. While the concept of intelligent frameworks is not new, the current context is highly favorable. Online learning is now more widely accepted, and LLMs like ChatGPT have shown unprecedented potential in real-world applications. This suggests that LLMs can significantly enhance personalization in education. To do that, within a collaborative learning platform, we propose the creation of RAGs (Retrieval-Augmented Generation) educational agents, designed to mitigate the hallucinations of LLMs. These agents can answer specific questions, guide learners along potential learning paths, mediate discussions, and collectively help to achieve desired knowledge outcomes in a personalized manner. Although our results are still preliminary, they indicate that autonomous tutor systems may soon be a reality. To evaluate the impact of these technologies we will compare results using traditional online settings against intelligent personalization.

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LANGUAGE COMPREHENSION OF FIRST GRADERS IN INCLUSIVE CLASSROOMS – SURVEY AND IMPLICATIONS FOR TEACHER PROFESSIONALIZATION

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Abstract

The hitherto neglected potential of teacher language is being focused with the objective to ensure learners' language comprehension in inclusive teaching contexts. As research data on language comprehension in inclusive learning settings is not yet available, the oral comprehension of words, sentences and texts by first-graders is being assessed using standardized test procedures. Based on the evidence, professionalization measures for teachers are being developed, tested and evaluated using videography and lesson diaries.

Keywords: *Speaking comprehension, oral comprehension, receptive language skills, language support in school, Specific Language Impairment (SLI).*

1. Relevance of the focus on language comprehension

The starting point of the study is the complex process of language comprehension as a significant competence for capturing teaching content and consequently achieving learning and educational goals. It is embedded in a research project called *Professionalization of Inclusive Teacher Language to ensure Language Comprehension (PROF-I-SV)* that focuses on the development and evaluation of measures to support language comprehension for learners in inclusive educational settings at the primary level. Language comprehension is often considered as self-evident and taken for granted (Elben, 2002). This is the main reason why there is significantly less attention in pedagogical and therapeutical work than the process of language production which, in contrast, is directly observable (ibid; Hachul & Schönauer-Schneider, 2019). Nation & Angell (2006) state that primary school teachers “tend not to notice comprehension difficulties, which are less high-visible” (quoted from Ellis & McCartney, 2011, 257).

Furthermore, there is a research desideratum in the field of language comprehension in science: Here the same phenomenon is observed, namely that the receptive side of language development disorders is often underestimated. Here, too, the focus is on the productive aspects of language and language difficulties.

As a result, language comprehension disorders often remain unrecognized (Clark et al., 2007). In addition to the above-mentioned difficulties in recognizing problems in language comprehension, children's coping strategies also play a significant role. Many affected children manage to cover up and hide their lack of comprehension through certain behaviors. For example, they impersonate what they observe in other children, or they use internalized empty phrases with which they can respond in various situations when addressed. In addition, misunderstandings that arise during communication are often misinterpreted by communication partners, e.g. as inattentiveness or as a defiance, such as "not-wanting-to-listen" (Schiefele & Berg, 2022). Such misunderstandings can also be misinterpreted as the result of learning deficits or cognitive limitations (ibid).

According to the specific of language in teaching contexts in which it does not only serve as a subject of learning but also as a carrier of the information provided, students with limitations in language comprehension require additional supportive measures and strategies to be able to successfully follow the lessons (Sallat, Hofbauer & Jurlita, 2017; Sallat, Schönauer-Schneider, 2015). The absence of these extra-support can lead to persistent difficulties in language comprehension which contain a significant developmental risk including learning disorders and emotional and social problems (Acosta-Rodríguez, Hernández-Expósito & Ramírez-Santana, 2022; Hachul & Schönauer-Schneider, 2019). There is a significant possibility of lifelong negative consequences on educational success and professional

perspectives (Hagen, Melby-Lervag & Lervag, 2017). Furthermore, social interaction and societal participation can be significantly hindered (Berg & Schiefele, 2021).

2. Current status of research

2.1. Language comprehension

There are few studies that aim to research language comprehension. In particular, this concerns the language comprehension of pupils in inclusive education. A few research studies, such as those by Acosta-Rodriguez, Hernandez-Exposit & Ramirez-Santana (2022), indicate that pupils with a diagnosed developmental language disorder (DLD) performed significantly worse in oral language comprehension than pupils with typical language development. Berg & Schiefele (2021) also point to a high prevalence of difficulties in language comprehension in grades 1 and 2 at special schools with a focus on language support. Around 60% of these pupils showed limitations in word, sentence and text comprehension (ibid.).

However, language comprehension disorders do not only affect children with a circumscribed developmental disorder of speech and language, i.e. children who are taught in Germany under the special educational focus on language. In another research study, Mayer (2021) revealed that a large proportion of pupils in the special educational focus on learning and emotional-social development have below-average performance in word and sentence comprehension.

Furthermore, other learning prerequisites such as multilingualism and the use of a second language (L2) as the language of instruction and learning could pose potential risk factors for language comprehension difficulties (ibid.). Based on this data, it can be assumed that similar limitations exist among a significant number of pupils in inclusive schools. Research studies with a focus on the extent of language comprehension in these schools are currently lacking.

Similarly, there is a lack of research studies in the area of effective support for pupils with developmental language disorders in inclusion (Mahlau, 2015). Nelson et al. (1996) state that not only children with, but also children without DLD benefit from the use of modeling techniques by the teacher, since in the survey the (linguistic) target structure was captured equally well (quoted from Kurtz & Mahlau, 2022). Thus, these findings provide some important clues for the development of professionalization measures for teacher language that can benefit all learners in inclusive classroom contexts. These need to be supplemented by studies that focus on language comprehension.

2.2. Teacher language

Teacher language is a constantly available tool for language-sensitive and language-supportive lesson design (Jungmann, Miosga & Neumann, 2021). In heterogeneous learning groups, it offers enormous potential for conducting classroom discussions with a high degree of differentiated support (ibid.) It is therefore all the more surprising that teacher language plays a rather subordinate role in the qualification of regular school teachers in Germany and is mostly aimed at methodically and didactically shaping certain classroom events (ibid.). There is still little practical experience to professionalize one's own teaching language (Eiberger & Hildebrandt, 2013).

In the federal state of North Rhine-Westphalia, teaching language is neither part of the first (academic) nor the second (practical teacher training) phase for primary school teachers. However, regular school teachers must ensure inclusive education (IE) for all pupils at the latest since the UN Convention on the Rights of Persons with Disabilities came into force in 2009. According to the Conference of Ministers of Education and Cultural Affairs (KMK) in 2019, the teaching of concepts of language education and language support should ideally be part of all phases of teacher training. As a logical consequence, this includes appropriate teacher language training to promote language comprehension in order to establish a basis for educational language in the first place. However, this has not yet taken place, nor has it been adapted to the circumstances of IE for all pupils.

A survey by Theisel (2015) revealed that of n=411 regular school teachers compared to n=290 special education teachers, primary school teachers used significantly fewer language-supporting behaviors in the classroom than special education teachers. A pilot study comparing the language used by primary and special school teachers by Ruppert & Schönauer-Schneider (2008) indicates similar results. In contrast, special needs teachers with a focus on language show a high level of professionalism in shaping their own teaching language to promote language development (Berg & Schiefele 2023; Schiefele & Berg, 2022). It therefore seems sensible to use certain training content from special needs education in the area of language support for the professionalization of teacher language in inclusive educational contexts.

2.3. Derivations

In inclusive classrooms, children with heterogeneous learning requirements and a wide variety of language biographies are seated. Based on the studies presented, it is reasonable to assume that a number of pupils in regular schools have language comprehension difficulties. At the same time, it has been delineated that ensuring oral language comprehension is a cross-sectional task for all teachers in inclusive settings. This raises the question of how teachers can effectively accomplish this challenging task. In addition to the general criteria of professional teacher language, such as clear articulation, target group-appropriate vocabulary and syntax as well as overall physical attention, further specific criteria are required in inclusive lessons, such as an appropriate slowed-down speech-rate, the use of modeling techniques, and speech accompanying the action, in order to actually promote language in cases of language development issues (Westdörp, 2010). Furthermore, from a speech therapy perspective, two aspects are relevant for successful teaching in cases of language comprehension limitations: targeted promotion of pupils' language comprehension skills and reduction of linguistic complexity, e.g., through language comprehension-supportive elements of teacher language (including reducing speech rate, prosodic emphasis, visualization). Teachers therefore find themselves in the tension between dismantling learning barriers caused by deficits in language comprehension on the one hand and developing language comprehension skills on the other.

3. The Project PROF-I-SV

3.1. Purpose

The focus of the project *Professionalization of Inclusive Teacher Language to ensure Language Comprehension (PROF-I-SV)* initially lies on reducing language comprehension-related barriers to learning. Based on the assumption that professionally designed teacher language has enormous potential to counteract difficulties in language comprehension, the central aim of this project is to professionalize teachers in inclusive educational contexts for a conscious language comprehension-supportive design of their own teacher language. After implementing and evaluating the measure to reduce comprehension-based learning barriers, the further aim is to integrate support for language comprehension skills into classroom teaching.

The research project commenced in July 2023 and is divided into two sub-projects:

- A. **Survey of the language comprehension** of primary school pupils and, building on this,
- B. Developing and testing a measure to **professionalize inclusive teacher language**.

3.2. Hypotheses and research questions

The aim of Part 1 is to expound which language comprehension skills teachers in inclusive elementary school can assume on average. The hypothesis is that

a large number of pupils who are taught in inclusive classroom settings have language comprehension disorders.

The resulting research question is as follows:

How can word, sentence and oral text comprehension skills of pupils in inclusive primary education be described?

This involves describing the current situation and conducting an inventory from which the support needs of language comprehension skills are analyzed and implications for professionalization are derived.

The second part of the project therefore deals with the development of a professionalization measure for prospective primary school teachers, aimed at increasing the proportion of language comprehension-supportive elements in teacher language. From the hypothesis:

teachers' language has enormous potential to counteract difficulties in language comprehension,

the following research questions can be derived:

1. How must a professionalization measure for teacher language be designed in order to have a lasting effect?

II. What effects does the use of inclusive multimodal teacher language have on pupils' language comprehension skills, and how can these be proven?

III. To what extent can the professionalization of inclusive multimodal teacher language become part of academic qualification and practical teacher training?

As part of the professionalization measure, a multimodal use of teacher language is to be learned and tested. The focus is on applying language comprehension-supportive elements of teacher language, such as the reduction of linguistic complexity, and integrating them into teaching practice. The processual development of teacher language will be accompanied, reflected upon, and evaluated with the help of videographies and documented teaching diaries. Self and peer reflection on their use play a major role in each phase of the professionalization measure. These reflection processes are initiated based on indicators jointly developed in the measure.

3.3. Status quo

The survey of primary school pupils' language comprehension took place over a six-week period from February 7th to March 22nd, 2024. In total, the word, sentence and oral text comprehension skills of n=152 first-graders from five elementary schools in IE were assessed using standardized test procedures. The following tests were used for diagnostics: *Peabody Picture Vocabulary Test (PPVT-4)* → Word comprehension, *Test for Reception of Grammar (TROG-D)* → Sentence comprehension, *Clinical Evaluation of Language Fundamentals (CELF-5)*: Subtest "Understanding Spoken Paragraphs" → Oral text comprehension, *Wechsler Intelligence Scale for Children (WISC-V)*: Subtest "Digit Span" → Working memory, *Mottier Test* → Working memory.

The test protocols are currently being evaluated. The results will be comprehensively presented and discussed in the presentation. In addition, an outlook on the further planning of the project will be provided.

4. Discussion

Ensuring language comprehension of pupils in is a fundamental task for teachers in inclusive teaching contexts. The extent to which the professionalization of teachers' language actually has an effect on pupils' language comprehension skills and, further on pupils' school achievement, must be demonstrated in future research studies. In addition, consideration must be given to how the topic of multimodal use of inclusive teacher language can be most effectively integrated into teacher training.

5. Conclusion

The results of the survey of first-graders' language comprehension provide valuable starting points for the development of a professionalization measure regarding the inclusive design of teachers' language. Particularly when it comes to issues in oral sentence and text comprehension, reducing speech rate and simplifying the syntactic structure of sentences should be integrated into the measure as language-promoting elements and can be evaluated quantitatively. When planning education and training, it is also important to consider what constitutes a "good" and lasting professionalization measure. The four levels (*participant reaction, learning gain, changes in teaching behavior, development of pupils*) and the six characteristics of "good" training (*duration and timing, deepening of didactic and diagnostic knowledge, effectiveness of one's own actions, interweaving of input, testing and reflection, orientation towards characteristics of effective teaching, feedback*) according to Lipowsky & Rzejak (2012) are beneficial for this purpose. Based on this foundation, the professionalization measure *PROF-I-SV* is planned.

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“FLIPPED COMMUNITIES BEFORE FLIPPED CLASSROOMS”: CONTEXT AND CONTENT AS BARRIERS OF FLIPPED CLASSROOM APPROACHES IN SOUTH AFRICAN UNIVERSITIES

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Abstract

The development of educational technology resulted in a shift in pedagogical methods and approaches to accommodate these technological advances in education. There are rapid changes in knowledge and technology, driving the development of education whilst considering innovative learning approaches (Akdemir, Bicer & Parmaksız, 2015; Ugras & Cil, 2014; Schaal, 2010). One such pedagogical method is that of the Flipped classroom approach which advocates that direct instruction is not the most effective use of class time. Instead, students encounter information before class, freeing class time for activities that involve higher-order thinking (Strayer, 2012) to allow for a more active learning environment in the classroom. While this is a productive initiative in addressing the time factor in the classroom, it takes little account of the context of the communities that students come from and the cognitive demand of content of modules, especially in the complex and diverse South African situation. This qualitative study aims at exploring the difficulty of implementing a Flipped classroom approach in the South African Higher Education environment. The case study design employs interviews and questionnaires to generate data on students in a South African university to establish the context of their communities. It further employs textual analysis on module content, together with semi-structured interviews with academics, to establish the cognitive demand and support required for a flipped classroom approach. The study showed that the contextual background of the communities situated around the university and the cognitive demand of the modules did not allow for an effective application of a flipped classroom approach. It recommended that Higher Education institutions in South Africa focus on community engagement projects that create conducive communal learning environments as well as university residence that have academic support structures and infrastructure.

Keywords: *Flipped classrooms, community, context, content.*

1. Introduction

The learning experience in higher education is a critically engaging process that involves several factors to produce student success. Student motivation and engagement is one of those factors that has been seen to play an important role in academic success (Barkley, 2010). It therefore became important for the academy to find pedagogical methods to keep students motivated and engaged. To achieve this, scholars in the late 19th century proposed the use of technology to motivate and engage student participation in academic success (see; Clark, 1983. Chickering & Ehrmann, 1996. Bates, 2000). The idea was that students born in the ever-changing technological era required active and stimulating digital education for success in the digital world. This evolution in technology therefore required pedagogical approaches to suite the shift. Such approaches included multimodal learning theory, connectivism, cognitive load theory, and most noticeably the Flipped Classroom approach. What distinguishes this approach is its ability to blend traditional teaching methods with the use of technology-based tools (Naidoo, 2020), while flipping the setting of where the learning takes place. The approach advocates for readjusting and rescheduling time spent on both in and out classroom activities to shift the ownership of the learning experience from the teacher to the student (Kashada & Li, 2017).

2. A Flipped Classroom Approach: Theoretical underpinnings

As a pedagogical tool, the flipped classroom approach has its roots in the late 1990's when teachers were attempting to provide supplementary content for learners who were absent in the classroom.

The approach later developed in Higher Education institutions around Northern Europe in an attempt to maximize contact lecture time. Its early proponents, Bergmann & Sams (2012) found that students who engaged with content at home could spend class time engaging in more meaningful activities, such as experiments and group work. This type of learning is active in nature and more student-centred than the traditional lecture system. Knowledge is constructed actively as learners prepare for class (Sohrabi & Iraj, 2016). Bergman and Sams (2012) propose the following four pillars for a Flipped classroom approach:

2.1. Flexible environment

As opposed to traditional classrooms that are non-conducive to learning, flipped classrooms require students to work collaboratively and in very flexible environments. Students are able to choose when and where to learn and the lecturer accepts these circumstances. Naidoo (2020) agrees with this as he describes flexible environments as constructive and conducive places outside the classroom where learners can engage with content in the comfort of a flexible setting.

2.2. A change in the learning culture

This pillar advocates that lecturers should assist students learn topics in greater depth by the use of pedagogies that are student-centred. Unlike traditional approaches that identified the lecturer as the solitary knowledge holder and provider, flipped classrooms identify the student as taking ownership in the knowledge making process.

2.3. Intentional content

This pillar requires the lecturer to be conscious and calculated with the way in which content is created and consumed by the students (Naidoo, 2020). The main objective in this case matching content with suitable instructional delivery modes. More so, the lecturer must be flexible enough to adjust from traditional instructional methods.

2.4. Professional educator

For success in the flipped classroom approach, experienced lecturers are best suited as the lecturer must capitalize on the learning opportunities existing and must observe the students keenly to guide them (Kashada & Li, 2017). The investigation of this study analyses these four pillars to explore how context and content can be a barrier to the application of a Flipped classroom approach in a South African University.

3. The South African university: Context and content

Any contextual discussion of South Africa will almost always revolve around its painful past. This is an important departure point as it explains many of the issues that the country still suffers from. The establishment of a higher education system dates back to 1873 with the first degree conferring institution known as the University of the Cape of Good Hope (Boucher, 1975). Administered under the University Incorporation Act 16 of 1873, this colonial university was only reserved for English speaking white European settlers. Post colonization, the Apartheid administration would redirect its focus to Afrikaaner universities in the former Transvaal and Orange Free State. Although these were exclusively reserved for white South Africans only under the Separate Amenities Act of 1953, the need for a skilled labour force arose with the development of the state. It is only under the Extension of Universities Act of 1959 that attention would be paid to colleges for Non white South Africans (Mdepa & Tshiwula, 2012). Black universities only started receiving state attention and support decades after former white universities. In the course of its 45-year rule, building upon 350 years of colonialism, the apartheid government institutionalized a higher education landscape consisting of 36 universities, 15 Technikons and approximately 140 single-discipline vocational colleges (nursing, education and agriculture). All of these institutions were structured along racial lines in terms of both admission and tuition (Mdepa & Tshiwula, 2012). This gruesome history of South African universities is similar to that of its communities who suffered irreversible socio-economic impacts from segregation. It is against this backdrop that this study explores the difficulty of implementing a flipped classroom approach in South African universities that accommodate majority students from these communities

4. Methodological procedures

The aim of this study was to explore context and content as barriers of implementing a flipped classroom approach in South African Universities. This qualitative study employed a case study design to do this. Babbie (2001) describes case studies as an in-depth description of a case or bounded system such

as a process, activity, event, programme or multiple individuals. A case study was suitable to the aims of the research because it allowed the researcher to explore in detail the case context and content in South African Universities. Purposive sampling was used to select one South African University based in a township in Kwa-Zulu Natal. One class of first year Engineering students were selected to partake in the study. First year students were selected on the bases that their inexperience in the university system that would be a source of rich data in understanding context and content. Data was primarily generated using semi-structured questionnaires. A combination of open-ended and close-ended questions were administered to the sampled students to explore the context of their communities. One-on-One interviews were also conducted with the Engineering lecturer to collect data on the content of the module and its suitability to flipped classroom approaches. This data was analysed using thematic analysis by examining the following four themes: flexible environment, a change in learning culture, intentional content and professional teachers (Bergmann & Sams, 2012).

5. Results and discussions of findings

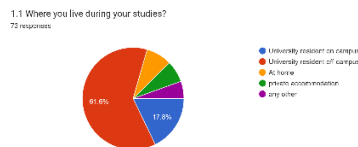
A total of 72 first year Engineering students responded to the questionnaire which aimed to explore how their context and content affected the implementation of a flipped classroom approach. The first 2 principal components of this approach, flexible environments and professional educator (Bergmann & Sam, 2012) explored context barriers while the latter 2 principal components, A change in learning culture and intentional content (Bergmann & Sam, 2012) explored content barriers.

5.1. Context

Flexible environment

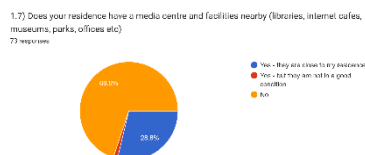
For a flipped classroom to work, the alternative flexible environment needs to be both conducive and constructive. Majority of South African Universities were built during the Apartheid administration that did not envision high enrolment for previously disadvantaged groups. This means that many of them have very little student accommodation on campus (Mzileni & Mkhize, 2019). Graph 1 depicts that 62.5% of the 72 respondents live in off-campus accommodations. This is however the case in many other South African universities because of historic Apartheid spatial planning (Mzileni & Mkhize, 2019).

Graph 1. Student residency during studies.



Flexible environments should have resource centres to assist students which learning using a flipped classroom approach. The approach advocates for completing and consuming module content outside the classroom to allow lecture time to be used for application, experimenting and exploring (Berrett, 2012). In addition to 62.5% of the respondents residing in off-campus residence, their residence lacks the media centres and resources required to assist them. Graph 2 displays how almost 70% of the respondents do not have access to media centres near their residence. 65% of respondents reported to sharing a room with more than one person, making it extremely difficult to utilize the space as a conducive study area. The lack of individualised space, as seen in graph 3, show the difficult of implementing a flipped classroom approach as students do not have conducive spaces to create the flexible environment required for the implementation of a flipped classroom approach.

Graph 2. Access to media centres and resources.



Graph 3. Number of occupants in room.



Professional educator

This core principal of the flipped classroom approach requires that lecturers are experienced and suited to capitalize on the learning opportunities provided by the methodology (Kadasha & Li, 2017). To

explore this principal, the study interviewed the Electrical Engineering lecturer who teaches the 1st year Engineering students. The lecturer stated that they have 7 years teaching experience and holds an MSc in Engineering. The lecturer responded that they have not been to any formal training or capacity building that deals with the flipped classroom approach. Alexander & Masoabi (2017) note that while South African Engineering academics have expert knowledge on content, they struggle to pedagogically relay this knowledge due to lack of teacher training. When the flipped classroom approach was explained to the lecturer, they stated that their institution may not have the required technical support and resources needed in a flipped classroom approach.

5.2. Content implications

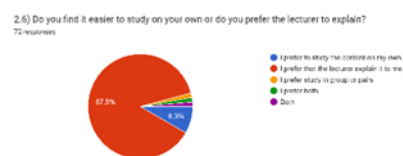
A change in learning culture

What was encouraging in this study is that more than 50% of the respondents have been taught using different multimedia, as depicted in graph 4. This is hopeful for South Africa's flipped classroom approach aspirations since students are somewhat familiar with tools used in the approach. However, more needs to be done to familiarise them with student-centred pedagogies as an overwhelmingly 87% of respondents preferred that the lecturer explains the content to them. The current learning culture in South African universities could pose a barrier in successfully implementing a flipped classroom approach.

Graph 4. Using multimedia.



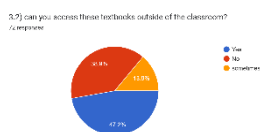
Graph 5. Student-centred pedagogies.



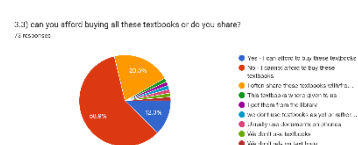
Intentional content

In investigating this principal, the study sought to find out the type and content that respondents were accustomed to, as well as how much access they had to this content to facilitate a flipped classroom approach. Most respondents used textbooks as the primary form of content consumption. What was somewhat encouraging about this is that 47% of respondents said that they can access these textbooks outside of the classroom. This means that the lecturer can attempt to direct students to engage content outside of the classroom and avail class time for other practical activities. Nonetheless, close to 60% of respondents cannot afford these textbooks. This is a major barrier to implementing a flipped classroom approach because many South African Students in underprivileged universities often struggle with affording textbooks and other educational resources (Goodier, 2019).

Graph 6. Access to content resources.



Graph 7. Affordability of content resources.



6. Conclusion and recommendations

The study found that the historic inequalities and state of South African communities and universities were a barrier to effectively implementing a flipped classroom approach. The study recommends a collaborative effort by the Department of Higher Education and Social services to 'flip communities' first before flipping classrooms. The role of the university in this regard is to focus its community engagement efforts at creating conducive communities where students can reside and study effectively. Furthermore, an additional core responsibility of the university is to ensure that students residing in off-campus residence have suitable resource centres and educational facilities to complete their studies. South African universities cannot afford to be left behind in innovative 21st century pedagogies because of its context and its barriers to content.

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INCREMENTA ATQUE DECREMENTA* ...
**MANAGING THE UNIVERSITY RESEARCH CENTRES:
THREE CASES AND A COMMON MANAGEMENT ISSUE**

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Abstract

The aim of this paper is to raise, amid several decision process issues, a major question: Is there any common reason behind failure in some cases encountered in higher education research centres or laboratories? If so, is it a matter of lacking professionalism or management skills; human nature or local culture; or environment pressure? This seems to be a rhetorical question – as the cause could be any or a mix of them, in addition to scores of others – depending on particular environments. However, the main purpose of this paper is to launch a discussion about possible administrative and management causes behind the research centre’s failure, and management conflicts eventually – both inside and outside university – yet related to the management of research units within universities. As methodology, the study largely relies on directly observed and/or personally experienced particular instances in the Romanian university environment – over a relatively long period of time (1980s–2000s). Secondary literature survey complements this primary research under scrutiny – illustrating the matter under investigation. There are three cases of university research centres with different profiles and importance, all sharing one common feature: failures after successful start. The investigation approach is by the domain of research, from macro- to micro-level (organizational). The conclusions resulting from each case are assessed, highlighting similarities and differences. As the focus is on the management issues, a particular root-cause has emerged. In all instances, the abrupt change of positive course of the research centre was a common management issue. *Notably, the failure cases under scrutiny are particular instances, among plenty of successful stories.* The concluding remarks are focused on a set of recommendations centred on the main findings (proper, principle-based management of the research centre, careful environment monitoring, timely information, change and conflict management) – to be recommended to the stakeholders: higher education policy makers, administrators and research managers.

Keywords: *University research centre, university centre for excellence, research and didactic laboratory, university administration and management, management principles.*

1. Introduction

This paper is not about the rise and fall of empires or the decline of great powers (Rapley and Heather, 2023) as the title might suggest, but about contemporary, less prominent organizations – like university research centres. However, there is one similarity: organizations, like more complex systems as empires and great powers, have their own lifecycle (Greiner, 1989; Lester, Parnell and Carraher, 2003; Bento and Alves, 2014; Jenkins, 2016), growth and glorious periods end up less gloriously, if not in ashes. There also are lessons to be learnt in both cases, and—as *The Economist’s* (2023) book review shows—organizations don’t always collapse but reinvent themselves, survive and thrive, despite many “Thucydides traps” (McCormack, 2023) embodied by competing organizations.

This paper opens a discussion on the causes that may provoke the collapse of the university research centres—despite their promising start-up—notably, *from causes other than competition* (“Thucydides traps”). In other words, the scope of work is less investigated (it is rather scarce from that

* *Incrementa atque decrementa* [Latin] is inspired by: *Historia Incrementorum atque Decrementorum Aulae Othomanicae* [*The History of the Growth and Decay of the Othman Empire*] written (1716) by Demetrius Cantemir (1673–1723), Romanian prince; encyclopaedist, man of letters and statesman who has also served as Voivode of Moldavia Principality twice (1693; 1710-1711).

standpoint of literature) for at least two reasons: (i) small research organizations are less studied than larger companies; (ii) the reason of failing is other than competition (i.e., internal rather external).

In addition, the specific scope of work is even narrower (the higher education environment; and smaller departments of the university—research centres or research laboratories—as advanced research units), limited to prominent Romanian higher education institutions. Therefore, the main research question is this: Is there any common reason (other than fierce external competition) behind the failures encountered in higher education research centres or laboratories? If so, is it a matter of lacking professionalism or management skills; human nature or local culture; or environment pressure? This seems to be a rhetorical question – as the cause could be any or a mix of them, in addition to scores of others – depending on particular environments. However, the goal is *to identify the root-cause in the area of administration and management*, and management conflicts eventually – both inside and outside university – yet related to the management of university research units. In addition, to launch a discussion around errors identified while managing the research units, and to formulate a *set of recommendations for the main stakeholders* (from research founders and funders to research managers) are ultimate objectives.

Consequently, the remaining of this paper is structured as follows: methodological approach; the core primary research based on cases of failing university research centres; discussion of findings and recommendations; research limitations and further research avenues; and conclusion.

2. Methodological approach

This study relies on secondary and primary research mainly – i.e. direct observation and/or personal experience related to particular instances in the Romanian university environment (namely medical, engineering and entrepreneurship studies)—over a relatively long period of time (1980s–2000s), before and after communism collapse in Eastern Europe. Secondary literature survey complements this primary research under scrutiny, illustrating the matter under investigation.

The case method serves to address the research objectives. There are three cases of university research centres with different profiles and importance (from local to national), funded from different sources, all sharing a common feature: failures after successful start (failure in terms of missing the strategic objectives, set according to their initial missions). The failure cases were selected subjectively (by author) based on his experience and own research. The selection criteria considered different domains of research, from macro- to micro-level (organizational), accidentally corresponding to reverse-chronological order. Since the focus is on management issues, a particular root-cause analysis was used.

3. Three cases of failing university research centres

A recent piece of news with some media echo (*Case 1*) was the spark for this piece of work. Two other summarized cases are symmetrically presented, on both sides of the historical cornerstone, which was the Romanian “1989 Revolution” (*Case 2* right after it, and *Case 3* right before). There were very different circumstances, yet similar promising start, followed by unexpected collapse. This is an attempt to explain the collapse. Each of these cases actually deserves an extended, in-depth study. Ciurea (2022) depicts the *Case 1* in more details, colours and feelings.

3.1. Case 1: A centre for excellence in neurology and neurosurgery

Founded back in 1975 as a national neurosurgery hospital, and extended in 1993 as an emergency hospital, this hub of medical services currently hosts the largest neurosurgery clinic in Romania. It also functions as an important advanced research, education and training centre in medicine.

In 1999–2000 the government has launched a project to fund a *Centre for Excellence in Neurology and Neurosurgery* (CENN) in this hospital, aiming to provide top medical services and conduct advanced scientific research in neurology and neurosurgery. According to Ciurea (2022, pp. 245-248), top medical equipment was acquired, including a GKS (Gamma Knife Surgery) system.

The CENN project was successfully completed in 2004, and the Minister of Health officially opened CENN in March 2005. The cost of this green field investment was €31 million for a 5,000 sqm building that included world-class medical utility infrastructure and equipment. The first patients visited the CENN and it seemed to have a promising take off and glorious future.

Unfortunately, in 2006, a government reshuffle (Minister of Health included) and an inspection of the new minister had as a result downgrading the hospital and turning the CENN into a regular neurosurgery hospital (emergency unit included) – as reported by Ciurea (2016; 2022). Fact is that CENN failed so quickly that it not only struggled for existence in the stage one of their lifecycle (Lester, Parnell and Carraher, 2003) but it also barely reached the early phases of small business growth (Churchill and Lewis, 1983). This rapid and unexpected extinction of CENN—recently narrated by the former CENN director—had

a strong reverberation in the author's business memory, which instantly recalled older somehow analogue cases (*Case 2* and *Case 3*).

In the CENN case it is rather difficult to discern the right and wrong between the Ministry of Health's criteria to decide CENN founding and funding (1999–2005) and the arguments of the same Ministry of Health (nevertheless, another minister) to decide CENN downgrading (2006), and collapse eventually. It is beyond the purpose of this study to judge that, based on limited information.

However, it is surprising that such costly contradictory decisions happened. On the other hand, it was an obvious *misalignment between a research project within hospital and the hospital strategy and overall strategy of the Ministry of Health*. Anyway, the root-cause of the CENN collapse was external to the research centre (a strategic decision made outside CENN).

3.2. Case 2: A center for business excellence

This story is older. The Romanian 1989 revolution came up with huge local enthusiasm and international waves of sympathy. The sympathy was soon followed by assistance programmes, mostly for developing the democracy, free-market economy, civil society and civic organizations. Some donors focused on reforming the education system.

Co-funding centres for business excellence in major Romanian universities was such a project. In particular, it was agreed that a Center for Business Excellence (CBE) to be developed in a major technical University – with the mission to stimulate and develop business education as well as support services as consulting, training and research (1991). Among other results, a team of local professionals and teaching staff were the beneficiaries of business management training by US university counterparts and soon they were certified as *business counselors*. A flexible organizational structure was developed by a core team of five professional and master consultants supported by an IT expert and an administrative clerk (occasionally extended to 15 people, including intern students). In the following years, CBE has developed organically, provided business services for over 2,000 entrepreneurs across Romania and Republic of Moldova (1998), and eventually became the hub of a national CBE network (Big, 2004).

CBE staff have produced and edited ten issues of a book series—*Research in Business Management*—between 1999 (*Issue 1*) and 2005 (*Issue 10*), referring to research projects conducted in CBE (e.g., *Issue 3, Issue 10*) in about a decade (1996–2005). On top of these, three doctoral research projects were conducted by CBE professionals, and associated PhD theses were successfully developed and defended (Scarlat, Bodo and Stanciu, 2001). The results of the CBE research work have influenced the entrepreneurial education in Romania. The first Entrepreneurship subjects were included in the University curricula (since 2000), followed by the first Romanian books on entrepreneurship and business management (Scarlat, 2001; 2003).

The activity of the CBE has enjoyed *national and international recognition* (member of the *US Association of Small Business Development Centers*, 1993; *Project of the Year Award*, 1997 by National Association of Management and Technical Assistance Centers from USA).

By the time the Romanian Ministry for SMEs awarded the *Project of the Year* to CBE for organizing *Business Plan Contest* for students (2008) and CBE was nominated for the *European Enterprise Award* (Prague, 2009), the University leadership decided to dramatically (literally) change the CBE course. With no notice—during the winter holidays—they allocated the CBE facility to a different purpose, and disposed the existing materials for recycling.

Obviously, the CBE dissolution happened during its maturity stage of the organization lifecycle (Lester, Parnell and Carraher, 2003). Hypothetically, in case of reasonable communication between CBE and University leadership, a possible transition to the fourth stage (renewal) would have been possible. At that moment, the facts demonstrated a neat misalignment of the CBE objectives with University strategy. The further development (the current interest of University demonstrates a clear orientation towards projects for developing entrepreneurship skills) depicts a different diagnosis: the CBE was probably born too early. In other words, the “strategy gap” is about a decade. Despite the CBE dissolution, the CBE-trained and experienced professionals have valued their experience, continued their research projects, and extended their international cooperation (Antoncic et al., 2007; Scroggins et al., 2016).

3.3. Case 3: A laboratory for ergonomics studies

This story is even older: it started during the last decade of the communist regime and centrally planned economy in Romania—as in other east-European countries (1980s)—and ended during early turbulent years of the post-communist transition to a free-market economy (early 1990s).

The *Laboratory for Ergonomic Studies* (LES) started its activity as a research centre and education laboratory associated to the Management Chair within a large Romanian technical university. The necessary support materials were prepared (Scarlat, 1983) and a proper location was assigned. LES was properly

equipped (from equipment to test work micro-climate to equipment to test working skills) as well as necessary staff support (laboratory coordinator, technical and secretarial support).

The number of students and faculties served by LES increased for a few years in a row, to that level that ergonomics classes in this laboratory were included in the engineering syllabi and curricula.

Then relatively quiet University elections were followed by violent and radical changes because of the “revolution” (December 1989) that has affected the university life for years. Before disappearing completely, the LES equipment was removed and placed in a storage room (with the blessing of the new leadership of University, faculty and chair). End of the story.

By the time of its brusque collapse, LES was reporting some success, probably towards reaching its maturity stage – according to Lester, Parnell and Carraher (2003, p.343).

It is rather difficult to assess the status of the hypothetical “future FES” in the “what if” scenario. Undoubtedly, the regime change was a historical fact, aligned with the political movements in the Eastern Europe by the end of last century. However, was the ergonomics removal an essential part of the regime change? Surely, not; it only was one of the numerous collateral, unnecessary victims. Worldwide, *Ergonomics did not disappear*; it only continuously adapts to the newer jobs (which is a strong reason to study this area). Then, why all these happened?

The root-cause emerges to be not only misalignment of the LES objectives with the University strategy, but also the lack of strategic vision (if not the lack of any strategy) at all management levels in the University. Apparently there also are two aggravating factors at both sides of the hierarchy, from macro- (tempestuous revolution) to micro-level (human nature oriented towards own interest); the first as an “opportunity” for the second, unfortunately.

4. Discussion: Findings and recommendations

The cases investigated display a large variety (research area, period of activity, activity peculiarities, circumstances of founding and dissolution, people involved – to name just a few). The major difference, from management standpoint, is the stage of their life cycle in which they have failed.

However, as their selection was based on a single criterion (they suddenly failed, apparently with no explanation), it was challenging to conduct the investigation (focused on management issues) up to the point of revealing—as it was expected—the root-cause of that abrupt change of positive course of the research centre. This was a common management issue in all cases investigated: a conflict (misalignment) of the objective/s of the research centre with the strategy of the larger patronizing organization.

The findings allow the formulation of a set of recommendations as follows.

- The founding of such research centres (RC) in a higher education organization (HEO) should be based on longer-term vision and not on short-term interest (apparently bringing advantages).
- The RC activity and objectives must be in line with the HEO strategy.
- Environment monitoring and timely information exchange between RC and HEO would help to keep the above alignment.
- The RC should organically be integrated in the structure of the HEO; yet the HEO Constitution should provide reasonable limits for flexible RC management.
- Besides functional and hierarchical management relationships, the HEO Constitution has to include clear (*not bureaucratic*) provisions related to financial relationships between HEO and RC, mainly in the perspective of RC financial self-sustainability.
- Conflicts between RC research projects and HEO (project *versus* organization-type) should be detected in their early stages; they can be avoided by keeping regular meetings and clear communication protocols.
- While working in a multicultural environment, developing industry-specific vocabularies would be beneficial (Scarlat and Sârbu Bărar, 2023).

5. Conclusions, limitations and further research avenues

This piece of work has reached its objectives. However, despite its novelty and contribution to filling the knowledge gap related to the failures of research centres within Romanian higher education organizations, this is just opening Pandora’s Box – as further questions may emerge.

Obviously, the number of cases surveyed is a serious limitation; yet the findings open research paths for further longitudinal and mainly transversal studies – extending the investigation on more failure cases, by activity periods and regions as well as research areas. Further studies on similar cases in other countries might lead to comparative studies.

On the other hand, in-depth and extended studies in each case with more detailed objectives might reveal novel findings. Finally, three comments are noteworthy:

- Usually the success stories are reported, and investigations are looking for successful people and organisations. This study follows the opposite approach.
- The failure cases reported are particular instances, among plenty of successful stories.
- Despite RC failures, the RC people (mainly young professionals) ended up stronger; they are more experienced as beneficiaries of lessons learnt, hopefully.

Acknowledgment

The author is grateful to all colleagues, with whom he worked along 1990s developing the Centre for Business Excellence (CBE) and the CBE Network, sharing enthusiasm, efforts, and proud satisfaction for reporting unforgettable achievements; yet with whom he was discussing the reasons behind CBE failure, and still sharing fond memories about that formative time of their careers.

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WHAT DATA AND DATA TOOLS ARE MOST NECESSARY TO MAKE POLICY AND PROGRAMMATIC DECISIONS?

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Abstract

What do early childhood administrators, policymakers, and advocates want in a data tool? It is easy to simply provide them with multiple datasets, geographic regions from which to choose, and lots of demographic data describing young children, their families, and communities. But is that what the early childhood community needs or wants? Working with other stakeholders across the state, this early childhood data hub interviewed key stakeholders, held focus groups, and investigated what the statewide community wanted in their data and data tools. As a result, existing data tools have been renovated and developed with the early childhood community in mind. This project considered the needs of stakeholders and users based on their data literacy. How does a data tool and its datasets bridge the divide that may exist between participants and users with differing capacity, interest, and knowledge of data? How do we build a foundation from which to develop higher capacity in using data, more confidence in using data tools, and better understanding of effective uses of data in reports, programming decisions, and changing policy? This presentation will provide an overview of the findings of this investigation and the tools that have been refurbished or developed based on those findings. The authors will explore the most necessary data, the quality of those data, and elements in a data tool that provide the user with the type and amount of data needed to make evidence-based decisions and answer specific research questions.

Keywords: *Data, data tools, policy, early childhood.*

1. Introduction

The state of Illinois in the United States is in the middle of a long-term data initiative, the Illinois Longitudinal Data System (ILDS), which involves redesigning public portals for ease of use and access of data, but more importantly, involves rethinking the value of discrete databases from each state agency to integrated datasets across all state agencies. This is occurring most predominantly in the arena of early childhood education and care data. The Early Childhood Participation Data Set (ECPDS) is in its fourth year of designing, building, and implementing integrated datasets from select standing databases from pertinent agencies. These agencies include the two responsible for most of the service delivery for young children and families—the State Board of Education (ISBE) and the Department of Human Services (IDHS). The Illinois Early Childhood Asset Map (IECAM) project was contracted to build and implement a new data tool, to be known as the Early Childhood Data Hub, and populate it with curated datasets from participating state agencies and data sources.

2. Rationale

IECAM (and partners') work has evolved from defining the process of the ECPDS to the necessary methodology to the reality of joining disparate systems' data into a single dataset using unique identifiers for each child to track their participation in different programs in different agencies. The work is done in a cloud-based environment. From the moment the curated data is uploaded into the cloud environment to the development of virtual standing datasets, from which to create integrated datasets across funding streams and programs, the data remains in the ownership of a particular agency. Researchers and evaluators from across the state who work within the confines of the cloud environment are instructed to develop data access and use agreements (DAUAs) with the data sources (i.e., agencies). Currently, the executive committee is working with the federal Head Start/Early Head Start program to ensure that its data is included in the initiative and meets the same governance criteria as other data sources and state agencies.

The conceptualization of the ECPDS project (1) began with the realization that many state agencies lack the necessary technology and technical know-how (i.e., capacity) to begin such an endeavor; (2) continued with the work of establishing communication and trust to discuss, much less share, data

between agencies; and (3) ended up in early 2024 having to meet challenges of the need for more funding, agency capacity, agency trust, and even more data with which to learn all we can about the children of Illinois. Pahlka (2023) insists that to make real change regarding the digital age and use of data, it is less about rushing to build new apps and tools and more about increasing governments’ capacity with data and technology. Although the culmination may seem to be developing the architecture of a data hub for users, collaborators across Illinois are learning the need to play the long game. The new Data Hub is being built on a durable foundation of trust, governance, collaboration, communication, and capacity building. We are learning it is less about the data that will be provided in the Data Hub and more about the ability and the infrastructure to look across datasets and answer questions that, on the surface, may seem easy, but are anything but. We are also realizing the expectations built into the development of the Data Hub for the state are themselves built on factors over which we have little to no control.

3. Methodology

Through a partnership with Northern Illinois University and the Center for Early Learning Funding Equity (CELFE), a third party was contracted to conduct interviews, focus groups, and a questionnaire of a specific group of stakeholders who either have used or will be using IECAM as a part of its current responsibilities. In September through November 2023, this contractor facilitated six focus groups to inform the design process of the new Data Hub on the IECAM website. The participants were shown draft designs for the Data Hub that would in the end offer enhanced functionality and flow of data. Participants were asked how useful they thought the Data Hub would be as well as suggestions for improvement.

The contractor sent an informal questionnaire to 181 contacts who were key stakeholders identified by the ILDS team and other respondents from an initial survey used in a previous project, and 58 responded.

4. Results

Participants responded with enthusiasm about the wireframe and the potential value of the Data Hub for presenting data. Although many of the comments were related to data questions, data quality, or availability, the results discussed here focus primarily on perceived usability of the draft Data Hub and suggestions for improving it (see Table 1).

Table 1.

Perceived Usability	Suggestions for Improving	Select Comments by Type
Potentially more user friendly than existing tools More accessible to “lay” audiences Ability to refer agencies and organizations to the tool Will save time and streamline processes for users Will serve multiple goals across different user types Will potentially answer specific early childhood questions unable to be answered at present. Useful for community needs assessments Useful for grant writing and reporting	Sets of “preset” views of the data: (enrollment vs. poverty, enrollments vs. demographics, enrollment vs. age) Contextual information for using the tool Native guidance for using the tool (e.g., orientation video and tooltips) Further beta testing to ensure its usability and accessibility	Appearance Visually engaging Visually overwhelming Colorful Too much text Data Old Inaccurate Need definitions Functionality User-friendly Sort of user-friendly Need tutorials

5. Discussion

While not surprised by the results, the contradictory nature of the comments was unexpected. For many of our users in the past and in the present study, their primary focus has been on their preferences (e.g., color, shape sizes, text fonts or sizes). Our users come from a variety of backgrounds and experiences with technology, digital tools, and data. What we have found is that in addition to capacity, knowledge of data, and ease with technology, preference or personal taste tends to play a large role in a user’s impression of a tool. One tool will not please every user. And, while data architects may choose a platform, a framework, and a language with which to develop a tool, for many users their preferences regarding color

or their proclivities for more or less white space on a screen may play an outsized role in whether they find a tool useful or not. This study aimed to answer three questions for IECAM as it developed the Early Childhood Data Hub:

1. What do early childhood administrators, policymakers, and advocates want from the Data Hub?
2. How could the Data Hub and its datasets serve participants and users with differing capacities, preferences, interests, and knowledge of data?
3. How can we help users and state agencies with differing levels of knowledge, ability, and technology use data tools more effectively?

5.1. What users want

Results indicated that users want everything in one tool, yet they want it to be intuitive to every level of experience. They want it visually appealing, with pleasing colors and shapes, without, of course, being overwhelmed on the screen of their choice. They want functionality to be user-friendly, yet robust. Users want a tool able to deliver rapid results, with data that are current, available in multiple geographic regions (e.g., counties, municipalities, zip codes) and displayed in appealing, yet understandable ways.

Audience is important when developing a data tool; knowing our audience helps us better design a tool appropriate to our purpose. Having a clear view of our users enables us to acknowledge their capacity for using a tool, provide guidance in functionality, and have clear definitions of terms and data. Individuals in the focus groups concentrated on the intended audience and gave clear descriptions of what a tool should and should not include based on that audience. For instance, one user stated unequivocally that the draft Data Hub was too focused on the early childhood community and should be more open to additional age groupings. Another focus group member reported that they appreciated the fact that it was designed with the early childhood audience in mind.

Text can provide the boundaries of a tool, providing guidance and limitations of a tool and the data. Is the text overwhelming the data? Is the text complicating what could be a much easier tool to use? In other words, are we using too many words when the data and display of the data can speak for itself?

Users want the most recent data, but we are only able to provide the most recent data available. There is a distinction between what users want and what they might be able to get. (For example, demographic data from the U.S. Census for 2022 was released in December 2023.) Providing current data primarily depends on each data source. That means building relationships with the data sources, cultivating a rapport of trust with agency staff, and building capacity within the data source so they understand the richness and usefulness of their data, as well as the importance of disseminating and sharing their data. Even though available data may not be as current as users want does not mean it cannot be useful. “Old data” can still be used to look at trends and patterns, even when it is not the most recent. While our goal would always be to have the most current data, realistically, that may not be entirely possible. Ensuring that users are aware of the efforts taken to get desired data and the integrity to be honest when we admit we are unable to provide them with the most opportune data is crucial. Providing needed data is a transactional relationship and one that needs trust at its core.

5.2. Bridging the divide

Acknowledging that our participants had high expectations for the Data Hub was critical in thinking about how we go about designing the architecture and building its functionalities. There seems to be at least three divergent approaches to handling differing perspectives and expectations for such a tool. The first is to make the decisions for the users. Tell them what they want. Sometimes people do not have the vocabulary or experience to know exactly what they desire in a new tool. This is completely natural and something we all experience. This option involves building a tool based off opinion (your own or others) and experiences (your own or others). An example of this type of approach is Steve Jobs and Apple. Of course, innovation is built on customer feedback and the reality of the market, but the original tactic was simply letting the users know what they wanted and needed in a tool. IECAM has never really taken that method. A second might be called the “more is more” approach. Incorporate as much as possible into a tool to see what works. Give more power to the user to interact with a tool. This does increase the amount of time and resources needed for development and may make a tool more difficult to use, but it provides users with everything they could need at their fingertips. (From IECAM’s experience, providing thorough definitions and documentation cuts down on redundant questions from users.)

This was IECAM’s initial approach. When IECAM was first developed in 2006, the original intent was to provide a set of interactive maps from which users could manipulate demographic parameters (e.g., poverty, maternal education, substance abuse) and overlay early childhood resources to show a full mapping of a particular geographic area in Illinois. Users could choose from a number of different parameters of demographics and ECEC programs and resources and produce their own maps. They could download, print, and use them in their own reports. While tabular data was offered, it was on a temporary

basis. But more wasn't more, it was mere muddle. What we found was that users were overwhelmed with choices and did not want to develop their own maps. The entire GIS (geographic information system) section went virtually unused for years. Slowly we began to simplify the maps, offering less parameters to choose from and, finally, we took all links to the GIS site off our main website. In addition to its widely used database that presents tabular data, recently IECAM has been publishing interactive maps with limited options and layers, and they are also quite popular on the website.

The third approach is to ask current and potential users what they want and need from a data tool. Keep those user suggestions in mind as you build your tool, but also rely heavily on your experience in building data tools as you sort through contradictory and unrealistic suggestions and expectations. Otherwise, you could end up with a confusing or contradictory range of choices or another "more is more" muddle. This is a balancing act that requires ongoing communication between the creators of a tool and its users, as well as the willingness to make necessary changes as time goes on. (Note that when it came to building the overall architecture, structure, language, or other necessary "back end" elements of the Data Hub, decisions were made by the IECAM team based on their extensive knowledge and expertise.)

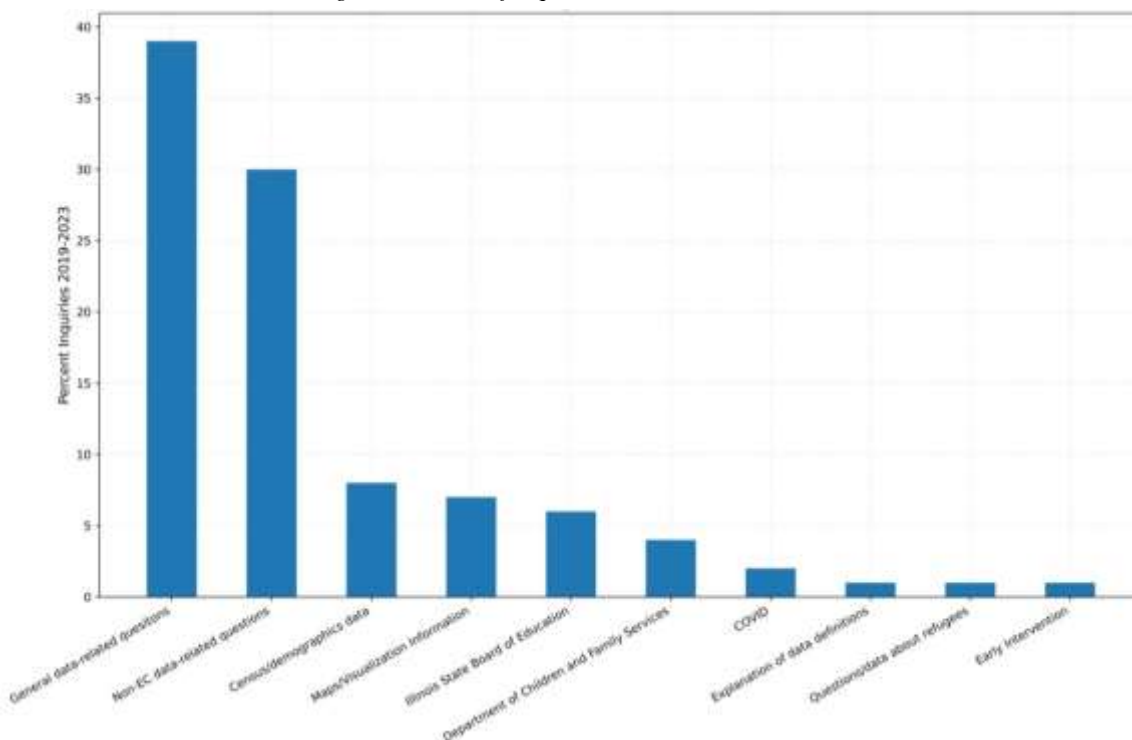
5.3. Developing capacity

IECAM is a publicly funded website with aggregate public data. Although users can find all the data on our website from other data sources, we offer a one-stop shop for early childhood and demographic data, descriptions and definitions of those data, charts, tables, and interactive maps and visualizations. While we have conducted focus groups in the past looking at functionality, appearance, and ease of use, having the chance to find out what current users want in a new tool before building it presented us with opportunities and challenges.

We identified a couple of issues that will need to be addressed and/or acknowledged moving forward. First, we cannot please every user. We can listen to users. We can respect their suggestions and thoughts. We can implement changes to some of these suggestions. However, we will not be able to build a tool, much less improve our existing website and tools, that will satisfy everyone.

Knowing that and being left with contradictory comments from the 2023 focus groups, we decided to look back at our own records. Users have been able to request data, charts, and custom maps. They can request assistance through telephone calls, emails, an electronic request form, and a chat box on the website. Users may ask for specific data types from a particular geographic region; they may ask for charts, tables, or maps to insert into their program reports. Some ask for information that requires staff to refer them to outside resources, websites, or organizations. IECAM has been tracking all data requests since 2008 and logging information, such as a description of the data request, geographical location of the request, organization of the requestor, and institution of requestor, if available. A breakdown of data requests for the past five years can be seen in Figure 1.

Figure 1. Percent of Inquiries between 2019 – 2023.



As shown in Figure 1, a third of data requests received from 2019 through 2023 fell *outside* the realm of early childhood data, resulting in questions including “how can I register my child in school?” to “who is my legislator?” (This was quite surprising to us. We suspect we get a lot of these inquiries because we land high in Google search results on early childhood topics and, even more so, we have a convenient chat box to ask such questions.) IECAM staff referred those users to other organizations or agencies for answers to questions they could not quickly answer. Thirty-nine percent of inquiries were based on data, ranging from requests about specific slot-gap calculations to percentages of eligible children. Users also requested data about refugees, demographic figures, or maps and visualizations.

Addressing the challenge of ensuring that all users can find answers to their inquiries on our website becomes complex, especially when 30% of the questions are unrelated to data. This presents a formidable task, and there is no one-size-fits-all solution. Catering to the entire spectrum of users is challenging, and, inevitably, we will encounter questions that are not within our scope. It raises another question about how we help state agencies build their resources to provide many of the answers currently being answered by IECAM.

We understand that part of our purpose is to provide support for data education and literacy. Many of our early childhood programs have staff with little working knowledge of data and how to use data appropriately. Some of our state agencies lack capacity in the technology they have to use, as well as the experience of working with their data. A lot of this is out of our control but influences our work with their data, the way we relate to our data sources, and the way we display and describe the data on our website and, more pertinently, on the new Data Hub.

5.4. Managing expectations

As we started developing this new Data Hub, IECAM took into consideration not only what users said what they wanted from the new Data Hub but also how we can serve a multitude of users with differing preferences, interests, and experiences as well as how we can develop and support greater staff and agency capacity for data and technology. As IECAM moves forward in developing the data hub, how do we manage the differing expectations of various audiences of users? We have always walked a fine line with the differing types of users coming to our website for data and information. The new Data Hub will potentially bring researchers and state entities and agencies to IECAM with more sophisticated methodologies and queries of the data. Yet, it’s also expected that the typical ECEC administrator should be able to use the Data Hub for community needs assessments or to assist in writing grants. How then do we develop a tool meant to be used by such a large swath of individuals with such different skill sets and purposes?

6. Conclusion

We see our path as being one of listening to our users, providing clear and concise descriptions of our data and visualizations for a broad scale of users, and being honest with users about the data they will see on our site, as well as the data they will not see. It is imperative that those of us fortunate enough to work with the data of young children, their families, and programs are honest about not only the benefits that come with accurate and reliable data, but also the limitations that are inherent within the data and the tools that provide and display data.

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THE OPEN RECRUITMENT SYSTEM FOR PRINCIPALS IN KOREA

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Abstract

The research analyzes South Korea's open recruitment system for principals and compares it with the traditional parallel system. It aims to explore the factors that led to the formation of the open recruitment system, analyze its policy implementation process, and assess its effectiveness. The study utilizes document analysis, interviews, and comparative research methods. The findings reveal that the open recruitment system for principals emerged due to efforts to promote social democratization and liberalization in education. However, there are challenges in attracting enthusiastic participation from potential principal candidates, leading to limited implementation of the system and unmet goals. Certain regions need more candidates and require increased publicity and talent attraction strategies. Implementing the open recruitment system also poses challenges due to varying promotion situations across different areas and the absolute decision-making power of education supervisors, which has sparked controversy. It is crucial to ensure a fair and transparent selection process, emphasizing the need for objective, transparent, and professional reviews to maintain impartiality and professionalism. Overall, this research comprehensively analyzes South Korea's open recruitment system for principals and offers insights for improvement. It is a valuable reference for South Korea and other countries seeking to enhance their principal recruitment processes. By addressing the identified challenges and incorporating the research's recommendations, countries can strive for a more effective and inclusive system that attracts qualified candidates and promotes educational success.

Keywords: *Principal, open recruitment system, Korea.*

1. Introduction

Principals play a vital role in the success of schools, teachers, and students, but challenges like rising accountability standards, limited decision-making authority, and mediocre pay make attracting talented leaders difficult (Chung & Miskel, 1989; Ehrhardt, 2009; García-Garduño et al., 2011; Kandasamy & Blaton, 2004; Doyle & Locke, 2014). Research indicates the need for better principal selection and training (Ham et al., 2019; Lee & Mao, 2020). In South Korea, the open recruitment system for principals, introduced in 2007, aims to address these challenges by breaking away from the traditional promotion-based selection process. However, attracting and preparing candidates for leadership roles remain key issues (Wang et al., 2021; Choi et al., 2022). This research analyzed South Korea's open recruitment system, compared it with the traditional system, and explored its advantages and disadvantages to provide insights for improvement and serve as a reference for other countries.

2. Objectives

The main objectives of this study are: (1) to explore the influencing factors in the formation of South Korea's open recruitment system for principals; (2) to analyze the policy implementation process of South Korea's open recruitment system for principals; (3) to understand the policy execution effectiveness of South Korea's open recruitment system for principals.

3. Method

This study employed document analysis. Document analysis collected and analyzes educational policy documents, with Professor Soojung Park assisting in interpreting Korean documents (Amirov, 2020; Fackler & Sexton, 2020; Joanna & Suskya, 2021; Kim & Dreamson, 2020; Mohammad et al., 2021; Ortiz Granero, 2020; Owen, 2014). Field studies will observe and interpret practices in natural settings (Academy, 2022; Moorhead & Nediger, 1989; Rossmiller, 1988; Turk et al., 2002).

4. Discussion

The open recruitment system for principals (ORSP) in South Korea emerged as a response to the changing socio-political landscape and the push for neoliberal education policies. The ORSP represents a significant shift from traditional principal selection methods, aiming to promote transparency, competition, and meritocracy in school leadership appointments. This system has evolved over the years, facing various challenges and undergoing refinements to better align with the goals of educational reform and democratic governance in South Korea.

4.1. Historical context and policy rationale

The ORSP was introduced in the context of broader educational and social reforms initiated by the Kim Young-Sam Administration in 1993, which marked the end of military rule and the beginning of a new era of democratization and liberalization in South Korea (Joo & Reyes, 2010). The administration embraced neoliberal principles, advocating for client-oriented education, excellence in education, and school autonomy. These reforms aimed to decentralize educational governance, increase competition, and promote market-oriented approaches within the education sector. The ORSP was conceived as part of these reforms to transform the traditional, seniority-based principal selection process into a more open and competitive system. The Ministry of Education announced the Promotion Plan of Open Recruitment System for Principals, encouraging local education authorities to adopt the ORSP (Ministry of Education, 2022/10). The system was designed to attract a wider pool of candidates, including those outside the traditional education career path, and to ensure that school leadership positions were filled based on merit and suitability rather than seniority or connections.

4.2. Implementation and evolution of the ORSP

The implementation of the ORSP has been a gradual process, with various modifications and adjustments made over the years to address emerging challenges and concerns. The system initially allowed for a significant portion of principal vacancies to be filled through open recruitment, breaking away from the strict seniority-based system. It also included provisions for designating certain schools, such as newly established schools and special-purpose high schools, to implement the ORSP, demonstrating the government's commitment to expanding and promoting the system (Joo & Reyes, 2010; Ministry of Education, 2022/10). However, the implementation of the ORSP has faced criticism and challenges. Critics have raised concerns about the system's potential to undermine the teaching profession's traditional values, create uncertainty and instability in school leadership, and favor candidates with administrative or political connections over those with educational expertise (Kim & Parkay, 2004). There have also been issues with the actual practice of the system, including inconsistencies in its application across different regions and difficulties in attracting qualified candidates in some areas. Despite these challenges, the ORSP has continued to evolve, with efforts to refine the selection criteria, improve transparency, and ensure that the system aligns with the broader goals of educational reform in South Korea. The Ministry of Education has issued guidelines and regulations to standardize the implementation of the ORSP, addressing issues such as the qualifications of candidates, the composition of selection committees, and the evaluation criteria for selecting principals (Ministry of Education, 2022/10).

4.3. Types of open recruitment and selection process

The ORSP encompasses three main types of recruitment: internal, recruitment, and open types. The internal type focuses on open recruitment from within the teaching profession, while the recruitment type targets qualified individuals outside the traditional education system. The open type is akin to corporate CEO recruitment, seeking individuals with unique skills and abilities that can contribute to school innovation and leadership (Huang, 2019). The selection process under the ORSP involves multiple stages, including school-level review, education office review, and final appointment by the superintendent or the Ministry of Education. This process ensures a comprehensive evaluation of

candidates' qualifications, leadership potential, and alignment with the school's vision and needs. However, the system's effectiveness depends on the selection process's transparency, fairness, and objectivity, which has been a focus of ongoing refinement and improvement.

4.4. Implementation and challenges

The implementation of the ORSP varies across different regions and is decided at the discretion of superintendents (local education chiefs). However, the number of schools implementing the system has yet to meet expectations, with only 11.4% of elementary and middle schools adopting the ORSP by 2021. This decline in implementation rates has raised concerns about the effectiveness of the reform. Several challenges have been identified: Varying Implementation Across Regions: The discretion given to superintendents has led to consistency in implementing the ORSP, with some regions limiting the number of schools participating in the system. Insufficient Participation of Candidates: In some regions, there needs to be more sufficient candidates for the open recruitment positions, leading to the re-announcement of positions. Superintendents' Final Say: The final decision-making power of superintendents in the selection process has been controversial, with criticisms of potential biases and lack of transparency (Huang, 2019). Despite these challenges, the ORSP has been seen as a step towards modernizing and democratizing the selection process for school principals in South Korea. It aims to break away from traditional practices and promote a more open and competitive environment for appointing principals.

5. Conclusions

The Open Recruitment System for Principals (ORSP) in South Korea marks a shift towards democratizing principal selection but faces implementation challenges, such as regional adoption variances and superintendent decision-making concerns. Continuous evaluation and improvement are needed for the ORSP to effectively enhance school leadership and education quality. Addressing challenges and stakeholder feedback will make the system a more effective tool for selecting innovative principals.

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HOW TO INCREASE FACULTY SKILLS FOR A NEW APPROACH TO TRANSFORMATIVE EVALUATION IN UNIVERSITIES

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Abstract

Quality assurance systems in higher education have developed over the last twenty years under the pressure of an international and national policy to promote the pursuit of common quality improvement objectives and which allow the comparability of qualifications between the various countries. Faced with this important turning point which has strongly marked the development of higher education, individual institutions have activated important internal changes in the effort to adapt to accreditation, self-assessment and evaluation models. The experience of countries that have long developed internal quality assurance systems, such as the Netherlands and the United Kingdom, demonstrates how the effectiveness of such systems owes much to the maturity of the system, which over time has therefore permeated processes, tools and skills in the culture of the organization. The culture of quality is an essential factor to enable the effectiveness of internal, but also external, improvement processes. The culture of quality is an essential factor to enable the effectiveness of internal, but also external, improvement processes. Through phenomenological research, it was possible to grasp the main elements - both organizational, managerial and of a value-based and cultural nature - which characterize a culture of quality in a university organizational context. It was also realized that many of these elements characterizing the organization's quality culture are directly correlated with the main points of Patton's theory of transformative evaluation (defining the evaluation question, reflexive function of the evaluator, usefulness and current use; link between leadership and evaluation; continuous evaluation). The objective of this research is now to outline, starting from the elements identified as foundational for the pursuit of quality and for the ability to generate a transformation of reality, how they can be developed by the people who work within the system of both internal and external QA, especially those responsible for carrying out the assessment. It is thus possible to define a competence profile of the evaluator and what knowledge, skills and competences he must have to carry out his work in the best possible way and how they can be transmitted, through a specific training curriculum that could be made available to the evaluators operating at international, national and local levels. Similar, albeit more limited, skills must be disseminated throughout the educational community of an institution in such a way as to increase the faculty's ability to know, understand and use the evaluation practice in a positive way, in order to better deal with the moment of "being evaluated" and recognizing the benefits in the correct use of the results of the evaluation from a transformative perspective.

Keywords: *Quality assurance, transformative evaluation, evaluator skills, higher education.*

1. Introduction

The increasing development of internal and external quality assurance (QA) systems in the university systems of various countries worldwide has been driven primarily by regulatory requirements, but also by the need to make the quality levels achieved evident to external and internal stakeholders. The goal of continuous improvement in the university system brings with it the concept of raising the quality of university education and scientific research, which entails knowledge of the quality goals to be achieved, as well as awareness of the critical areas on which to work and the techniques and methodologies for measuring and analysing them (Freed et al., 1997).

The gradualness with which QA systems are implemented requires careful reflection on how these responsibilities are assigned and how these competences are disseminated and ensured. The scale of implementation starts at the international level, with the supranational accreditation agencies, moving at the national level to the national external evaluation agencies, at the institutional level with the evaluation commissions and the promotion of internal quality culture, and then moving on to the level of the individual teaching or research structure (Rose, 2005).

The experience of countries that internal quality assurance systems long before these were made compulsory by legislation, such as the Netherlands and the United Kingdom (Maassen, 1998), shows how

the effectiveness of such systems owes much to the maturity of the system, which over time has therefore allowed processes, tools and competencies to be become established into the culture of the organisation. In fact, an important concept that has been introduced in the international debate, subsequent however to the definition of QA systems, has been that of the "quality culture" which, in addition to foreseeing organisational and process elements necessary for the achievement of quality objectives, also incorporates within it factors of a value-based nature of attitudes and, indeed, cultural factors, as they are equally fundamental for grasping aspects of meaning and depth in evaluative action (Ehlers, 2009).

2. Design

Typical elements of the culture of a complex organisation such as a university cannot be understood *a priori*, without investigating the experiential experience of the operators within the QA of a university. This is why a previous phase of research of phenomenological analysis (Mion, 2023) made it possible to grasp a framework of elements characterizing the quality culture of an organisation, both from a system and a value point of view, comprising different perspectives of lecturers, students and technical-administrative staff, as well as different levels of experience: national (Italian), local University and local individual course or department. The different perspectives of these figures intersect in a holistic view of a culture of quality, which is expressed through constant learning and the incorporation of 'quality thinking' into practice (Yorke, 2000).

The elements that emerged from this research can be partly traced back to Patton's transformative evaluation theory, in particular: i) the importance of defining the evaluation question (Patton, 2010); ii) the reflective function of the evaluator, who within the organisation in which he or she operates must promote the sharing of evaluation results with decision-makers and other stakeholders (Patton, 2010); iii) the importance of the evaluation being guided by its usefulness and current use (Patton, 2015); iv) the close link between leadership and evaluation (Richardson & Patton, 2021).

3. Objectives

In order to concretely disseminate a culture of quality in the context of higher education, after outlining its founding features, it is necessary to identify the enabling factors, i.e. how it can actually be generated through the competent human action of all the players operating in the university system.

Since people are the 'raw materials' of a university, and of any other enterprise providing a public service to the community, raising and developing a culture of quality necessarily entails working on people. The development of competences, through the application of knowledge and skills, is an important opportunity to be seized by faculty development, so that culture of quality becomes part of university *knowledge management* (Tadesse, 2014; Vidal, 2003). The aim here is precisely to:

- identify the elements characterizing the culture of quality in the university system that can be developed through the skills of the individuals working there;
- grasp what are the main competences that need to be developed to promote an effective QA system;
- at which levels they can be developed, considering the gradualness with which QA systems can be implemented: international, national, local university, individual course or department.

4. Methods

As described above, the first phase of the research concerned the definition of a quality culture framework starting from phenomenological analyses, conducted by means of in-depth semi-structured interviews and a subsequent codification and categorization process, by means of classification reasoning and the use of tacit and intuitive senses (Lincoln & Guba, 1985). In fact, the phenomenological style allows one to enter the context being studied with a naturalistic approach, building a theory from the context and without being influenced by pre-constituted theories. This approach is therefore indicated for research that deals with a complex phenomenon such as educational relations (Mortari, 2007).

The results of the phenomenological research are thus the basis for a construction of a set of competencies graded on different spatial and vertical levels, according to the instructional designer competencies approach.

5. Discussion

From the framework of elements characterizing quality culture studied in a previous research phase, it was possible to identify the consequent competences required to develop these elements and to ensure that they are disseminated in the university community (Stitt-Bergh et al., 2016). Considering the

organisational complexity within which these competences have to be included, one cannot but operate a sort of "hierarchization" of these competences, based on the one hand on the type of competence, considering Bloom's taxonomy (Anderson & Krathwohl, 2001) on competences, and on the other hand on the different organisational levels at which they are to be applied - from the international level, to the national level, the local level of a single institution, or of a single teaching or research structure, to finally arrive at the most basic level of the individual. Due consideration must also be given to the role of the various figures operating within the university system, which for this research are differentiated between those who hold top political positions, at various levels (Ministers, National Agency for Evaluation, Rectors, Directors, Presidents of Courses), those who hold external or internal evaluation or self-evaluation positions (external evaluators, Evaluation Committees, internal self-evaluation committees) or lastly those who have no role of the previous ones.

5.1. Competences for the generality of those working in the university system

Considering the broad spectrum of the subjects, it is possible to identify a first batch of basic skills which should be broadly disseminated to all people working in the university system, and which mostly refer to conceptual knowledge (Table 1).

Table 1. Competences for the generality of those working in the university system, using Bloom's taxonomy.

remember	Knowledge of the university system (or of the local university in which one operates)
	Knowledge of the QA system (subjects, roles, processes, tools used to ensure quality in one's own entity), both the current one, but also its history; understanding the various stages of evolution of a system allows for a better grasp its current peculiarities and the efforts made to build it
apply	Knowledge of the quality vision of the organisation; to achieve quality, it's necessary to know its definition, what objectives are to be achieved, and the principles of quality as internationally recognised by quality standards and in their application in the context of a given institution.
	Ability to listen to and pay attention to different people according to their role, as well as to involve the various stakeholders according to the different QA processes (this consequently implies good communication and interpersonal skills, co-matching)
	Ability to direct one's choices towards the interest of the institution, i.e. to act in order to pursue quality objectives, thus applying the quality principles and values of one's own organisation
evaluation	Ability to grasp the opportunities for improvement arising from QA work, which involves espousing the transformational approach to quality management work, including evaluation activity. When experienced in a passive sense, evaluation activities should be experienced positively, and their outcomes used for the purpose of improvement
	Ability to evaluate the activities carried out and identify actions for improvement (self-critical capacity), since in all university QA systems, individuals are also called upon at some time to exercise a kind of self-evaluation (either for the purpose of obtaining forms of incentives and rewards or for reprogramming their teaching and research activities)
	Ability to identify the elements that determine a suitable working environment and try to realise them, as everyone is a proponent of a favourable working climate, albeit conditioned by organisational factors and availability of resources determined by the top management of the organisation
	Ability to organise time properly and distribute work correctly, so as not to be adversely affected by the various tasks required, on different fronts

5.2. Competences for those with a governance role

People who have governance roles in the university system, being temporally bound to the electoral and appointment mandate, are those who are destined to a more frequent turnover and, therefore, need more attention in the formation of competences, right from the beginning of their mandate. The higher the office held, the more complex are the skills required. It is therefore considered that competences are required first at the international level, then at the national level, at the local level of individual institutions and finally at the level of individual teaching and research units.

Table 2. Competences for governance, using Bloom's taxonomy.

rem.	Knowledge of the founding elements of a governance system in terms of strategic planning (down to the level of the individual institution), i.e. the basic vocabulary that must be learnt and known by those who must correctly use concepts such as 'objective', 'strategy', 'mission', 'vision of quality'
apply	Capacity for team building and open discussion between different positions and roles (at all levels), including the ability to gather ideas on strategic planning and practices and to communicate the outcomes to all
	Ability to correctly attribute to the individuals operating in the QA system activities and functions appropriate to their role and to the competence profile of each (down to the level of the individual institution)
	Ability to give proper weight in one's work to quality management (at all levels)
	Ability to simplify the evaluation system and reduce the different levels of evaluation (down to the level of the individual institution), within the limits of the possibilities resulting from regulatory approaches that translate into an overly defined evaluation system, and the different actors and levels operating within it
	Ability to find strategies to increase the competences of people working in QA (down to the level of the individual institution)
	Ability to relate to external parties and listen to their expectations (at all levels)
evaluat.	Ability to discern daily in one's actions, so as to adopt choices always consistent with the role assigned, i.e. choosing the interest of the institution over the interest of oneself or of a few (at all levels)
	Ability to choose the appropriate tools to achieve quality objectives and try to achieve them (at all levels)
create	Ability to define the strategic planning of its structure (at all levels)
	Ability to have a vision of quality and to apply the necessary actions to achieve it (down to the level of the individual institution); in fact, while the strategy of action can be defined for each individual organisational unit, the vision of quality must be defined by an individual organisation, if not by a national and international policy

5.3. Competences for those with a self-assessment role

Those who increasingly play a central role in internal and external quality assurance are those who carry out the actual evaluation activities. If carried out externally, they usually have a national and

international impact on their activities. On the other hand, if carried out internally, they mostly take on the function of self-evaluation, since they are performed by the same individuals who work in that particular institution or in that particular teaching and research structure'. There are soft skills referring to internal auditors' that consist of the ability to have harmonious face-to-face interaction with clients and other stakeholders, but also other soft skills that do not directly concern face-to-face such as critical thinking, analytical skills and written communication. (Coetzee & du Plessis, 2021) The competences required to adequately fulfil the role of self-evaluation are manifold and mainly concern all the different levels of action (from the highest international level down to the level of the individual teaching or research unit), while in some cases they refer to the international, national and individual institution level.

Table 3. Competences for evaluator, using Bloom's taxonomy.

remember	Knowledge of the available information system and the available data and indicators (at all levels), especially if the evaluation is quantitative
	Knowledge of different evaluation methodologies (at all levels), in fact according to different situations, contexts and evaluation objectives, the methodologies that can be used may be different
apply	Capacity for team building and open confrontation between different positions and roles (at all levels)
	Ability to be involved in the evaluation or self-assessment of different work areas and organisational grades (down to individual institution level)
	Ability to select suitable data and indicators to assess the level of quality achievement of the evaluation object (at all levels)
	Ability to inform and train those involved in evaluation or self-evaluation on the evaluation system or on specific issues which are dealt with from time to time (down to the level of the individual institution)
analysis	Ability to carry out the evaluation having in mind that the purpose of the evaluation is the improvement of the evaluated subject/object (at all levels)
	Ability to adopt evaluation and self-assessment procedures effectively and efficiently, reducing formalities (down to the level of the individual institution)
	Ability to define and manage evaluation and self-assessment processes in a way that is easily applied by all practitioners (at all levels)
evaluation	Ability to make evident evaluation outcomes that are relevant and useful to external stakeholders (at all levels)
	Ability to discern one's own actions while remaining consistent with the assigned role (at all levels)
	Ability to introduce new evaluation practices while maintaining the link with the pre-existing ones that are still in place (at all levels), to understand the evolution of methods and practices and to give continuity to the results so that they maintain a degree of comparability
create	Ability to make value judgements that enable the recipient to understand that value, and find useful points for improvement (at all levels)
	Ability to design an evaluation and self-evaluation system, within a broader QA system, adapted to the complexity of the university system and easily applicable in all university contexts while preserving the specific peculiarities of each entity (at a national and international level)
	Ability to provide outside the organisation with a clear and relevant message about the benefits of work with a view to improving quality and the resulting social impact (at all levels)

It is evident that a large proportion of the competences mentioned are directly linked to the personal dispositions of the evaluator, which in turn are influenced by the values and beliefs of their own organisation. A competent evaluator must be able to manage his or her personal dispositions in a way that allows professional values and beliefs to guide his or her practice (Davies, 2021).

6. Conclusions

The diverse framework of competencies presented in this research, if disseminated and applied across all the different organisational levels and roles, should allow for the effective development of QA systems that enable work towards real continuous improvement in the university system. This entails activating appropriate training initiatives that are promoted at all the various levels, starting from the less complex cognitive and applicative knowledge mentioned above. Training modules aimed at teaching and technical-administrative staff should be provided periodically, with a view to lifelong learning, and attendance must be incentivized, by means of formulas for recognizing professionalizing credits, rewards or recognition for career advancement purposes. These incentives are all the more important for all those who do not have governance or evaluation roles within the organisation and who, therefore, do not see a direct return for such training initiatives in their work. The introduction of systematic QA experiences is capable of changing the attitudes of faculty members over time (Yonezawa, 2002). Similarly, those with governance and evaluation roles at national and local level should also be able to follow training modules, perhaps at the national level provided by inter-university consortia or national evaluation agencies, in order to consolidate cognitive and application skills. The elective nature of the appointments to governance roles cannot mandate the fulfilment of a training obligation. This could instead concern those who are in charge of evaluation, especially external evaluation, at least at a national and international level. Often professional registers of evaluators exist in different countries, whose membership is tied to previous experience in the professional field, but it would also be important that the continued membership of such registers be tied to the acquisition of a minimum number of hours of training, provided by an extensive and varied training plan. Such training could also be included in certain educational pathways for first and second level students, as is already the case in America (LaVelle, 2020), as it would already provide skills required in possible job profiles in the management of quality systems in various fields (McShane et al., 2015).

It is more difficult to envisage 'traditional' training for competences involving cognitive skills of a higher complexity, as it would be more appropriate to set up experimental laboratories to test these competences with adequate methodologies. This should comprise University Centres dealing specifically with Faculty Development. on-the-job training pairing "junior evaluators "with "senior evaluators" is

another way of transmitting these skills. Through field experience and individual training, seniors can transmit the values and the knowledge required to perform their evaluation work to the best of their ability, developing an evaluation thinking that is linked not only to the process, but also to the mindset with which one acts (Volkov, 2011).

A further development of the research could be a comparison of the competence framework outlined in this research, matching the profile of individuals holding evaluation roles at national level with the current requirements for access to the registers of evaluators, with the aim of understanding which competences are not required at an entry level, but which are necessary for the performance of this work and should therefore be acquired to reduce the gap between competences required and possessed (Dewey et al., 2008). The measurement of the degree of achievement of the competences described so far using different levels of evaluation (Kirkpatrick, 1994) would require further developments.

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FACILIS DESCENSUS AVERNO*
OR
INTERACTIONS OF DOCTORAL RESEARCH PROJECTS
WITH UNIVERSITY'S OTHER PROJECTS

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Abstract

This piece of work is focused on higher education research, in particular PhD research projects in a large university, aiming to analyze the effects of interactions between doctoral research projects and other organizational (university's) projects. Assuming that objectives of doctoral research projects are aligned to the organization (university's) strategic objectives, there were a few research questions, specific to this pilot, explorative study: How could the effects of interactions be measured? Are the effects of interactions always positive? If the effects of interactions are negative, then which might be the reasons behind them? Ultimately, are there any solutions to avoid the negatives or, at least, to mitigate them? As methodology, the study includes both secondary research (literature survey) and primary research. Since the literature on this topic is rather scarce, this study relies mainly on primary research methods: directly observed and personally experienced doctoral projects in a Romanian university environment under scrutiny, completed with semi-structured interviews with doctoral students. Besides the approach of this narrow research area and associated methodology, this piece of work reveals novel types of inter-project conflicts within higher education institutions. The results are not definitive; however, they allow the formulation of several concrete, core-recommendations centred on better coordination between PhD research projects and other projects run by the university, mainly at the strategic level. The findings are *critically important to doctoral schools and PhD supervisors in particular* as well as to major stakeholders: higher education leaders and strategists, policy and decision makers, administrators and research managers.

Keywords: *PhD project interactions, doctoral research projects, higher education and research, organization versus project, organization management versus project management.*

1. Introduction

Universities experience “chronic disruption and crises” (Ling and Livingston, 2024) as effect of the tense international relationships between the global powers because of their efforts for supremacy as well as associated complex processes. The international trade is influenced accordingly, softly turning from the free trade-based globalization to protectionism (WB, 2023), which is visible in the acts issued by both the US and Chinese governments (Weightman, 2018) as well as other large economies as European Union, Canada, Australia (Barr, 2023). In addition to successive sanction packages against Russia, the US-China trade war is producing global effects (Fajgelbaum et al., 2023) not only in international trade flows and commercial supply chains (Bobek et al., 2023) but also in research and development (R&D) investments and resource allocation across industries. Amid rapid technology advance and increasing R&D investment, the invested amounts are not uniformly distributed (neither by industries nor by countries). Thus, some industries and research areas (e.g., IT, genetics, materials, etc.) enjoy larger shares of the R&D invested amounts. A proper illustration is the defence industry: in five years (2019–2023) the budget of the US Department of Defence for improving ‘energetics’ (i.e. explosives, propellants and pyrotechnics) increased from \$20m to “more than \$250m” (Economist, 2024a, p.68). The larger and more developed countries are spending more. However, even among them, the R&D investments are uneven.

* *Facilis descensus Averno* (Latin): *The path to ‘underworld’ is easy* (Virgil, Aeneis, Book VI, line 126, 29–19 BC).

In general, the dynamic of scientific publications follows the general trend of technology development and associated R&D investment. *The Economist* (2024b, p. 62) shows that higher-education institutions across the world employ 15 million researchers that “produce five times the number of papers each year. [...] In theory, therefore, universities should be an excellent source of productivity growth. In practice, however, the great expansion of higher education has coincided with a productivity slowdown.” Arora et al. (2023, p. 38) argue that “sluggish growth in productivity over the last three decades or more in the face of sustained growth in scientific output” happened because abstract ideas (i.e., generated by PhD research in universities) are difficult to use. Then the firms “appear to lack the absorptive capacity to use externally supplied ideas unless they are embodied in human capital and inventions” (*Ibidem*, p. 39).

However, amid the general trend that features booming volume of publications, (Economist, 2023) highlights that *publications related to significant scientific advances are not progressing at similar pace; moreover, their proportion is going down*. Even more alarmingly, Park, Leahey and Funk (2023, p. 138) declare: “slowing rates of disruption may reflect a fundamental shift in the nature of science and technology.” *This state of facts and affaires invites to careful examination*.

Getting different results than thought and planned is an old story (mostly in R&D process). The old Latin dictum *facilis descensus Averno* (attributed to the Roman poet Publius Vergilius Maro), which has circulated in the Christian era as *the road to hell is paved with good intentions*, has the same meaning in English (Collis and Risso, 1992; Kalman, 2010) as well as in many other languages (Ray, 1670; 1768; Mawr, 1885; Scarlat, 2019). Its profound meaning (in terms of how the wonder-plans may turn into not-so-wonderful reality) is explained by scholars (Powers, Koestner and Topciu, 2005; Gollwitzer and Sheeran, 2006) using the modern instruments of social psychology. Scarlat (2019, pp. 179-202) also provided evidences of proverbs that illustrate such behaviours along project life cycle or abstract principles of project management (Scarlat, 2022).

This study looks at a less explored, narrow research environment, at a micro-level: *PhD research projects conducted in a doctoral school from a relatively large science and technology university*. More specifically, this paper opens a window for discussions on the influence that other university projects (all aligned to the university R&D strategy, theoretically) may have on the doctoral research projects.

2. Methodology: scope of work, research circumstances, objectives and method

For the purpose of this study, the (PhD project) interaction is defined as active involvement of the PhD student in another project of the university, for a limited period during their doctoral studies (in this study, interactions were from 1 to 15 months). The effects of interactions are scrutinized from the doctoral projects’ standpoint; yet from both doctoral supervisors’ and PhD students’ (researchers’) perspectives (Lee and Bongaardt, 2021). The effects are: positive if they facilitate the doctoral project progress; negative in the opposite case; or neutral if no effect is reported.

Assuming that objectives of all university projects (and, implicitly, objectives of doctoral research projects) are aligned to the university strategy (and its strategic objectives), the specific research questions in this pilot explorative study are essentially qualitative: (i) How could the effects of interactions be measured? (ii) Are all the effects of interactions always positive? (iii) If there are negative effects of interactions, then which are the reasons behind them? (iv) Are there any solutions to avoid the negatives or, at least, to mitigate them? Hence, the main objectives of this study.

The study includes both primary and secondary research (literature survey), which is rather scarce (Ling and Livingston, 2024). Thus this study relies on primary research methods mainly: directly observed and personally experienced doctoral projects in a Romanian university environment, completed with semi-structured interviews with doctoral students. An interview map (guide) was developed for this purpose. The collected data are processed, then results are discussed, and implications are highlighted.

3. A pilot study on PhD research projects

During the period under scrutiny (18 months: 1 October 2022–31 March 2024), 15 doctoral students (enrolled to pursue a PhD degree in engineering sciences) were engaged in different phases of their PhD projects. From this pool, 7 doctoral students were identified as subjects of interactions (as defined in this study), and their projects were anonymized: PhD1–to–PhD7. The PhD projects interacted with four other research projects of their University as follows: one international-level project (marked I), two national-level projects (marked N1 and N2), and a single university-level project (U).

By duration, there are two categories of interactions: short-term (one month) and longer-term interactions (over one year, 12/15 months). *Table 1* depicts these interactions, by project types, including durations of the corresponding interactions.

Table 1. Seven cases of interactions between PhD projects and other university projects, and respective durations.

PhD Projects	Planned duration [from-to/extended]	Estimated durations of interaction with other university projects			
		I	N1	N2	U
PhD1	01.10.18–30.09.21/extended '23		12 months		
PhD2	01.10.19–30.09.22/extended '24	15 months			
PhD3	01.10.20–30.09.23/extended '24	1 month			
PhD4	01.10.20–30.09.23		12 months		
PhD5	01.10.21–30.09.24	1 month			
PhD6	01.10.22–30.09.25			15 months	
PhD7	01.10.22–30.09.25				1 month

In general, one-month interactions were international exchange visits and study tours, excepting U project, which was organization and participation at a local promotion event (research fair). Longer-term (12 months) interactions meant participation in many routine project activities as meetings and events as well as workshops and training sessions (e.g., developing entrepreneurship and pedagogical skills). N2 interaction involved secondary research (literature survey) and production of research reports, which are fairly related and may be useful to the doctoral project.

Qualitative by nature, this study is balanced in that respect of measuring the effect of each interaction: from both perspectives: PhD student and PhD supervisor.

From *PhD candidate's standpoint*, the assessment is descriptive and qualitative (answers to open questions during interviews), and expectedly favourable – viewed through the lens of personal career development (for most of them it is a novel experience). However, in order to have an overall quantitative measure of satisfaction as a result of interaction, the doctoral students also provided an overall score, subjectively, as a quantitative measure of their level of satisfaction on a scale going from positive to negative feelings (3=highly positive, 2, 1; 0=neutral; -1, -2, -3=highly negative).

From *PhD supervisor's perspective*, the effects are primary quantitative, in terms of the doctoral project deliverables: deadlines research progress reports and scientific production (i.e. conference proceedings, journal articles, etc.) against the research plan of each PhD student. The results (Table 2) answer to the **first research question (i)**.

The examination of Table 2 also provides the short answer to the second **research question (ii)**: no, the effects of the interactions are not overall positive. A more detailed answer is even divisive. PhD students' assessment is definitely positive (despite having a negative scale available) although gradual (1-to-3). Oppositely, the PhD supervisor assessed the interactions' negative effects: hard delays (overdue deadline for thesis defense), which required extension procedures (in three cases), as well as failures in scientific production and dissemination of the research results (five cases, with different intensities, measured in number of papers that missed the submission deadlines, or failed completely).

Notably, *delay in research dissemination is direct result of delays in the research process itself*.

Table 2. Effects of interactions between PhD projects and other university projects.

PhD Project	University project	PhD student perspective [score]	PhD supervisor perspective	
			PhD thesis defence	Scientific production & dissemination
PhD1	N1	fairly positive [1]	1 year overdue	Publication of 2 papers delayed (3, 6 months)
PhD2	I	highly positive [3]	1 yr. 6 mo's overdue	-
PhD3	I	highly positive [3]	6 months overdue	Publication of 1 paper failed
PhD4	N1	fairly positive [1]	-	Publication of 2 papers failed
PhD5	I	positive [2]	-	-
PhD6	N2	positive [2]	-	Publication of 2 papers delayed (9, 12 months)
PhD7	U	fairly positive [1]	-	Publication of 1 paper delayed (6 months)

4. Results discussion

To answer to the third **research question (iii)**, and identify the reasons behind the negative effects of the interactions, a case-by-case discussion is required in this respect. Overall, the result of shared opinions is not surprising, as standpoints are different (individual versus PhD project), assessment frameworks are different and so the assessment criteria, objectives, and metrics are. While PhD students assess the effect of (other) university projects on them (as individuals), the PhD supervisor (under the pressure of observing the milestones) perceives negative effects on the PhD project (in quantitative terms of project management: missed and overdue deadlines and objectives).

Besides different interaction durations and circumstances, interactions have different natures and peculiarities. In addition, besides influence of ‘other projects’ there were other reasons behind the negative effects, which might become significant in each PhD project (topic, student’s interest, experience, family and work environment, etc.).

As opposed to PhD5 that was assessed positively with no negative effects (*Table 2*, marked in blue), the results of PhD2 and PhD3 (both marked in orange)–yet all referring to interactions with ‘project I’–deserve special attention because they display the extreme split between PhD students’ highest score for assessing the project experience (+3) and devastating effect on their PhD work (in terms of both research dissemination and overdue PhD thesis public defence). Hence the inference that *negatives in the doctoral process have nothing to do with the quality of university projects* (evidenced by the positive scores) but the *resources (mostly time) dedicated to university projects were “stolen” from the already planned resources allocated to PhD projects*. Interviewees’ comments converged to same conclusion.

The results are not definitive, but have allowed the formulation of several concrete, core-recommendations *centred on better coordination between PhD research projects and university projects, mainly at the management level*, in order to avoid or mitigate the negative effects (**research question iv**):

- Themes of PhD research projects were already set when doctoral students are invited to join [other] University projects, in many cases just to complete the number of participants (target group). Then: invitation should be selective (restricted to projects with aligned objectives, only).
- This invitation should be made *via* Doctoral School/s; and participation of the PhD student/s in [other] University project/s should have the formal agreement of their PhD supervisor/s.
- Before agreeing, PhD supervisor/s should be informed in advance about the activities their PhD student/s have to complete during respective interaction period.
- A formal communication channel and clear communication protocols between the University’s project manager and PhD supervisor should exist for the duration of interactions, at least.
- PhD supervisor should be informed in a timely manner about activities completed by the PhD student (while the University project advances). *None of these happened in the cases discussed.*

Assumption: basic principles of management in higher education (research included) were respected:

- Objectives of research projects are aligned with University’s strategy and strategic objectives.
- Research objectives of the University are in agreement with the needs of industry.
- A proper constitution of the University is in place, in order to regulate the relationships organization-projects and detect possible conflicts between them in their early stages.

The number of cases analysed is a limitation; yet the findings open further research paths for longitudinal and mainly transversal studies – extending the investigation to other domains of doctoral research – other than *engineering sciences (management and industrial engineering*, in particular) as well as to other universities. In-depth studies, by types of interactions, are also possible.

Possible correlations between interaction durations and their negative effects (as overdue deadlines for doctoral thesis defence and/or dissemination papers) might be topics for further studies.

Notably, the negatives reported are particular instances, among many successful stories (in which interactions with [other] University projects stimulated the progress of doctoral research projects).

5. Conclusions

Besides the approach of this narrow research area and associated methodology, this piece of work reveals novel types of inter-project tensions and conflicts within higher education institutions. The research questions were addressed, and all answers provided, thus research objectives were matched. However, new questions arise, and paper limitations point to further research directions.

The findings (typology and measurement of PhD project interactions; reasons behind the negative effects of interactions–among them) are *critically useful to doctoral schools and PhD supervisors in particular* as well as to major stakeholders: higher education strategists, policy and decision makers, administrators and research managers. The set of recommendations goes to them.

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POSTERS



IMPACTS OF ARTS-BASED ECOPEDAGOGY IN SUSTAINABLE RESIDENTIAL FOOD WASTE MANAGEMENT

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Abstract

How can arts-based ecopedagogy impact sustainability in organic waste management? In Winnipeg, Canada (population 841,000), there is no publicly-funded program for the 34 million kilograms of Residential Food Waste produced annually, nor is there an industrious environmental education program to support it. The consequence of inaction is the increase of greenhouse gas emissions from untreated waste, further threatening global warming, especially an issue for the disadvantaged urban population, and those in multi-family dwellings such as condominiums/apartments. This paper outlines a research proposal set to commence in 2024/2025. A suitable framework model chosen for this critical environmental exploration was ecopedagogy, a transformative teaching in which researchers' problem-pose the politics of socio-environmental connections through local, global, and planetary lenses. Arts-Based and Participatory Action Research will follow ecopedagogy as an innovative and mutually supportive multidisciplinary and methodological approach to knowledge-building with the creative arts at its core; useful not just for inquiry and learning, but also to challenge dominant ideas, hegemony, oppression, and ideologies through a critical lens. A practical guide and example for the effective methods of Participatory Video under the framework of ecopedagogy will be displayed to enable research participants as active co-researchers. All humans have a right to live in a clean, healthy and sustainable environment, based on the resolution that was unanimously signed by the United Nations General Assembly, 28 July 2022. Is this creative approach of arts-based ecopedagogy right for you?

Keywords: *Arts-based research, ecopedagogy, participatory action research, sustainability, critical pedagogy.*

1. Introduction / research background

This paper is a proposed research study to examine the management of residential food waste as a component of climate change, a real and undeniable threat to our entire civilization. "Municipal solid waste landfills are responsible for almost one-quarter of Canada's methane emissions, which are generated when biodegradable waste decomposes. Cutting methane emissions from all sources, including landfills, is one of the fastest and most cost-effective ways to combat climate change" (Government of Canada, 2023). Anxiety about climate change, unsustainable migration, inequality, food scarcity, and reinforced poverty forced the United Nations (UN) to convene with world leaders to address the concerns of the planet and its people. The UN officially adopted the 2030 Sustainable Development Goals (SDG) in 2016 after 193 nations agreed that changes needed to occur to save the planet, consisting of 17 goals to achieve a greener, fairer, better world (United Nations, 2023). Unfortunately, the 2023 disappointing midpoint report from the Secretary-General of the UN yielded the following blunt statement: "unless we act now, the 2030 Agenda will become an epitaph for a world that might have been" (United Nations, 2023). What is needed in this study is an exploration of how people perceive the truth of the waste management situation, and to influence education and policy for a proposed city solution that is inclusive of all its citizens. This qualitative study will explore: How can arts-based ecopedagogy impact sustainability in residential food waste management? My objectives are: (a) monitor residential food waste collection through participatory action research in support of city and non-profit organizations; (b) evaluate arts-based research for developing environmental education for city and non-profit organizations; and (c) influence local public policy decisions regarding residential food waste management.

2. Theoretical approach / framework

The need for a critical pedagogy for the environment originated formally in the early 1990s, inspired by global concerns about the earth, evolving to a movement that was inspired by the revolutionary work of critical educator and philosopher Paulo Freire, in particular his influential 1968 work *Pedagogy of the Oppressed*, where he promoted the concept of a need for dialogue and consciousness in education for the marginalized (Freire & Macedo, 2018; Misiaszek, 2020). Earlier models of Environmental Education and Education for Sustainable Development focused successfully on the topic separation of humans and the environment but lacked the critical social analysis of the combined impacts, resulting in ecopedagogy's enhanced goals of "minimizing environmentally adverse outcomes, minimizing social injustices, and being within Earth's resource limits" (Misiaszek, 2020, p. 621). The framework of arts-based ecopedagogy is a new angle to promote critical inquiry with the people it affects, through the creative aspects of the arts, to influence key environmental and educational strategies. The addition of arts-based and eco in arts-based ecopedagogy translates to adding two additional layers to Freire's theoretical framework of critical pedagogy where the arts are used as an inquiry tool to complement the intersectional analysis of the research in the environmental (ecological) context (Leavy, 2018; Freire & Macedo, 2018).

3. Methodology

This study will blend the synergies of participatory action and arts-based research methodologies. Participatory action research builds knowledge together in social change action with participants as co-researchers, critically planning and implementing results of the research project (McIntyre, 2008). Leavy promotes arts-based research as a multidisciplinary and methodological approach to knowledge-building with the creative arts at its core; useful not just for inquiry and learning, but also to challenge dominant ideas, hegemony, oppression, and ideologies through a critical lens (2018). These approaches are well suited techniques to include, through arts-inquiry, the participants as active co-researchers within the social problems with which they are embedded. Arts-based research is about tackling issues to create new knowledge by arts-based inquiry, whereas participatory action research is designed to empower individuals and the collective (de Oliveira Jayme et al., 2016).

4. Methods, data collection and key activities

The goal of this study is to explore how arts-based ecopedagogy might impact sustainability in residential food waste management, educating leaders based on critical collective feedback from the analysis of knowledge created using arts-based techniques with research participants. Some participants will be the influencers, and some will provide vital feedback to those who can effect change. The chosen method is Participative Video (which will be explained below), but other artifacts may accompany film should the participant or the situation dictate.

Phase 1 – Preparation. Confirm participants, research objectives and plan. Participant selection will occur in 2024/2025 across the city of Winnipeg, Canada, to include representation from the solid waste community: policymakers, project managers, collectors, educators, businesses, allies, funders, and citizen groups. Participant selection of approximately 20 people will be based on the guidance of the city's provincial Manitoba Association of Regional Recyclers, a member driven association that helps ensure efficient and effective waste reduction programs. As is common with participatory action research, phase 1 will include a presentation of the research proposal, with opportunities for participants as *co-researchers* to ask questions, clarify goals, and even made requests for amendments to the previously stated objectives.

Phase 2 - Pre-production film workshops and filming. The action element in this study will be a collaborative set of hands-on film workshops, participant filming, data analysis, editing, and the production of film(s). Collection of data will focus primarily on the use of participative video, a form of video data collection using techniques to empower participants to become active in the research, and film within the problem state from their perspective as a co-researcher. Participants will be invited to six-hour workshop training sessions in pre-production (storyboarding, camera operation, storage, framing, etc.), and six-hour post-production sessions (footage selection, film editing, music, voice-over, etc.) at a professional studio in the city.

Phase 3 - Data collation and analysis. Data collected will consist of participants critically filming their residential food waste experiences with personal phone cameras during a four-month period. This information will then be coded using MAXQDA, a software tool for transcription, building a coding frame, visualization, analysis of videos, concept mapping, and group comparisons (Kuckartz, 2019).

Coded data will then be reviewed by the participants as a focus group. Data examination will critically focus on the video footage to include (as a minimum): the exploration (not proof) of biases based on individual perceptions of food waste collection; the study of food waste impacts to inclusive environmental education contributions; and the investigation of exclusion in food waste management policy. These dialogues will discover if the research problem statement has been achieved.

Phase 4 - Edit film(s) and present art to propose change. This project will be completed with a full-length documentary film under the supervision of a professional producer. The film will be screened across multiple audiences within Winnipeg and streamed publicly. This will be one of the possibilities, as it is expected that both other forms of art will appear, and filmed experiences of art creation might lead to a community or private art show/demonstration to educate and influence policy. The goal of answering the influential questions/objectives is more important than the art media or form. Participants will be enabled and empowered to make their own decisions based on the unique nature of their engagement with food waste management, and what perspectives they feel are most important to be communicated in creative ways.

5. Conclusion

This proposal provides a clear implication of practical application of blending the theoretical framework of ecopedagogy with the methodologies of both participatory and arts-based research. The nature of ecopedagogy also allows a critical perspective of both the environmental education component of problem exploration, as well as the intersectionality of how these types of problems might be viewed through a lens of the UNSDGs with the objectives of racial justice, equity, and diversity implications. My objectives are: (a) monitor residential food waste collection through participatory action research in support of city and non-profit organizations; (b) evaluate arts-based research for developing environmental education for city and non-profit organizations; and (c) influence local public policy decisions regarding residential food waste management. Research will commence in 2024/2025.

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AN INNOVATIVE MODEL FOR HIGHER EDUCATION

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Abstract

As the landscape of education evolves in the 21st century, there is a pressing need for innovative models that can adapt to the dynamic demands of a rapidly changing world. This abstract introduces a model for higher education, designed to foster an enriched learning experience within university settings. The model combines interdisciplinary real-world elements with critical thinking and problem-solving skills. Furthermore, the model advocates for a flexible curriculum that adapts to the evolving needs of industries and society. By forging partnerships with industry leaders, the university can offer students opportunities for experiential learning, internships, and research projects that bridge the gap between academia and the professional world. The aim of the presented model was to suggest to the faculty a methodology for selecting courses so that the study programme contains subjects that will improve the graduate's position on the labour market. Preliminary assessments of the model on selected faculty (Faculty of Chemical and Food technology in Bratislava) reveal positive outcomes, including increased student engagement, improved academic performance, and enhanced readiness for the workforce. The innovative model for higher education presented in this abstract serve as a blueprint for universities seeking to innovate their educational approaches, ensuring graduates are equipped with the skills and knowledge needed to thrive in an ever-changing global landscape.

Keywords: *Education, innovation, study program, model for education, critical thinking.*

1. Introduction

Developing innovative models for higher education is essential for addressing the needs of the national economy and guaranteeing the prosperity and competitiveness of higher education institutions (Jakovljevic, 2018). For the establishment of a superior lifelong learning system, it is imperative to integrate higher education, science, and business (Andreev, 2023). The implementation and administration of novel educational methodologies are crucial in enhancing the standard of education and the competitiveness of higher education establishments (Kuchynska et al., 2022). Major catalysts for innovation in higher education institutions include knowledge management, technological advancements, competitive advantage, and globalization (Mazorodze & Mkhize, 2022). The literature examines institutional innovation and several innovation models in higher education, highlighting the significance of fostering an inventive environment that advances the field of higher education and science (Romanovskyi et al., 2020). The text emphasizes the importance of socio-philosophical analysis, research paradigms of innovation development, and the mechanism of innovative climate construction in fostering the inventive development of higher educational institutions (Klimova, 2019).

Moreover, higher education systems, such as universities and public research laboratories, have a significant impact on interactive innovation processes. They both influence and are influenced by technological innovation and the innovative activities of companies (Lanciano-Morandat et al., 2006). Innovative concepts, especially in the context of globalization and internationalization of higher education, have impacted the organizational, content, and technical components of the educational process in higher education institutions (Kalimullin, 2017). The adoption of an interdisciplinary approach is acknowledged as offering novel prospects for organizing and enhancing efficacy in the realm of engineering education against the backdrop of digital change (Миронова, 2022).

Ultimately, the literature underscores the importance of establishing suitable business models and frameworks to foster innovation in higher education institutions. This involves integrating higher education, science, and business, as well as effectively implementing and overseeing innovative educational practices. Furthermore, this text emphasizes the factors that drive innovation in higher education, the involvement of higher education systems in interactive innovation processes, and the significance of creating an inventive environment that will advance the field of higher education and science.

2. Results

Figure 1 illustrates the general model of education. The model was developed according to the PDCA Deming cycle. The process has a series of 8 sequential steps. An initial phase involves doing an assessment of the current condition of higher education. This step examines the existing data on higher education institutions, specifically focusing on the patterns in the quantity and composition of graduates, financial support, legislative and legal prerequisites for study programs and subjects taught, and the quantity, composition, and ranking of higher education institutions in the area.

The second step is labor market analysis. The requirements of practical experience should serve as the fundamental cornerstone upon which study programs are built. The primary objective of higher education institutions is to provide graduates with the necessary skills and knowledge to succeed in the job market. Therefore, it is essential for individual topics to consider the specific requirements of employers. This task can be achieved by market analysis, employer surveys, or research undertaken by specialist institutions that specifically concentrate on the labor market or employment supply.

Next, it is necessary to examine the specifications of the National Qualifications System (NQS) and the National System of Occupations (NSO). These registers, which are accessible to the public, serve the purpose of delineating the knowledge, skills, and competency prerequisites necessary for carrying out particular occupations. They consider not just technical talents but also interpersonal skills. Through the analysis of these registries, we can have a comprehensive understanding of both present and future demands.

The fourth step centers on acquiring information regarding students' knowledge, requirements, and challenges. This model presupposes the participation of students in intermediate years, senior years, and postgraduates. Based on this analysis, we have a perspective from the students' point of view.

After acquiring information from previous steps, a direct comparison is made with the subjects that are actually taught. Through an examination of the courses and their syllabuses, we can gain insight into how well the requirements from the previous steps are met. We analyze vulnerabilities and capabilities, provide prospects for enhancement, and pinpoint areas of deficiency. Within this section, we analyze the outcomes derived from consultations conducted with teachers and course supervisors.

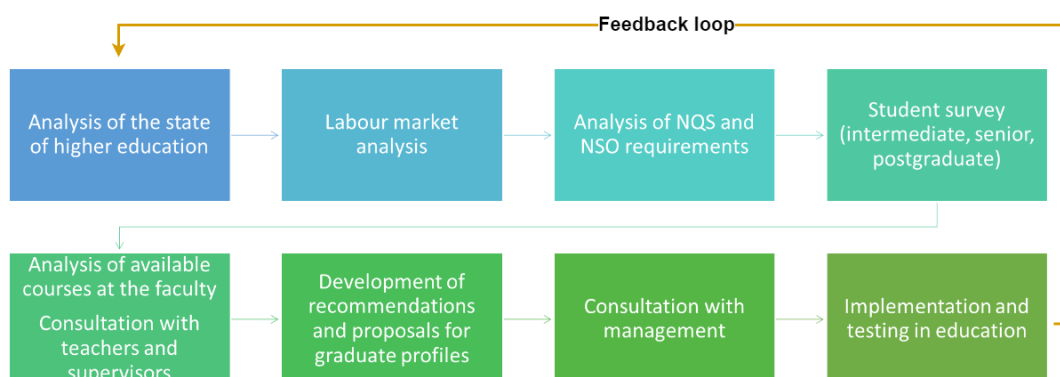
The sixth stage is formulating recommendations and developing a graduate profile. Based on the preceding assessments, we may develop a profile of graduate that integrates the demands of professional practice, national registries, students, and the existing capacities of the educational institution. Simultaneously, during this stage, criteria for incorporating or enhancing courses are established to ensure the comprehensive development of the graduate's profile by addressing any areas that may be lacking. The guidelines have already been revised to include feedback from teachers and course supervisors.

The second-to-last step involves presenting the graduate profile that has been developed to the faculty management and the relevant staff of the educational institution. Obtaining the endorsement and consent of the management is an essential prerequisite for implementing the required modifications and adaptations.

The final stage involves incorporating the outcomes into the educational process. Depending on the magnitude of the required alterations, this phase can either be a singular step or be subdivided over multiple intervals.

Once implemented in the teaching process, a feedback loop is established to verify that the introduced modifications and the updated curriculum align with the specified criteria. Periodically, the initial 4 stages undergo re-evaluation and, if needed, the graduate profile, courses, and curriculum are revised.

Figure 1. The general model of education.



3. Conclusion

The proposed innovative education model offers a comprehensive strategy for institutions to update their curricula in order to align with the current demands of the job market, students, and legal regulations. The model is universally applicable across several educational domains and can be easily customized to suit the unique attributes and needs of any educational establishment. The specific details and arrangements of each step must be determined and modified throughout the initial phase of implementation to align with the intended goal.

First and foremost, this model will undergo testing and then be utilized to provide a comprehensive profile of a technical student, incorporating economic factors, for all aspects of the Slovak University of Technology. Consequently, the graduate will acquire soft skills that align with the labor market demands, making them more attractive to potential employers. This will serve as the primary result of the project under which the paper is processed.

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VIBE – VIRTUAL REALITY IN STEM EDUCATION

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Abstract

In the XXI century, information technology and, more recently, the Covid-19 crisis have reshaped our educational system. Distance learning has proven to be an effective, reliable, easily standardized and generally economical form of learning. Internationally recognized e-learning platforms have been widely used in education. However, the use of digital and virtual reality (VR)-based platforms is still not generally accepted, despite offering multiple advantages. The current challenge is not to invent new technologies, but to ensure that educators can develop effective ways to deliver curricula in high-quality VR environments. This immersive and innovative means of visualization, interaction and flexibility means that virtual reality systems are unrivalled in terms of engagement and motivation with education, and also provide a scalable platform and a relatively easy-to-share solution for massive online learning. At a European level, there is a demand for healthcare providers, scientists, qualified engineers and informatic technologies (IT) specialists. Employers are continually seeking a highly qualified workforce and lifelong learning is also essential for the development and progress of our society. This project aims to revolutionize and reshape medical and STEM education. The main objective of the V.I.B.E project is to enhance this digital transformation and develop the digital skills of participants and other stakeholders, using innovative VR-based IT methods and solutions, with the aim of establishing a link between medical and STEM skills.

Keywords: *Virtual Reality, STEM, biomedical skills, digital health, innovation.*

1. Introduction

In the XXI century, the rapid development of informatic technologies (IT) based solutions is reshaping our world, in our social life, work environment and education. The digital transformation has been especially apparent over the last decade and restrictions resulting from the Covid-19 pandemic have significantly accelerated this process. Well-established digital competences to a satisfactory level are very important to broad range of social groups of different ages (Hamilton, McKechnie, Edgerton, & Wilson, 2020). In the field of higher education, e-learning methods can provide an effective, standardized and relatively easy-to-share solution for teachers to share knowledge and provide tools for co-creation and collaboration. Digital education tools are also important for engaging younger generations in higher education, and can serve as a means of communication with citizens and the wider community (Timotheou et al., 2022).

On the other hand, medical and STEM education is essential for the continuous progress of our society through greater innovation, research and science activity, and the development of regional, national and international healthcare systems. The lack of medical professionals and healthcare providers is a national and international phenomenon. STEM skills combined with medical training results in the concept and professional field of “biomedical engineering” that generates solutions for multidisciplinary medical issues. Biomedical engineering represents one of the most rapidly growing branches of industry in the developed world and aims to provide revolutionary and innovative healthcare professionals that operate beyond the bounds of classical treatment. These specialists use their expertise to develop novel technical solutions, for example, using robotics in medicine.

Virtual reality (VR) technology has been found to be a highly effective, reliable and interactive method for a wide range of education. VR technology offers a unique and modular training environment

for both commonplace and specialised situations. It allows participants to gain practical skills in a safe, replicable setting, supporting functional competence to an advanced level (Oyelere et al., 2020).

However, there are several challenges regarding this immersive and innovative e-learning tool, VR based platforms are not readily accessible, potential users do not have the proper knowledge and information about the technology, and in most cases, the stakeholders do not have the necessary digital competencies to successfully implement VR technology in everyday teaching. Preliminary needs analyses show that PhD courses, joint degree programs and part-time education programs have not yet been developed in VR spaces before, despite the large number of students involved in this sector. Distance education methods can be used not only in teaching theory, but can also be useful in developing practical skills in a non-invasive environment. It is also important that in practice-orientated education of medical and STEM science, an innovative, reliable, and accessible tool is needed to enhance interdisciplinary project work, which is especially important in the field of biomedical engineering.

As such, a group of institutions came together to clearly define the needs in terms of digital transformation of the educational system, committing to reshaping online and distance education using innovative technologies and good practice guidelines through the V.I.B.E. project, involving the target groups and wider public. This consortium was formed by the collaboration between 3 renowned Universities – University of Porto (Portugal), University of Pécs (Hungary) and Silesian University of Technology (Poland) – and an Innovation Centre – DEX Innovation Centre (Czechia).

2. Objectives

The goal of the V.I.B.E. project is to develop and strengthen the digital competencies and educational cooperation of the participating organisations, as well as to share the knowledge and good practice guidelines with the wider community. The stakeholders include young people interested in medical and STEM higher education, university students and staff, and citizens who are interested in this field. By implementing the project, we aim to attract and retain students and encourage them towards ongoing, life-long education with practice-oriented tuition.

Building on previous data and experience, our aim is to establish VR based BSc and MSc training, as well as a joint degree program in collaboration with our partners. PhD courses and part-time courses will be organized for lifelong learning, along with sustainability and continuous improvement of the project. Moreover, V.I.B.E. aims to open new horizons in education for part-time learners, upskilling within companies, retraining or group building activities, providing an innovative solution for life-long learning. As a result, we expect an increased level of digital competencies in the participating higher education institutes, a growing number of students interested in applying to the STEM and medical fields, and a communalisation of the usage of VR as an educational tool. We believe that the results of the project will create a new, immersive and inclusive digital environment for all stakeholders.

3. Activities / methods

The first step was a detailed analysis regarding digital competences and preferences. Surveys were created and conducted among students and professionals from the academic field, companies and industrial partners, inspired by the main categories for VR user experience assessment introduced by Tcha-Tokey et al., 2016: presence, engagement, immersion, flow, emotion, skill, judgement, and technology adoption. Next, we developed a benchmarking activity of existing online VR educational contents platforms, using available published data to compare their success in competence-building. The results of the benchmarking and the surveys then led to the creation of a handbook in VR, including an overview about available platforms, use cases related to the medical and STEM field and good practices related to course and curriculum development. Lastly, the project culminated in the conceptualization and creation of contents in VR to be implemented. The main criteria for these contents were the need to be innovative, practice-orientated and adapt to distance education. The effectiveness of the V.I.B.E. project on education was measured by the number of attendees in the online courses, as well the involvement of faculty staff and high school students at virtual and personal events.

4. Outputs / results

Outcome 1 - Results of the benchmarking activities related to VR and digital based e-learning platforms were made available to all stakeholders through a handbook on VR technologies. The handbook is available for free download and showcases several success stories.

Outcome 2 - Three courses in medical and STEM education available via Massive Open Online platform. These courses were titled “Exploring the Mysteries of Life: An Introduction to Cell

Biology”, “The psychology and physiology of Stress” and “Introduction to the use of Virtual and Augmented Reality in STEM Education”. the first course had an average of 150 users in the first month of being available online, with a 87% completion rate.

Outcome 3 - a PhD course in biomedical engineering. Based upon the information collected and learning from the best practices, an entire online VR-based PhD course was created to advance the quality of the education available for future biomedical engineers.

Outcome 4 - A new curriculum for a Biomedical Engineering BSc was developed using the VR platform as a co-creation and collaboration tool. The implementation of this system allowed us to use VR as a tool for project management and project support, meaning that the development and trial of at least three different projects using the platform is possible.

Outcome 5 - A protocol of one hands-on laboratory skill development course in surgical techniques was developed and used in the context of the teaching curricula at the University of Pécs.

Outcome 6 - A simulation online course in 3D visualization and printing techniques was created and piloted with several groups of students from the partner Universities.

5. Discussion and conclusions

The V.I.B.E. project is expected to achieve its objectives by not only developing digital competencies but also fostering educational collaboration. The project's impact is expected to resonate at both regional and international levels, influencing the education landscape in medical and STEM fields.

The initial surveys provided a foundational understanding of the landscape, aligning with established categories for VR user experience assessment. The subsequent benchmarking activity evaluated existing online VR educational platforms, enabling the project team to draw insights and best practices. This data informed the creation of a VR handbook, a valuable resource outlining platform, use cases, and course development practices tailored to the medical and STEM fields.

The diverse outputs, including a handbook on VR technologies, three MOOC courses, a PhD course in biomedical engineering, and a new curriculum co-created through the VR platform, showcase the breadth and depth of the project's impact.

The quantifiable outcomes, such as increased attendance in online courses and active participation in virtual and personal events, indicate the project's effectiveness. The creation of a VR handbook and the development of courses and curricula demonstrate a commitment to providing accessible and practice-oriented learning experiences.

The V.I.B.E. project has not only responded to the immediate needs of higher education institutes, students, and professionals but has also set the stage for ongoing initiatives in lifelong learning. The incorporation of VR as an educational tool has the potential to create an immersive and inclusive digital environment, thereby contributing to the evolution of educational practices in the medical and STEM domains. The project's legacy lies not just in the achieved results but in the transformative potential it brings to the future of education.

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ASSESSING SKILLS TRANSFER FROM COMPUTER GAMING TO ACADEMIC LEARNING: AN EXPERIMENTAL DESIGN

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Abstract

The relationship between computer games and academic learning has been a topic for research and debate over decades. Here, we present an updated, theory-driven experimental design for assessing how specific skills that players train in commercial computer games may transfer and be subsequently applied to study-relevant tasks in a school context. As theoretical starting points, we posit that i) skills transfer from such seemingly disparate domains as gaming and studying can be better understood on the metacognitive level of self-regulation of one's progress towards a goal, and ii) what drives learning in both domains can be understood in terms of their "core mechanics", or means of interaction, towards this goal. Drawing from the evidence-based approaches described by Schwarz et al. (2016), we identified specific core mechanics for learning in the popular esports game *League of Legends (LoL)*. Whilst a multiplicity of learning mechanisms are present in computer gaming, we focus on *deliberate practice* as an overarching concept for the driving interactions for learning that can be empirically investigated. We describe how students' use of these learning mechanics can be assessed empirically by observing how students plan, perform and reflect upon a study task. Our hypothesis is that training these strategies from computer gaming can facilitate their application to studying, by means of skills transfer from one domain to the other. We present a tentative experimental design of how this can be assessed, and hence proper supports be developed, by observing how students engage in self-guided deliberate practice in the game (LoL) and in their academic studies, respectively.

Keywords: *Esport, computer gaming, transfer, learning, schoolification.*

1. Introduction

The aim of this paper is to present, and open up for scrutiny, an experimental design for assessing how skill acquisition when playing commercial computer games may transfer to study-relevant skills in a school context (i.e., academic learning). The practical relevance and theoretical underpinnings for such a project have been elaborated in previous publications of ours, which looked into the increasing "schoolification" of competitive computer gaming known as esports (Sjödén & Jonasson, 2023) and how its integration into formal education can be analyzed within the framework of self-regulated learning (Sjödén & Trotter, in press). Here, we will therefore cover the background in brief, in order to build upon previous findings and focus on the empirical questions on how skills transfer from computer gaming to academic learning can be investigated and evaluated, for a relevant target group. Central to this project is the concept of *deliberate practice*, which we discuss in some detail, as a "core learning mechanic" (Schwartz et al., 2016) for developing specific skills and concepts. As a case in point and empirical material, we consider the highly popular, commercial computer multiplayer game *League of Legends*. We propose that computer gaming, and the systematic, explicit and structured form it takes in esports, might provide excellent learning opportunities for deliberate practice that can be applied also for academic learning.

A particular challenge to be addressed is how to balance experimental rigor with ecological validity, considering that computer gaming typically takes place in an unregulated setting, outside school, while academic learning (especially for young people) largely takes place under regulated conditions in a school and classroom context. We argue that the results of such a project would be highly important for providing clear measures on the possible educational value of esports in school, beyond previous theoretical accounts, and hence for making headway in developing evidenced-based educational practices in this domain.

2. Deliberate practice for developing self-regulatory skills

Deliberate practice is an activity central to theories of self-regulated learning (SRL) and skill acquisition. Ericsson (2006) defined deliberate practice as “activities specifically designed to improve performance” (p. 693), something which requires both effort and focus on the specific skill or concept to be learned. Zimmerman (2000) proposed that during skill development, learners move towards the ability to being able to systematically adjust strategies and adapt to task demands. There is evidence of more predominant use of SRL strategies among higher performers in both academic contexts (Zimmerman and Martinez-Pons, 1986), and in esports (Trotter et al., 2023; 2021). Together, this evidence suggests that it is important for performers to have a deliberate approach to their training or practice and be able to adapt their behaviours through effective self-regulatory skills. In contrast, “autonomous practice”, refers to the repetitive performance of a skill or task without focused attention or deliberate effort to improve specific aspects, typically after a certain level of proficiency has been achieved, and may not lead to significant improvement on its own.

As to professional computer gaming, esports players have generally low levels of self-regulatory skills (Trotter et al., 2023) and tend to spend between 5,5 and 10 hours each day practicing (DiFrancisco-Donoghue et al., 2019). No research has directly determined if these hours are spent on deliberate or autonomous practice. However, a recent case study has shown that deliberate practice is anecdotally effective for improving communication within *League of Legends* teams (Bubna et al., in press). Since esports high school programs have been suggested as an effective method for recruiting young people who are not traditionally sporting interested (Polman et al., 2018; Tjønndal and Skauge, 2021; Trotter et al., 2022), esports may be an avenue to encourage development of both self-regulatory strategies and an understanding of how deliberate practice can be used to improve developmental outcomes in academia.

For the present purposes of developing effective deliberate practices that can transfer from the gaming domain to the academic domain, one goal is to maximize its supporting conditions while countering its risks. For example, it seems clear that success in both domains depends on proper goal setting, responsiveness to feedback, sustained efforts and motivation. Setting goals and interpreting feedback are subskills that are particularly supported by the help of experts, such as a teacher or a more competent peer. Sustaining efforts and motivation are probably better supported from a time perspective of “less is more”, that is, shorter periods of more focused practice is better than longer periods of stretched out practice.

Risks associated with successful deliberate practice might be that the learner needs to step out of their comfort zone (that is, doing something less enjoyable) and that they become so specialized in the task they have practiced, that they lose flexibility (Schwartz et al., 2016). Computer games may serve well to counteract such risks, since they are designed to be intrinsically motivating, whereas the effects on flexibility for expert gamers remains an open empirical question. As to the academic domain, there are potentially desirable external rewards (e.g. higher grades) associated with advanced academic skills, besides the intrinsic value of “learning to learn” as an aspect of personal growth and development.

2.1. *League of Legends* as an arena for skills practice

League of Legends (LoL) was chosen as the game for the design of this study for two main reasons. The first was that LoL is one of the most popular competitive computer games (esports) and much of the literature examining self-regulation in esports has focused on LoL (Kleinman et al., 2021; Trotter et al., 2020; 2021). The second reason is that the first phase of gameplay in LoL is generally relatively predictable, where players ‘farm’ gold from ‘minions’ (AI non-player-characters). A player’s ability to farm gold at the start of the game is very important to level up and purchase upgrades which give them an advantage. Farming minions requires careful micro-management of the player avatar to deal the final blow and killing the minion to obtain gold. If the player does not deal the final blow to the minion, they do not get gold and thus miss out on the potential advantage. Learning to effectively last hit minions is a skill which can be honed through deliberate practice. Players can learn this skill by watching tutorial videos on Youtube, professional players on Twitch, or from feedback from other players in their match. On a metacognitive level, the strategies used by players to learn mechanical skills in esports such as farming minions could be applied to academic learning, for example when it comes to reflecting upon which strategies lead to desired educational outcomes.

3. Towards an experimental design

In conclusion, we hypothesize that metacognitive or self-regulatory skills and strategies developed and honed in an esports context can transfer to enhance academic learning. Table 1 describes our tentative experimental design for assessing this hypothesis.

Table 1. Proposed experimental design and empirical assessments.

I.	Baseline self-report measures and/or objective physiological measures of activation and stress.
II.	Tasks in multiple conditions with varying degrees of support, conducted in phases 1-3.
	1. Computer gaming task (farm gold in LoL) conditions:
	a) Full support; coach-assisted co-regulated learning (incl. access to online resources).
	b) Partial support; participants are made aware that they can spend time researching the problem and are provided with access to a computer with online resources.
	c) No support; participants are given access to the game, and online resources but are not encouraged to employ self-regulatory strategies beyond unstructured playing of game.
	2. Academic task (e.g. science or math problem) conditions:
	a) Full support; coach-assisted co-regulated learning (incl. access to online resources), encouraging students to deliberately employ previous strategies for problem-solving.
	b) Partial support; participants are made aware that they can spend time researching the problem and are provided with access to a computer with online resources.
	c) No support; participants are given the academic problem to solve, and online resources but are not encouraged to employ self-regulatory strategies beyond self-guidance.
	3. Reflection and assessment:
	Participants are interviewed by the researcher and given multiple questions, as to how they rate their strategies to solve the problem in the different conditions, and how the esports condition influenced the learning approach in the academic condition.

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DEMONSTRATION OF TIME-SYMMETRY BREAKING IN A JET FLOW

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Abstract

Although the Newton laws are time-reversible, we can observe lot of systems, which are irreversible in time. One of such a simple system is the fluid jet, i.e. a case, when a fluid flows into or out of a tank through an orifice (hole). In the case of flow out, the fluid approaches towards the hole from all directions symmetrically, the flow sustains laminar up to high pressure gradients and the fluid velocity decreases with second power of distance (in 3D, in 2D it does with first power). Thus the drag force decreases with 4th power of distance. On the other hand, if the fluid is pushed into this tank, then the fluid inertia conserves the direction creating a fluid structure known as jet – the column of moving fluid with a plume on its head. The boundaries of this moving column are home of the famous Kelvin-Helmholtz instability creating vortices, which spreads out into the entire jet and its surroundings. The turbulence soon fills the entire vessel and mix it powerfully. In total, a simple device consisting just of a tank and a syringe can show various effects from details of fluid mechanics up to philosophical problems of the universe. We would like to present this device in the END conference as a poster. Look at our YouTube video: <https://youtu.be/BiuOKTng8jE>

Keywords: *Turbulence, rheoscopic fluid, demonstration experiment, jet, education.*

1. Introduction

Education is one of the basic prerequisites of scientific progress. Although indirectly, the education quality determines the quality of future scientific research and technological progress. The future scientific, technical and thus economic and culture level of each nation is determined by the education quality *now*. This connection is clear and it does not need further arguments. But, its main weakness is that any change takes long time, because good education needs good teachers, who passed a good school... For this reason, not only levelling education up to a good conditions takes long time, but also its destruction is a slow process. This leads to a false myth, that our contemporary scientific, technical, economic and cultural levels are something natural, that it was always here and it will be here forever.

High quality education means, in first point, the truth. Of course, it is not possible to fully reproduce the way towards each statement. A statement is valuable, when it is easy to disproof it (in principle), when it is possible and useful to doubt about it and to seek up the limits of its validity. Therefore, it is important to be free from ideological and political weed, which has usually a dogmatic character prohibiting doubts. Another important point is, that the education has to be in national language, definitely not English, although the terminology is worth to be listed in English or Latin (according to habits of each subject). Next danger is the decoy of paid education. That rule would filter out lot of potential students in dependence on salary of their *parents*. The last but not least challenge for quality education are the *inner* obstacles: the motivation is needed at both sides, students and teachers as well. An easily accessible entertainment in a form of social networks, movies or games is a very strong concurrence to classical thick book full of rigorous proofs and long equations, e.g. (Alekseenko, 2003) (Schlichting, 1951) (Frisch, 1995). Therefore, we try to enrich the education process by *demonstration experiments*, which show, that the claimed statement is true (at least in the limited conditions), that the equations have some physical meaning and that the knowledge is interesting and esthetical. We wish to share with the students our exultation over all the beautiful and rich phenomena of the God's creation. We continue our work (Duda et al., 2019) (Duda, Uruba, & Yanovych, 2022) by simple apparatus for demonstration of the jet flow, which shows not only jet itself, but also the time-irreversibility on a simple case.

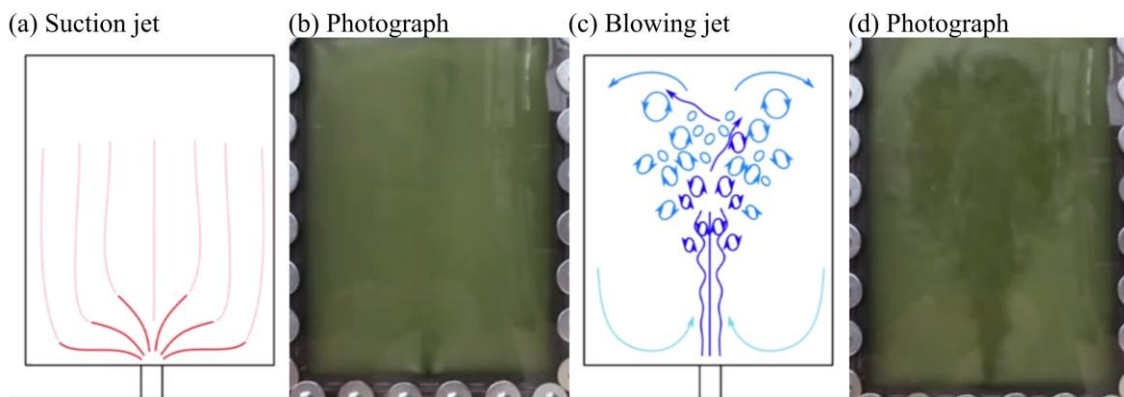
2. Experimental setup

The geometry is very simple: a vessel of rectangular cross-section, the inner size is $180 \times 100 \times 10$ mm, the front wall is made of transparent polystyrene. The tidiness is ensured by small groove of diameter 2.8 mm. A flexible hose is pushed into this groove, it exceeds the upper surface of the 3D printed part, therefore, the transparent wall is in contact with this flexible hose and not with the 3D printed surface with relatively high roughness. The transparent wall is pushed by using screws and wide washers. At the bottom part, there is orifice connected by flexible tube to syringe. To avoid pressurizing, there is another free orifice at the top, where the air can freely flow in and out.

The working fluid is water with a rheoscopic fluid based on the crystals of stearic acid extracted from shaving foam according the recipe from Borrero-Echeverry et al. (Borrero-Echeverry, Crowley, & Riddick, 2018). Additionally, there is a food colouring to make it cooler.

3. Observations

Figure 1. Schematic sketch (a, c) and photographs (b, d) of the two asymmetric states of the jet: (a, b) show the case, when fluid flows out from the vessel, while (c, d) show blowing.



A naïve assumption could state, that there is not important, if the fluid goes one way or another way, as the basic laws of mechanics are time-reversible and the pressure gradient would introduce a motion of fluid. However, there is the *inertia* – the mass's reluctance to acceleration.

In the case of suction, the near fluid just approaches the area of lower pressure, this happens from all directions. The result is, that the velocity in this case decreases with distance as $u_{3D}(r) \sim r^{-2}$ due to the mass flow conservation (the flux through a virtual sphere has to be independent on its radius) in 3D case without boundaries. In the pseudo-2D case, which is the shown one, the velocity decrease is not so steep as there is only a cylinder, over which the flux has to be conserved. The fast decrease of velocity is projected into even faster decrease of pressure aerodynamic forces: as the force scales with velocity as $F \sim u^2$, then $F_{3D}(r) \sim r^{-4}$, which is very steep change – increasing distance twice means decreasing force 16×. Daily example can be found in cleaning by using vacuum hoover: attracting some object by using air flow is almost impossible, it feels nothing, or it is just sucked immediately. It is even worse than trying to balance force of permanent magnet, which decreases as $F_{mag}(r) \sim r^{-3}$. Note that the suction jet may transit into turbulent regime as well, but at much higher Reynolds numbers than that accessible in our apparatus.

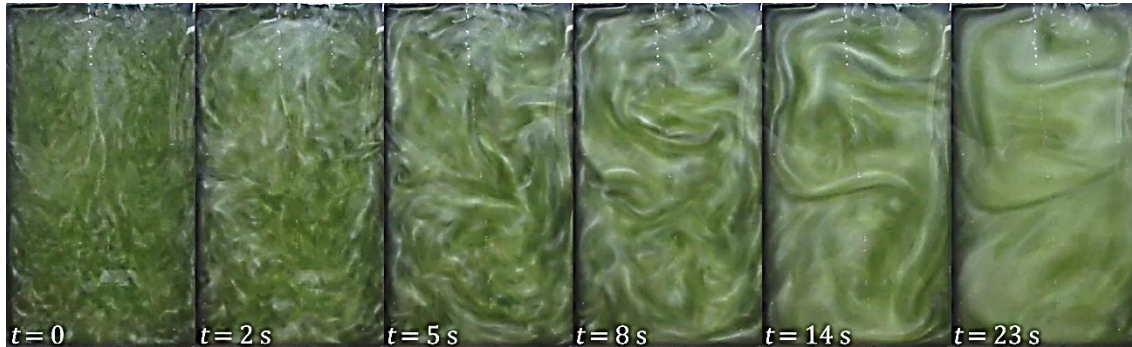
The opposite case is much more interesting, the fluid's inertia conserves the direction of the inflow and the fluid continues and continues. This fluid phenomenon is called *Blowing Jet*. According to List: “*Turbulent jets are fluid flows produced by a pressure drop through an orifice.*” (List, 1982). The pressure drop is important; it is not just general gradient. The *shear layer* between the moving column and the surroundings is home of the famous Kelvin-Helmholtz instability (Helmholtz, 1868) (Kelvin, 1871), which further leads to large-scale vortices, which pair and decay leading to turbulence. Turbulence mixes the fast and slow fluid, therefore the jet effectively gets wider and slower (continuity equation connects it). In larger distance, the jet width b jet scales as $b \sim x^1$ while the center-line velocity as $U_m \sim x^{-1}$. The mean profile of near shear layer follows the complex Michalke's function (Michalke, 1972) describing asymmetry between the side of fast and slow fluid respectively, but this asymmetry originates in the boundary layer of the nozzle. The shear layer is crucial for stability of entire jet. Surprisingly, the jet can be stabilized by longitudinal vortices in the shear layer as shown in (Duda, Abrahám, Uruba, & Yanovych, 2021).

Alternating the *suction* and *blowing* jet leads to the *synthetic jet*, i.e. zero-flow-mass jet.

As our experimental device is quite small in comparison to the jet, the far region cannot develop, the large-scale flow is limited to a pair of turbulent counter-rotating vortices. The interior of these vortices

is fully turbulent and the turbulence decays by non-linear energy transfer from larger scales to smaller ones. Energy at smallest length-scale, called *Kolmogorov scale* (Колмогоров, 1941), is dissipated to heat. The consequence is, that the observed scale of turbulence grows in time, because the smaller scales are already consumed (Duda, Yanovych, & Uruba, 2021) and the flow looks “*smoother*” (see Figure 2), the large-scale structures survive longer and they are the last observable structures until the motion disappears.

Figure 2. Photographs from the turbulence decay. The time $t = 0$ represents the end of fluid ejection.



4. Conclusion

We made a simple demonstration experiment showing jet. We hope, that this demonstration shows students, that the nature (gr.: $\eta \phi\upsilon\sigma\iota\varsigma$) is awesome, that God has much higher phantasy than we have and therefore, that it makes sense to read the mentioned thick books, because they are true and inspiring, although they are not easy to read.

Acknowledgments

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LIFE CYCLE ASSESSMENT OF A PRODUCT FROM 3D PRINTER AS A NEW TOOL FOR SCHOOL

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Abstract

The article is devoted to life cycle assessment, specifically determining the carbon footprint of a product produced with the help of a 3D printer. The aim of the article is to help the LCA (Life Cycle Assessment) method used not only to show students and pupils places with a negative impact on the environment but also how to identify them and possibly eliminate or limit them. At the beginning of the article, mind maps are described that relate to a specific product printed on a 3D printer, which has clearly defined goals: to describe the individual phases of the product's life cycle; orientate yourself in concepts related to product quality; define product life cycle costs; assess the impact of various factors on product quality; to evaluate the impact of production using a 3D printer on the environment. The next part of the article is devoted to the creation of a carbon footprint calculator. There are various calculators for calculating emissions, which, after filling in, will evaluate the result. However, it is often impossible to look at how the process was calculated to know how a particular value arrived at. Therefore, a simple calculator was created in Microsoft Excel, in which the method of calculation is clear, and the sources of the coefficients can be found. At the end of the article, recommendations will be made on how to apply the sustainable development of active learning methods to teaching.

Keywords: *Life Cycle Assessment, production process diagram, 3D printing, product quality, active learning methods.*

1. Introduction

Sustainable development and environmental management make it possible to satisfy the needs of the human population and, at the same time, do not threaten the standard of living of future generations while preserving the intact ecosystem of our planet. And it is here that sustainable development education and environmental education in schools play an irreplaceable role. The key question is how to approach the teaching of sustainable development in schools and how to familiarize pupils with the topic. In addition to basic information about the reasons for the emergence of the idea of sustainable development, its application in specific practical areas is also extremely important. The concept of education has a great advantage for sustainable development, namely the use of the current content of education and the connection with ordinary life. Another important condition of education for sustainable development is the maximum involvement of students. One part of the environmental management is LCA (Life Cycle Assessment). LCA is a system analysis focused on collecting and evaluating inputs, outputs, and possible impacts of a product (or service) on the environment during the entire life cycle. During the assessment, all impacts associated with the product are mapped, from the extraction of raw materials, production, and use to the end of the product's useful life and disposal.

3D printing is recognized as an efficient and sustainable technology in the field of advanced manufacturing. In the last few years, there has been considerable research, including technological innovation in industrial enterprises to support 3D printing for better manufacturing performance (Zhichao et al., 2016; Krotký et al., 2016; Böhm et al., 2023). 3D printing technology can be applied, for example, in civil construction, mechanical engineering, electrical engineering, medicine, education, art, and confectionery. This article will show the impact of 3D printing on the environment, which will allow students to understand the issues of 3D printing and, at the same time, provide researchers and educators with better guidance for future research.

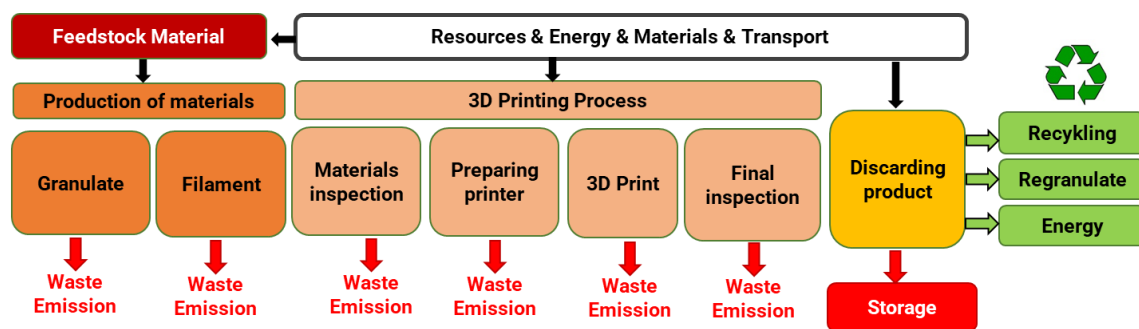
2. Education for sustainable development

Education for sustainable development must use all four perspectives on the content of education: economic, environmental, social and cultural. This concept offers methods to educate in a different way. The life cycle of a product is the time interval from the determination of the product concept to its disposal. Costs are also related to the product life cycle and sustainable development. Life cycle costs are total (cumulative) and can be divided into acquisition costs (for example, market research, project design and management, software development), ownership costs (for example, production planning, quality management, maintenance of production equipment, modernization, employee training), costs for disposal (for example collection and processing of non-functional products, legal fees (Bertini et al., 2022, Al Rashid et al., 2023).

2.1. Life cycle assessment of a product from a 3D printer

The 3D printing process begins with design and modelling, followed by material preparation, printing and quality control of the final manufactured product. Time can be saved because it is not manufactured according to standard processes, such as casting, forging, machining, pressing, extruding, etc. (Zhichao et al., 2016). But even for 3D printing, an environmental analysis is necessary. It is interesting to study that home 3D printing produces minimal waste, reducing its environmental impact. Home 3D printing reduces transportation needs, including packaging, which means less plastic (Drizo & Pegna, 2016). That's why we used a home 3D printer to calculate the Life cycle assessment of a product.

Figure 1. Scheme of the production process of 3D printing.



2.2. Creation of a carbon footprint calculator

Choosing the right emission factors is the key to correctly calculating the carbon footprint, but unfortunately, it is not always easy to calculate. Determining the boundaries of analysis is a key initial step for any carbon footprint analysis. It means determining which steps of the production process (Figure 1) are included in the calculation of greenhouse gas emissions and which are not. The following stages were chosen to determine the product's greenhouse gas emissions using 3D printing: material transportation, production of Polyethylene terephthalate (PET) material granules, energy consumed for printing, and material recycling PET.

Calculation of CO₂ emissions for 1 litre of diesel fuel: 1,92 kg of oxygen is needed to burn 1 litre of diesel fuel (0,84 kg); the resulting carbon dioxide is equal to the sum of 0,72 kg of carbon and 1,92 kg of oxygen, which is 2,64 kg of CO₂ from 1 litre of diesel fuel burned (Bařhová, 2021). The amount of carbon dioxide that a vehicle emits into the air is directly proportional to the amount of fuel it consumes and the carbon content of the given type of fuel. PET material is produced from oil and natural gas, which we import, for example, from Saudi Arabia (Hamieh et al., 2022). The road distance between the Czech Republic and Saudi Arabia was considered to be 5295 km. The total fuel consumption of diesel fuel is 371 litres.

Due to the lack of information and data on combustion, emissions from the petrochemical industry are generated from three main sources: fuel combustion, electricity consumption, and input raw materials. Consumption of basic raw materials to produce 1 kg of PET granulate: oil 0,64 kg (33,18 MJ) and natural gas 0,23 kg (12,63 MJ) and CO₂ in the production of 1 kg of PET granulate is 2,3 kg (Přibyllová, 2000).

The university's laboratory carried out calculating CO₂ emissions related to the printing process and energy consumption per 1 kg of product. Prusa MK2.5 3D printer was used to print the product. Consumption for preheating the pad and nozzle was 11 Wh (40 kJ). Energy 93 Wh (335 kJ) was used to

print a product weighing 4,14 g. The energy to print 1 kg is 22,5 kWh (81 MJ). From the statistical data of the Ministry of Industry and Trade of the Czech Republic, the value of the CO₂ emission factor from public electricity production for the year 2022 was 0,413 t CO₂/MWh. When 1 MWh of electricity is produced in the Czech Republic, 413 kg of CO₂ is released (430 g of CO₂ is released when 1 kWh of electricity is produced).

When calculating CO₂ for PET recycling, it was assumed that the combustion would take place in a high-quality incinerator, where a highly controlled combustion process would burn PET and produce carbon dioxide and water. The amount of CO₂ is calculated from the PET chemical formula: HO- [-CH₂-CH₂-O-OC- C₆H₄-CO- O-] n -OH. Burning 1 kg of PET produces 2,2 kg of CO₂. In the case of incomplete combustion, other substances can be formed, which can also cause an increase in CO₂ values.

3. Conclusion

Primary, secondary and grammar schools can use the concept of education for sustainable development. Thematically, they can stay with well-known areas, which they can supplement with economic, social, environmental, and cultural areas. Methodologically, it is important to connect school teaching with the real, practical world; for this, it is proposed to use the method of locally embedded and situational learning, which are characteristic of education for sustainable development. Education for sustainable development is often also implemented in projects where, for example, engaged learning and experiential pedagogy can be applied. Further research will focus on the comparison and repeatability of the 3D-printed product. Part of the research will focus on the design of the product and the properties of the selected materials. Analysis and evaluation of crossing, retraction, room temperature and airflow during printing will be needed. A more detailed analysis of the issue of CO₂ emissions and 3D printing and its relation to active learning methods will be carried out, including specific case studies.

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DEFINITIONS MATTER! HOW ONE STATE IS ATTEMPTING TO STANDARDIZE DATA DEFINITIONS

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Abstract

As data collection and analyses proliferate our lives and raise expectations for what data can tell us, there are increasing demands for integrating data from several sources to get a wholistic view of the landscape of an area (e.g., a state), a population (e.g., young children), and/or field (e.g., early childhood education). This quest for data is particularly prominent in recent efforts to create more equitable educational systems. However, these initiatives are often hindered by different ways of collecting and defining data elements, such as age and race and ethnicity. The key to addressing this problem is identifying conflicting data definitions from different programs and agencies and working with all stakeholders involved to agree on common data collection and definitions.

Keywords: *Data definitions, longitudinal data systems, early childhood.*

1. Introduction

The Illinois Early Childhood Asset Map (IECAM) was created in 2006 to provide comprehensive early childhood data and maps to local and state agencies and other stakeholders to improve outcomes for Illinois children. As part of this role, IECAM works closely with early childcare education and care (ECEC) services are managed by multiple different government agencies in Illinois, the data collection and storage of these data are siloed away from each other. By having disparate data, analyses done on these data encounter problems with “comparing apples to oranges”: data that should be representing the same indicator not being defined in the same way. This is especially true with specific definitions on indicators such as age, race/ethnicity, and homelessness. Through all of our data work in Illinois, IECAM is trying to identify many of these definitional disagreements and standardize agreed-upon definitions for use across all Illinois agencies and ECEC providers.

In addition, IECAM also has been collaborating with the American Institute of Research (AIR) to identify and provide suggestions to fix the more common differences in definitions in ECE data work.

From the research, some very common disagreements included:

- What words do we use to describe an ECEC entity?
- Is it possible to have an accurate and standardized definition of age ranges?
- How do we define a child’s race and ethnicity so it’s standardized across multiple agencies?
- What is considered a “rural” area in Illinois?

A larger, systemic problem also came to light: How do we ensure an accurate use of terminology across the early childhood spectrum and maintain a consistent use of unique identifiers for each child across the whole system?

2. What words do we use to describe an ECEC entity?

Problem: A very broad topic that kept coming up when comparing data definitions at different agencies was the very general terms used when presenting information about ECEC providers in reports and data systems. Do you describe an ECEC provider by its funding source (federal department of education) or which agency is administering it (state board of education)? Or do you describe it by only its specific program model or by the age of children served? None of these are inherently incorrect, but there is inconsistency in current systems that causes confusion.

Across documentation and data systems, there is also disagreement on what words are used for the physical ECEC entity. According to the AIR report on data definitions, “terms like ‘facility,’ ‘site,’ and ‘program’ are used often interchangeably, yet the meaning of them may vary greatly” (D’Souza et al., 2022).

A clear definition on what constitutes a center-based program and a home-based program is also lacking because there are situations where center-based care providers may provide services inside the home.

Proposed Solution: Consistency in how ECEC entities are described is the major factor here. Making sure all data are inclusive of funding stream, age range, and program type from the beginning would help. This would make combining and analyzing data from different systems much easier and more accurate, especially when trying to pinpoint programs that affect a specific age range or group.

Clear definitions must also be representative of a community's needs and its work force. It should be very clear whether the data is referring to an actual care site or an administrative building. Adding an indicator to provider-level data that distinguishes between these different types of locations would go a long way.

A lack of a definition of what constitutes a center-based care provider is missing at the moment. An agreed upon definition from program providers, including what types of services that center-based care providers offer (including any home-based services) should be included in any data system.

3. Is it possible to have an accurate and standardized definition of age ranges?

Problem: The most consistent confusion was around age ranges for ECEC programs. Many programs in Illinois and the United States are for children of specific age ranges, such as 0–2-year-olds, or 3–5-year-olds. Or sometimes specific federal and state grants will target different age ranges such as birth to 5 or birth to 3. When looking at documentation for these programs and talking with the many different people involved, a lack of consistency in what ages these ranges actually include became apparent. The problem appeared to come from uncertainty about the upper limits of the ranges and whether they are consistent. When someone says that a program is for children “birth to 3,” does that include 3-year-olds? Or are they no longer eligible on their third birthday? Do newborn programs serve only children after birth or pregnant people as well? Using the word “to” in an age range seemed to spark much of the confusion, as different parties interpreted that as both inclusive and noninclusive of the higher age figure.

Proposed Solution: Clear definitions on what age ranges a program is designed for is a must, and those definitions must be agreed upon and used by all relevant parties. Deliberate language that avoids misinterpretation is also incredibly important. Avoiding the word “to” in an age range and instead adopting language like “children age 5 and under” indicates inclusivity. Being more specific by using months instead of years also can add clarity by narrowing the upper figure to a single month rather than an entire year. This can be done by changing “0–3 year olds” to something like “between birth and under 35 months.” As opposed to age 2 and under, the 35 months also provides a more specific reminder of the critical time a child may transfer out of one program and into another, such as the transition from early intervention to early childhood special education.

4. How do we define a child’s race and ethnicity so it’s standardized across multiple agencies?

Problem: Equity and inclusivity in ECEC programs are major concerns in Illinois. Data is a major component of making sure this is done accurately and fairly. Currently there are no standards at the state level that codify how race and ethnicity data are collected, which inherently is not a bad thing, but can cause problems when trying to get an accurate picture of data across programs and agencies. Sometimes this is even a problem within the same ECEC program. One particular program in Illinois houses its data in two separate, distinct databases. One database has 50 values to indicate race and ethnicity and the other has 10, all for the same ECEC program. This may be a case of over specificity, as was reported by AIR: “A clear set of race/ethnicity categories were used in documents, but they aggregated many people of color, undermining representation of diversity.” (D’Souza et al., 2022)

Proposed Solution: IECAM’s suggestion was to use the race and ethnicity definitions used by the U.S. Census Bureau. This would offer across-the-board consistency in collecting information on race/ethnicity. It would also make it easier for datasets from different agencies to be merged on race/ethnicity.

5. What is considered a “rural” area in Illinois?

Problem: Currently, rural areas in Illinois are defined using counties as the principal geographic unit of measure. There are a few definitions on what makes a county “rural.” According to the U.S Census Bureau, rural is defined as a county not part of a metropolitan statistical area (MSA) or a county that is part of a metropolitan statistical area but has a population fewer than 60,000. Another definition used is from the National Center for Health Statistics, which is a bit more granular. It classifies counties as *large central metro*, *large fringe metro*, *medium metro*, *small metro*, *micropolitan*, and *non-core*. From IECAM’s experience providing early childhood demographics for Illinois, we know that using counties for this offers consistency, but it also runs the risk of overlooking diversity and the specific needs of communities within counties. For example, IECAM’s home county has a population of a little more than 200,000, but most of its geographic area would be considered rural. The county’s population is concentrated in two adjacent cities in the middle of the county.

Proposed Solution: Using a smaller geography to determine rural status. IECAM provides population estimates at the zip code level, which could be used for more granular classifications.

6. How do we ensure an accurate use of terminology across the early childhood spectrum and maintain a consistent use of unique identifiers for each child across the whole system?

The overarching, structural problem that kept appearing is that there is not agreement across ECEC agencies and providers. As Illinois moves toward the creation of a new longitudinal data system (ILDS) that will house data across multiple agencies, a standardized set of data definitions is needed more than ever. The goal of the ILDS is to be able to track the entirety of a child’s educational journey in the state. To do this accurately and equitably, all identifiers and indicators used in the data must be consistent and reliable across all data systems. Without clear data definitions, this task becomes much more difficult. Ideally, a set of mandated rules from the Illinois government would be implemented for all agencies to follow. Until then, all we can do is offer researched evidence and suggestions on best practices.

Given our position as a major influence on ECEC data use in Illinois, we also must lead by example. On our website, we have extensive definitions pages for each type of data we provide and make sure to share those as widely as possible. IECAM is also a key developer in the ILDS system, so we are providing our expertise and definitional suggestions at the source.

7. Conclusion

Data usage and analyses are incredibly important when trying to make ECEC programs equitable and accessible to everybody that qualifies for them. In Illinois, many of the programs provided in early childhood are managed by different government agencies with their own data collection and governing standards.

Because of IECAM’s work as a major voice in ECEC data in Illinois, we’ve experienced many of these definitional inconsistencies firsthand and know how they can hinder quality analyses on programs that affect similar populations. To lower the risk of errors in data analyses, especially when that data is used in governmental decision making, ECEC data in Illinois needs to be clearly defined and those definitions need to be consistently used by all parties.

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SCHOOL EXPERIENCES OF A MULTILINGUAL ELEMENTARY STUDENT ON THE AUTISM SPECTRUM – A CASE STUDY

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Abstract

Estimates predict that up to a quarter of children on the autism spectrum may grow up speaking more than one language. However, there is a dearth of research on the school experiences of multilingual children on the autism spectrum. The current study aimed to address the lack of research including multilingual children on the autism spectrum and their school experiences by focusing on the following questions: What are characteristics of the school experiences of a multilingual elementary student on the autism spectrum in an inclusive, monolingual setting; What are stakeholders' perspectives on multilingualism in children on the autism spectrum and how are these perspectives reflected in their practices? A case study was undertaken to observe the school experiences of a multilingual student on the autism spectrum in an inclusive elementary school in Germany. The method included semi-structured interviews with the student, the student's mother, the primary classroom teacher, the education assistant, and the school principal. Interpretative phenomenological analysis was used to analyze the interviews. In addition, an ethnographically informed observation of the school experiences was conducted, and field notes were collected and analyzed. Interviews and observations showed a lack of knowledge about multilingualism and autism by school personnel. None of the interviewed stakeholders had received professional development related to supporting multilingual students on the autism spectrum. The student overall reflected positively on their school experiences. The student's mother discussed that communication with the school was often difficult due to language barriers. Overall, more research and professional development opportunities are needed.

Keywords: *Autism spectrum disorder, bilingualism, multilingualism, inclusion.*

1. Introduction

Despite estimates that a significant number of children on the autism spectrum are likely to grow up in multilingual environments (Trelles & Castro, 2019), there is a dearth of research exploring the school experiences of multilingual children on the autism spectrum. Howard et al. (2019) interviewed 11 bilingual autistic children aged 7-14 in the UK regarding their school experiences. Results showed that students educated in multilingual settings reflected more positively on their multilingualism than their peers educated in monolingual contexts (Howard et al., 2019).

Both parents of children on the autism spectrum and practitioners have voiced concerns regarding the impact of multilingualism on the language development of children on the autism spectrum (Hampton et al., 2017; Howard et al., 2021) despite research showing no evidence of any detrimental effects of bilingual exposure for children on the autism spectrum (see Gilhuber et al., 2023, for a systematic review). In addition, parents of children on the autism spectrum have frequently reported receiving advice from practitioners to prioritize one language in their interactions with their child (Fernandez y Garcia et al., 2012; Kremer-Sadlik, 2005). Studies that gathered data from multilingual autistic adults found that they often reflected positively on their multilingualism and the impact on their lives (e.g., Digard et al., 2022).

2. Objectives

The current study occurred in Germany, where about 18 percent of all minors grow up in a household with a primary language other than German (Der Informationsdienst des Instituts der deutschen Wirtschaft, 2021). This study built on three questions that aimed to address the lack of research

focusing on the school experiences of multilingual students on the autism spectrum and the perspectives of the stakeholders involved in the education of multilingual students on the autism spectrum:

1. What are characteristics of the school experiences of a multilingual elementary student on the autism spectrum in an inclusive, monolingual setting?
2. What are stakeholders' perspectives on multilingualism in children on the autism spectrum?
3. How are stakeholders' perspectives on multilingualism in children on the autism spectrum reflected in their daily practices?

3. Methods

The current study consisted of an ethnographically informed case study that included semi-structured interviews with a bilingual, fourth-grade student on the autism spectrum and the primary stakeholders (parent, primary teacher, education assistant, and principal) involved in the student's education in an inclusive, general education classroom setting in a rural town in the south of Germany. In addition to interviews, the principal investigator conducted an ethnographically informed observation of the day-to-day school practices, following the student's schedule for two days and collecting field notes.

Interpretative phenomenological analysis (IPA; Smith et al., 2022) was used to interpret and analyze participants' responses. As a qualitative research method, IPA focuses on a phenomenological, ideographic analysis (Smith et al., 2022) of participants' experiences (Demuth & Mey, 2015). All interviews were conducted in 1:1 settings, audio-recorded, and transcribed. Transcript analysis included multiple re-reading, exploratory noting, and the development of experiential themes (Smith et al., 2022).

The Institutional Review Board of the Pennsylvania State University approved the current study. All participants were assigned pseudonyms to protect their identity.

4. Findings

At the time of the current study, Tom attended a fourth-grade classroom with 18 other students. In his classroom, Tom was one of six students with special educational needs and one of two students with a diagnosis of autism spectrum disorder. Tom's first language was Romanian, the first language of his parents and the dominant language spoken in the family's home. Tom overall reflected positively on his school experiences. When asked which languages he liked, Tom indicated a preference for English, taught as a foreign language at the school he attended since third grade. Sophia, Tom's mother, and Antonia, the education assistant who supported Tom during the school day, both mentioned in interviews that Tom displayed great interest in English at home and at school.

Sophia, Antonia, and Katherine, Tom's classroom teacher, all reflected that communication between the home and school was sometimes difficult. When asked about the communication with the school, Sophia reflected that the limits of her proficiency in German negatively affected the communication, especially regarding the numerous documents the school sent home. Katherine, who was in her fifth year of teaching at the time of data collection, also discussed that communication with Tom's parents sometimes proved difficult due to the language barrier they experienced speaking German as a foreign language. Katherine also reflected on the limitation of a lack of access to an interpreter. Neither Katherine nor Martha, the school principal, reflected specific strategies to support multilingual students with disabilities. Martha and Katherine indicated that they primarily relied on Antonia to provide the additional support Tom needed.

5. Discussion

Tom overall reflected positively on his school experiences. He did not explicitly reflect on his own bilingualism but displayed an interest in languages, especially English. According to data from the interview and observations, the primary characteristics of Tom's educational experience were the monolingual instruction in German, the individual support he received from his education assistant, and his reflected satisfaction with school processes. Tom's mother discussed being satisfied with the support her son was receiving at school but reflected that communication with the school was sometimes difficult due to the language barrier she experienced.

The three participating educators identified as monolingual speakers of the dominant societal language and displayed a lack of understanding of multilingualism as a complex phenomenon and the implications of multilingualism and disability as intersecting identities. Stakeholders' daily practices reflected their perspectives on multilingualism. Discussions around language centered on strategies promoting the societal language German, not on utilizing bilingualism as an asset. None of the participating school personnel had received professional development in supporting multilingual students

on the autism spectrum. Previous studies have shown that experience and training can influence how educators perceive multilingualism (Camenzuli et al., 2023). All involved educators would have benefited from additional training to support Tom and other multilingual students with a diagnosed disability. More research is needed to reflect the school experiences of multilingual students on the autism spectrum and the perspectives of the stakeholders who work with multilingual autistic students and to develop evidence-based practices to support the needs of multilingual students with disabilities.

As a single case study, the current study reflects the unique experiences of one multilingual student on the autism spectrum. Additionally, the principal investigator could only attend the daily school practices for two days, which limited the data collection for the observation.

6. Conclusion

The individual experiences reflected in the current study showed that in a monolingual education context, stakeholders primarily focused on supporting the student in advancing his skills in the dominant societal language. Educators' perspectives reflected a lack of knowledge of culturally responsive strategies that build on bilingualism as an asset, a limited understanding of the intersection of disability and multilingualism, and a dearth of professional development opportunities for supporting multilingual students with disabilities. Educators need more support and training to utilize culturally responsive pedagogy to support culturally and linguistically diverse students and build on students' multilingualism as an asset. Additionally, more research is needed on the school experiences of multilingual students on the autism spectrum and the perspectives of stakeholders involved in their education.

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DEVELOPMENT OF TIME MANAGEMENT AS GENERIC COMPETENCE IN AN ENGINEERING DEGREE: FIRST RESULTS

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Abstract

The experience has been implemented in two successive subjects in the third year of the Degree in Electronic Systems Engineering (University of Malaga) through the performance of the following activities: initial assessment of students' knowledge, outline a table of objectives at various time levels (first semester); keeping a record of the activities carried out during one week; attend a time management workshop; perform a strengths and weaknesses analysis; maintain a list of activities and an agenda for the rest of the subject; continue to deepen time management through the TRELLO© program free version (second semester); and a final evaluation of the development of the activity. The results show that there is a high dispersion of students' opinions initially. At the end of the second semester, a certain degree of improvement can be observed from the student's point of view. This experience was developed during the last academic year and is being carried out again with the same students in two fourth-year subjects with the idea that students improve their acquisition of this GC.

Keywords: *Time management, scheduling, engineering, generic competences.*

1. Introduction

Competencies represent a dynamic combination of knowledge, skills, abilities, and values. Promoting these competencies is the aim of the educational program, being assessed at different stages; the students obtain them. Learning outcomes are expressed in competencies (Menéndez Varela, 2009). The concern within the University of Malaga (UMA) for students to obtain learning outcomes associated with Transversal or Generic competencies (TC), as required by the degree reports themselves, is not new to different theses and research on the need to develop competencies during the university stage (OECD, 2003). A multitude of actions has been carried out in this sense over the last couple of decades, most of which have been characterized by the following:

- Total need for a development plan integrated with the degrees. Obtaining degrees does not provide any information on the TCs that graduates may have acquired.
- They are almost always extracurricular and voluntary, as they have yet to be considered in the curricular design, so there is no space for them, despite appearing in the degree reports.
- They are specific or sporadic actions without continuity over time, as they are associated with temporary projects and restricted to certain subjects.
- Being undervalued by the teachers themselves (considered of secondary importance or at least their teaching responsibility is limited to these specific outcomes).

The competencies that were selected to work on in this pilot project according to the model proposed by some researchers (Legault, 2012; Le Boterf, 2001), without implying that others are not of similar relevance, were effective communication (oral and written); autonomous learning and information management; and planning and time management. This article deals with the development of the latter.

2. Objectives

Good performance at university depends to a large extent on proper management and organization of study time, paying attention to the also necessary leisure time. Time management, knowing how to plan work, applying good techniques, being motivated and having confidence are essential. Effective study management allows for good results and avoids the dreaded moments of overwhelm (Allen, 2001; Marchena et al., 2008).

It is useful to have an agenda to check that the deadlines set out in the study plan are being met. The initial organization will improve as the course progresses and the pace of each subject, its level of difficulty, the final days of exams, etc. are known with greater precision. But time is a resource common to our work, our leisure and all the other private activities of our lives, including leisure time. Therefore, a good management of our individual time should include all our activities, professional or private, including breaks, leisure, free time, etc. This was the first level of study.

At a second level, the individual's time management requires the management of time-sharing by a group or team: the team leader should try to organize time-sharing, without prejudice to the individual team member's individual time management that is in line with time-sharing management.

Finally, at a more advanced level, project planning is a further step in time management, adding to time management the management of human and material resources, and the design of all the activities associated with the project.

So, three levels will be identified (Sodexo, 2018): individual time management, shared time management (working group), and management of human and material resources and design of the activities associated with the project. The results of the first level (individual) are detailed in this article.

3. Design and methodology

The training sequence (full course) for time management at the individual level includes self-knowledge of the learner's starting point, knowledge of tools (TRELLO©) and techniques, and application and exploitation. This training sequence consisted of the following activities:

- Self-assessment survey (García- Ros & Pérez-González, 2012)
- Creating a table of goals or objectives (Figure 1)
- Detailed activity log for one week
- Attendance at a training workshop
- Analysis of strengths and possible actions for improvement
- Development of planning (master list) and individual agenda (Figures 2 and 3)
- Self-assessment survey and comparison with the first survey.

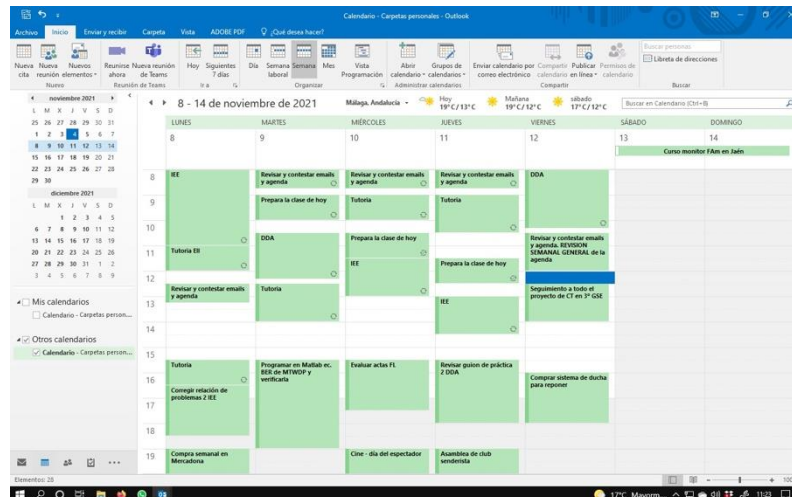
Figure 1. Example of a target table.

	Long-term goals	Medium-term goals	Short-term goals
Academic/ labor	AL 1. Obtain the next six-year research period (14 months to go).	A1.1. Publish MTWDP article in IEEE journal (expected to be submitted in 3 months)	AL1.1.1- Obtain equations for "Extreme conditions" AL1.1.2-Obtain BER equations AL1.1.3-Verify BER equation AL1.1.4- Analyze graphs and draw conclusions
	AL.2. Improved subject results	AL2.1. Development of the pilot project in 3 GSEs with 3 TCs, with perception of improvement by students	AL2.1.1-Reply to reviewers and send
Personal	P1. Home maintenance	P1.1. Repair paint defects P1.2.Faucet repair	P1.2.1.Shower repair
	P2. Miscellaneous	P2.1. Hiking trails	P2.1.1. Alcornocales Route (N-P) P2.1.2. Cortijo Hornillo Route (december)
		P2.2. Leisure	P2.2.1. Weekend in the Alpujarra with friends P2.2.2. Pending readings P2.2.3. Movies / theater pending
		P2.3. Others	P2.3-Christmas gifts

Figure 2. Example of the use of a master list.

GENERAL MASTER LIST				
Task	Subtask (only if decomposition by size is required)	Associated objective or goal (Although it is not mandatory, try to ensure that the tasks have an associated objective or goal from your list).	Priority	Comments (free field)
Arrange all-risk insurance			Important	
Look at hiking boots		P2.1	No-priority	The current ones are still good I can wait
Review GDI delivery		AL4	Important	For the return from Easter
Prepare IPN CV		AL5	Important and urgent	

Figure 3. Example of a weekly agenda.



4. Results and conclusions

In general, the experience has been very satisfactory. Thanks to the research, it has been possible to integrate the transversal competencies (detailed in the introduction) within the subjects as opposed to the current model, in which they appeared complementary. Generally speaking, it can be concluded that the students have been quite participative. Obviously, it is important that students have some type of motivation for their participation that is reflected in their final mark for the subject.

Regarding competence in time management, the students think that fewer activities would be desirable to reduce the workload. The participation of the students has been uneven, despite having a small percentage in the final grade for participating in this experience. Of the participating students (65%), it can be concluded that 68% perceive that they have improved their competence despite a specific dispersion of opinions. Student participation can be divided into three groups: those who have not carried out the activities; others who have carried them out, but only for the sake of the file and without really paying attention; and a third group who have shown interest, regardless of what they have achieved.

Overall, the experience seems positive, although it is important to be careful not to overload the students with too many additional tasks that overwork them with labor by adding additional tasks to the ones they already have to do in the continuous assessment activities of the subject.

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TELEREHABILITATION: CURRENT STATUS FROM THE PERSPECTIVE OF TWO ERASMUS+ PROJECTS

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Abstract

Online rehabilitation has gained popularity during the COVID-19 pandemic and due to many advantages for both the therapist and the patient, it seems to be accepted as a valid and widely implemented method, but most countries were found unprepared for the digital management of online medical services. The present paper presents new approaches for online rehabilitation in the framework of two Erasmus+ projects, particularly through building digital education readiness, development of digital competencies, and strong cooperation between the world of education, digital technology providers, and the world of work. This was achieved by the development of a theoretical course, case studies, a database of standard protocols for rehabilitation and prevention in different pathologies, and a virtual medical environment that functioned as an online rehabilitation clinic. The methodology for delivering project outputs was tailored to the target group's needs. The proposed adaptations were first tested by the project team and by a group of trainees and patients. We registered 511 users on the e-learning platform and 87% of the beneficiaries reported improved skills for telerehabilitation. The prophylaxis videos posted on the YouTube channel targeting patients, professionals, and the public at large reached 1355 views by the end of the project. Of the interviewed patients, 92,3% considered that the online rehabilitation protocols would be useful in daily life for the long term, 95% considered that the use of online protocols would decrease the number of visits to the doctor and 98% would like to benefit from protocols in the future. From the perspective of these projects, we can conclude that online rehabilitation services represent a contemporary problem-solving idea for physiotherapists' education and professional development.

Keywords: *Online rehabilitation, virtual clinic, physiotherapy education.*

1. Introduction

Rehabilitation is an essential part of universal health coverage. The World Health Organization estimated that 2.4 billion people are currently living worldwide with a health condition that may benefit from rehabilitation. The need for rehabilitation is largely unmet and in some low- and middle-income countries, more than 50% of people do not receive the rehabilitation services they require (WHO,2024).

Within e-health, telerehabilitation is a field with great applications in different pathologies and encompasses the delivery of various services via different information and communication technologies (Muñoz-Tomás et al, 2023). From the available evidence, there is moderate-to-good quality consistent evidence to indicate that telerehabilitation may be as effective as usual care (Appleby et al., 2019). The main advantages include equal access for patients from remote areas, lowering costs for transportation, better adherence to the treatment, and better satisfaction of patients (Cotrell et al, 2017).

The World Confederation for Physical Therapy (WCPT) and the International Network of Physiotherapy Regulatory Authorities (INPTRA) produced a report in 2020 on digital physiotherapy practice and offered several recommendations. Beginning with entry-level education, physical therapists must develop competencies required for digital practice and post-entry-level opportunities must be provided to ensure that practicing physical therapists also have opportunities to develop digital practice competencies and practice.

A study conducted by Seçer and Tosun in 2022 regarding the evaluation of telerehabilitation knowledge, awareness, and opinions of physical therapy professionals and rehabilitation students indicated that the majority of the respondents stated that even if the topic is of great interest, they were not prepared for telerehabilitation due to the lack of lesson curriculum. Currently, according to existing research, the main needs in telerehabilitation are the inclusion of it in health curriculums in higher education and the development of cost-effectiveness and implementation trials, especially in low- and

middle-income countries where access, investments, and digital health literacy are limited (Baroni et al, 2023).

The present paper presents new approaches for online rehabilitation in the framework of 2 Erasmus+ projects aiming to spread knowledge and practical skills about online patient rehabilitation, for physiotherapy professionals, physiotherapy students, and patients.

The first project entitled "Development of digital skills for online rehabilitation therapies" intended to enhance the theoretical knowledge, skills, and competencies regarding telerehabilitation for physiotherapy professionals and to train this group to use resources to develop digital skills as needed by the labor market.

The second project entitled „Modernization of physiotherapy education for Bachelor Degree in WB countries through Innovative Ideas and Digital Technology”, aims to support the telerehabilitation curriculum development, cooperation, and knowledge transfer according to Higher Education modernization Agenda and through Innovative Ideas and Digital Technology.

2. Methods

The methodology for delivering e-KINE project outputs was tailored to the target group's needs and to the foreseen deliverables. From the medical perspective, we intended to train physiotherapists and students for the management of online-patient rehabilitation, including online assessment (posture, range of motion), and patient-centred approaches. To cover these aspects, we developed several databases with standard online protocols specially designed to be adapted to the patient's needs. For each protocol, there is a text description and a correspondent video. This enabled the user to watch the procedure that is presented in the text and ensure a better connection between knowledge and skills development. Due to ethical and deontological reasons, the videos were restricted with a password. An Ethics Advisory Board was the guardian of the correct governance practices which reviewed at regular intervals

From the technical perspective, we intend to help the target groups to acquire theoretical and practical knowledge in order to develop digital skills to work in the online environment. This included providing information on actual e-health approaches with main benefits and limitations so they can choose the best one and offering basic knowledge needed for the development of an online rehabilitation unit (how to develop and manage patient database, how to develop and manage communication with patients and other medical professionals; data protection and ethical considerations, legislation in each country, payment, promoting the business) by the development of an e-course entitled "Contemporary Applications of IT for online rehabilitation services",

The delivered educational materials were included in an interactive e-learning platform based on open-source software Moodle and suitably customized and optimized to include interactive tools to present medical images, video files etc. giving opportunity to develop video conferencing, track results of the training, learner performance, users activity and grades, assigning homework, upload and manage documents in different formats: Audio, Video, HTML, Text, rich text, .zip, .pdf; Track statistics

The training path prototype (environment and content) was tested internally by all project team members and by a group of trainees and patients (iterative and formative evaluation) with feedback to identify potential changes that were incorporated into subsequent forms.

As a pilot study for all the training materials and online approaches, a virtual space was developed, aiming to offer complete and quality services and personalize patient care. The online clinic can be accessed across different operating systems and specialized assistance can be available from laptop or smartphone. Additional built-in features (appointment scheduling, measurement tools, and communication with patients) are also available. Each patient can benefit individually of an assessment session followed by a rehabilitation-guided session with real-time monitoring by a physiotherapist.

Selected indicators of knowledge, attitudes, and practices were measured by questionnaires and surveys addressing the target groups (physiotherapists and students). The perception of beneficiaries' patients & stakeholders about the quality and benefits of services based on SMART scheme was also evaluated.

3. Results

As mentioned before, the partnership developed online courses regarding theoretical aspects of telerehabilitation, a database of standard protocols for rehabilitation and prophylaxis in different pathological conditions, and a virtual medical environment as a pilot application of the e-course.

Quantitative indicators included 8 PPT modules (160 slides), over 300 text pages and 20 case studies (cc. 400 slides); 120 protocols and correspondent videos for online rehabilitation and prophylaxis; 100 hours spent on study; 20 hours for assessment, 3 e-KINE online rehabilitation clinics in RO, BG, TK and 3 curricula on telerehabilitation certified by partners in RO, TK and BG.

As result indicators, we reached 511 registered users of the Project e-platform. The evidence of positive changes attributable to the projects included:

- 88% of participants expected the e-KINE project to enhance their level of knowledge and practical skills necessary for online rehabilitation;
- 95% found the presentations within e-KINE easy to follow, having a level and complexity appropriate to their background and experience,
- 97.8% were interested in learning more about the project.
- 87% improved digital skills for telerehabilitation (according to questionnaires).

Of the interviewed patients (10/country), 92,3% consider the e-KINE protocols will be useful in daily life for the long term, 95% consider that the use of e-KINE protocols will decrease the number of visits to the doctor/kinesitherapist, 98% would like to benefit of e-KINE protocols in the future and 93,4% would recommend the e-KINE project to other persons.

Of the interviewed stakeholders (20/country), 93% of respondents rated as good and very good the e-KINE approaches regarding the achievement of the stated aims of the project, positive changes to previous methodologies, and usefulness of the project results. In the assessment of the sustainability of the activities, 96,7% of respondents rated as good and very good the e-KINE approaches and intend to use the project results within their own organizations, affordability of the project results, ongoing support and development, and willingness to contribute to the future development of the project results.

4. Conclusions

Online rehabilitation services represent a contemporary problem-solving idea for physiotherapists' education and professional development. The educational offer in physiotherapy lacks courses related to digital competencies for online rehabilitation services. The development of sustainable learning tools for lifelong learning will encourage telerehabilitation replication and promote transferability.

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METAPHONOLOGICAL STIMULATION, ALPHABET KNOWLEDGE AND VOCABULARY PROGRAM (PEMAV) FOR PRESCHOOLERS: ELABORATION AND PILOT STUDY

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Abstract

The importance of stimulating cognitive-linguistic skills, vocabulary and metaphonological skills associated with knowledge of the alphabet is described in international literature for subsequent success in learning to read and write, however there is a gap in studies in Brazil to stimulate these skills in early childhood education. Therefore, this study aimed to develop a metaphonological stimulation program, alphabet knowledge and vocabulary (PEMAV) and its applicability in a pilot study with preschoolers. Forty preschoolers aged 5 years and 5 years and 11 months participated in this study, who were divided into two groups, GI (20 preschoolers submitted to PEMA) and GII (20 preschoolers not submitted to PEMA). The results were analyzed using the wilcoxon and chi-square tests and demonstrated positive changes, with domain of cognitive-linguistic skills, knowledge of the alphabet and vocabulary in preschoolers in GI, when compared to GII.

Keywords: *Learning, stimulation studies, preschoolers, reading, literacy.*

1. Introduction

According to Sargiani and Maluf (2018), children need to develop cognitive-linguistic skills during the first 6 years of life, as they will be fundamental for later school success. Among these cognitive-linguistic skills, knowledge of the letters and sounds of the alphabet stands out; metaphonological skills and vocabulary (Andrade, Andrade, & Capellini, 2013; Sargiani & Maluf, 2018).

International studies with preschoolers indicate that the stimulation of metaphonological skills, vocabulary and the alphabetic principle (Goldstein et al., 2017; West et al., 2021) play a very important role in the development of reading and writing skills in the early years of literacy.

Although the importance of stimulating these skills in Early Childhood Education is recognized in international literature, in Brazil there is a gap in studies with these skills integrated into the knowledge of letters for this age group.

2. Objectives

This study aimed to develop a metaphonological stimulation program, alphabet knowledge and vocabulary (PEMAV) and its applicability in a pilot study with preschoolers, aged 5 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 68360023.8.0000.5406. The study was divided into two phases:

Phase 1: The choice of activities for developing the stimulation program was based on studies by Goldstein et al. (2017); West et al., (2021). In this phase, linguistic stimuli were selected corresponding to different semantic classes, giving rise to the main themes of the program, which were grouped into 5 thematic boards: Getting to know animals, Holidays at the beach, A day at school, Playing in the room and Walking at the fair. The thematic boards were created with the distribution of 4 main cards with pictures that represented the theme's vocabulary, which increased cumulatively until a total of 20 cards were

presented. Each main card of the thematic boards was composed of 3 more alliteration cards and 3 rhyme cards. Thus, the program consisted of 25 boards and 700 figures, with 140 figures presented per specific theme.

Phase 2: 40 preschoolers enrolled in two municipal Kindergarten, aged 5 years to 5 years and 11 months, participated in phase 2 of this study. These preschoolers were divided equally into 2 groups: Group I (GI): composed by 20 preschoolers submitted to PEMAV and Group II (GII): composed by 20 preschoolers not submitted to PEMAV.

All preschoolers went through the same assessment procedures in pre- and post-testing situations, the version adapted for Early Childhood Education of the IPPL – Protocol for Early Identification of Reading Problems (Queiroga, Rosal, Braga, Melo, and Capellini, 2023) and the Vocabulary Test (TIN) (Seabra, Trevisan &, Capovilla, 2012).

The results of this pilot study were analyzed using the SPSS V26 software (2019) with the application of the Wilcoxon test and Chi-square to compare the variables between the groups in pre- and post-testing situations. The statistically significant value is described with an asterisk in the tables.

4. Results and discussion

Table 1 presents the comparison of the performance of preschoolers from GI and GII in pre- and post-testing situations in the skills assessed in the adapted version of the IPPL (Queiroga, Rosal, Braga, Melo, & Capellini, 2023).

Table 1. Distribution of the mean, standard deviation and p-value of the performance of preschoolers from GI and GII in pre- and post-testing situations.

			N	Average	Standard Deviation	P-value
Alphabet knowledge (AK)	GI	Pre	20	12,95	7,96	<0,001*
		Post	20	16,15	7,23	
	GII	Pre	20	12,75	7,71	0,006 *
		Post	20	14,45	7,59	
Rhyme Identification (RI)	GI	Pre	20	2,9	4,68	<0,001*
		Post	20	10,2	6,25	
	GII	Pre	20	3	5,35	0,057
		Post	20	4,45	5,88	
Rhyme Production (RP)	GI	Pre	20	0,4	0,94	<0,001*
		Post	20	9,05	5,74	
	GII	Pre	20	0,25	0,79	0,027 *
		Post	20	1,5	3,17	
Syllabic Segmentation (SSEG)	GI	Pre	20	13,05	8,62	0,001*
		Post	20	19,3	3,01	
	GII	Pre	20	16,9	4,85	0,34
		Post	20	15,8	6,23	
Word Production based on initial phoneme or syllable (WP)	GI	Pre	20	7,15	5,05	<0,001*
		Post	20	15,4	5,06	
	GII	Pre	20	6,35	4,22	0,001*
		Post	20	8,9	5,38	
Syllabic Synthesis (SSYN)	GI	Pre	20	14,5	5,08	<0,001*
		Post	20	19,4	1,23	
	GII	Pre	20	17,1	4,68	0,232
		Post	20	17,15	5,79	
Initial Sound or syllable Identification (ISI)	GI	Pre	20	9	7,73	<0,001*
		Post	20	14,1	8,09	
	GII	Pre	20	12,45	9,08	0,043*
		Post	20	10,75	8,9	
Phonological Working Memory (PWM)	GI	Pre	20	17,8	3,16	0,001*
		Post	20	20,4	3,08	
	GII	Pre	20	18,85	2,76	0,632

Papid Automatized Naming (RAN)	GI	Post	20	18,65	3,17	0,015*		
		Pre	20	50,2	13,64			
	GII	Post	20	43,95	7,61			
		Pre	20	50,85	17,23		0,408	
	Correct Automatized Naming (CAN)	GI	Pre	20	30,8		4,91	0,010*
			Post	20	33,65		1,6	
GII		Pre	20	31,95	3,94			
		Post	20	31,7	3,81	0,520		
Silent Reading (SR)		GI	Pre	20	2,75	1,33	0,001*	
			Post	20	5,05	1,39		
	GII	Pre	20	4,1	1,77			
		Post	20	4,1	2,05	0,953		
	Hearing sentence Comprehension (HC)	GI	Pre	20	11,65	3,20		<0,001*
			Post	20	14,95	3,07		
GII		Pre	20	12,75	2,84			
		Post	20	13,90	3,70	0,134		

The table 1 showed statistically significant difference in the pre and post-test comparison in all skills of the adapted version of the IPPL in GI, while in GII there was an increase in performance in only 3 skills. The comparison of the performance of preschoolers from GI and GII in the TIN vocabulary test (Seabra et al, 2012) in terms of classification in pre and post-test situations showed statistically significant difference for the GI in terms of classification. This effect was not observed in GII.

The findings of this study confirm the importance of stimulating phonological awareness in the last year of early childhood education, being considered a fundamental skill for entry into the 1st year of literacy (Queiroga et al., 2023).

5. Conclusion

In this study, it was possible to develop a stimulation program for preschoolers aged 5 years to 5 years and 11 months and observed the impact in the preschoolers of GI when compared to GII in domain of cognitive-linguistic skills stimulated.

In this way, we can conclude that the Metaphonological Stimulation, Alphabet and Vocabulary Knowledge Program (PEMAV) developed was effective and will be applicable in the educational context.

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MOBILE INFORMATION TECHNOLOGIES AS A KEY FACTOR OF MODERN LEARNING POLICIES

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Abstract

Over the past few decades, modern information and communication technologies, education and science have become tightly related. As a result of their symbiosis, numerous innovative forms and methods of learning, grading and teaching making active use of the new opportunities provided by contemporary mobile technological solutions have emerged. Mobile technologies and learning are the subject of the present paper introducing an „Information portal for mobile learning and mobile access to library services and resources“. The portal has been created as part of the completion of an eponymous research project financed by the National Science Fund of the Ministry of Education and Science in Bulgaria after winning a Competition for young scientists and postdocs' fundamental scientific research funding. The main aim of the project is to systematically analyze the issues of mobile learning and mobile access to library services and resources to achieve, assemble and present new scientific knowledge and products in a common information internet portal revealing and summarizing the positive changes brought about by information technologies in modern society. The following scientific methods have been used in order to fulfil the above-mentioned aim of the project and the tasks related to it: analysis and synthesis, systematization and summarization of document resources, comparison, modelling for the creation of the conceptual model of the information portal. Both the completed project and the present paper highlight that mobile technologies are of great significance for modern information and educational policies and contribute to promote awareness of their implementation in learning approaches.

Keywords: *Mobile digital libraries, mobile learning, mobile technologies, research project, education.*

1. Introduction

Modern information technologies, in particular mobile information technologies (MIT), are now an indispensable part of modern learning policies. The ubiquitous advent of mobile technologies into every sphere of public life opens up new opportunities for development and optimization. From the point of view of modern information processes, the effective inclusion of mobile technologies in the spheres of education, science, access to information and library activity is inevitable.

In January 2022, the International Federation of Library Associations and Institutions (IFLA) published the IFLA TREND REPORT 2021 UPDATE. Three of the main trends identified in the report directly relate to mobile digital libraries and mobile education, which are the focus of our attention:

- **Virtual is here to stay** – people continue to prefer to access library services remotely, putting into question the value of spaces and physical offerings.
- **A mobile population** – with people ever more nomadic, the concept of a “local” library becomes less relevant, and the need to provide joined-up services across borders rises.
- **A single, global collection** – with digitization of resources and possibilities to work across institutions, it is no longer so relevant to talk about local collections, but access to universal resources (IFLA, 2021).

These trends in the development of the global information environment once again prove the need to include mobile technologies in new information and educational policies, so that educational and cultural institutions can meet the current reader needs of the “mobile population” and adequately respond to changes in the modern digital information environment.

It is the symbiosis between mobile technologies and the educational and information sphere that is the research field in which the research team of the project in this paper works. On the basis of the conducted research and the carried out approbation activities, we came to the justified assumption about the following advantages of MIT in education:

- **Accessibility:** students can study from anywhere and at any time;
- **Personalization:** these technologies can be adapted to the individual needs of each student;
- **Interactivity:** they offer multiple interactive tools that engage students in the learning process;
- **Collaboration:** facilitate collaboration between students, teachers and the public;
- **Motivation:** the learning process is more fun and more motivating for students.

2. Research project “Information portal for mobile learning and mobile access to library services and resources “– main goal and methodology

The project "Information portal for mobile learning and mobile access to library services and resources" was developed by a team of researchers from the University of Library Studies and Information Technologies - Bulgaria. This project won funding in the Competition for financial support for projects of junior researchers and postdocs, organized by the National Science Fund at the Ministry of Education and Science of the Republic of Bulgaria, led by Assist. Prof. Elisaveta Tsvetkova, PhD.

The main goal of the project is to systematically study the issues related to mobile learning and mobile access to library services and resources, both in Bulgaria and in other European countries, to reach new scientific knowledge and products united and presented in a common informational Internet portal, through which to reveal and summarize the positive changes that information technologies cause in modern society in terms of new opportunities for access to learning and information, through the active role of mobile digital libraries, whereby to increase the interest and spread of these forms of information in the educational, scientific and cultural spheres.

3. Information portal – a major applied contribution of the research project

The most valuable scientific and applied contribution of the described project is the creation of the first Bulgarian thematic information portal for mobile learning and mobile digital libraries, freely available in the Internet space, with the title “Information portal for mobile learning and mobile access to library services and resources”. The activities for the creation of the portal began with research, analysis and synthesis of information with the aim of creating 5 information databases to be the basis of the information portal. The study, analysis and systematization of documentary sources, Internet resources, scientific literature on the developed topic, the search for good practices at home and abroad began with the launch of the project and was carried out throughout the entire period of its implementation. The publications on the topic in the world information bases Scopus, Web of Science, ScienceDirect, in the publishing catalogs of renowned global publishing companies such as “Rowman & Littlefield”, the websites of numerous libraries and universities were thoroughly studied. Much of the valuable information discovered was found on the websites and e-libraries of international organizations such as UNESCO, the International Association for Mobile Learning: IamLearn, the International Federation of Library Associations and Institutions (IFLA), the American Library Association, etc.

As a result of the systematic search for information on the subject of the project, the following 5 main information databases with their own sub-bases were systematized:

- **Information database:** Mobile digital libraries:
 - **Bulgarian mobile digital libraries:**
 - Bulgarian public mobile digital libraries
 - Bulgarian university mobile digital libraries
 - **Foreign mobile digital libraries:**
 - Foreign public mobile digital libraries;
 - Foreign university mobile digital libraries;
- **Information database:** Projects and initiatives in the field of mobile learning;
- **Information database:** Institutions - leaders in the field of mobile libraries and training;
- **Information database:** Scientific forums related to mobile digital libraries and mobile learning;
- **Information database:** Normative documents and policies:
 - **In Bulgarian;**
 - **In English.**

The systematized information databases were included as the main structural elements in the information portal created under the project for the promotion of mobile learning and mobile digital libraries.

A few months after the start of the project, the website “Information portal for mobile learning and mobile access to library services and resources” was created and information about the goals,

methodology and expected results of the project was uploaded. Gradually, the information is expanded and enriched. In its final version, the information portal provides information on:

- The University of Library Studies and Information Technologies (ULSIT) - the leading institution of the project;
- the team working on the project;
- the objectives, methodology, relevance and expected results of the project implementation;
- a complete bibliographic list of the publications realized in implementation of the project - 14 scientific papers published in refereed scientific publications, indexed in Web of Science and 13 scientific papers published in other refereed scientific publications - a total of 27 papers presented at 9 international and 7 Bulgarian scientific forums;
- the electronic version of the monograph “Information, Libraries, Education. Application of modern mobile technologies” authored by Elisaveta Tsvetkova (Tsvetkova, 2022);
- a gallery of photos from the final seminar on the project;
- the five information databases that provide an opportunity for easy and convenient access to systematized information in the field of mobile library and information services and mobile learning (Information, 2024).

The creation of an information portal for the promotion of mobile learning and mobile digital libraries increases the opportunities for public awareness and creates prerequisites for the wider application of the latest achievements of information and communication technologies to improve access to information and knowledge, for the socialization of Bulgarian literary culture heritage preserved in library institutions to stimulate scientific research in the field and to preserve the cultural identity of society.

4. Conclusion

Mobile technologies are of key importance for the quality provision of educational services in the conditions of the digital age. Based on them, the following policies are defined to promote their use in education:

- **ensuring access:** all learners must have access to mobile devices and the Internet;
- **teacher training:** teachers must be prepared how to use MIT in the teaching process;
- **quality content development:** quality content should be developed specifically for mobile devices;
- **ensuring cyber security:** it is important to take measures to ensure the cyber security of the educational process when using MIT.

The focus of modern education is on digital forms to provide quality, diverse and quickly accessible information (The World, 2024; UNESCO, 2024). The common vision and shared efforts of the world’s information providers to deliver and maintain digital and mobile access to their information resources is an adequate response to the modern educational and scientific reality characterized by extremely rapid technological development offering many innovative opportunities, with a new type of information users looking for the fastest and easiest access to quality resources from anywhere and anytime, with multiple up-to-date information sources creating a highly competitive information environment (OER, 2024; Coursera, 2024). Combining knowledge and information with new digital technologies is a key factor in modern education policies and today’s globalized and networked society. Mobile information technologies are and can be a powerful tool for improving the learning process, but it is important to use them in an appropriate way.

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DEVELOPING EDUCATIONAL TOOLS FOR EFFECTIVE TEACHING INDUSTRIAL ROBOTICS IN TWO- AND FOUR-YEAR DEGREE INSTITUTIONS

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Abstract

Experiential learning is a crucial component of effective education methodology, allowing students to apply theoretical knowledge gained in classrooms to real-world scenarios. The industrial robotics curriculum is very common in two- and four-year institutions due to the high demand for specialists in the field. However, due to the high cost of the hardware and limited options for prebuild end-effectors that can be implemented in the educational environment, custom solutions for various end-effectors must exist. Michigan Technological University has an advanced industrial robotics curriculum in the Mechatronics program. In this paper, the authors provide details on the design, development, and implementation of the custom vacuum end-effector developed for palletizing purposes.

Keywords: *Robotics, end-effector, experiential learning, mechatronics.*

1. Introduction

Experiential learning is a crucial component of effective education methodology, allowing students to apply theoretical knowledge gained in classrooms to real-world scenarios. It bridges the gap between theory and practice, providing a more holistic understanding of electrical engineering concepts. Experiential learning provides students with hands-on opportunities to develop critical skills, making them better prepared for the challenges they may face in their careers. Michigan Technological University has an advanced industrial robotics curriculum in the Mechatronics program. In this paper, the authors provide details on the design, development, and implementation of the custom vacuum end-effector developed for palletizing purposes. The study aims to identify and analyze the design considerations of foam vacuum grippers, providing a research-based model tested in a production setting. The research-based model focuses on three vacuum maintenance methods: check valve grippers, port metered grippers, and foam valve grippers. The chosen method, port metered gripper, balances cost-effectiveness, manufacturability, and performance. Foam vacuum grippers are used in industry for a wide variety of tasks. Their design allows them to handle most objects that have at least one mostly flat surface. Foam vacuum grippers work by creating a high flow low pressure vacuum over a large area, then placing a sheet of specially engineered Ethylene Propylene Diene Monomer (EPDM) foam on the vacuum surface. The sheet of foam allows for the gripper to conform to the contours of the part(s) being handled. Most commonly, foam vacuum grippers are used for palletizing operations.

An ideal foam vacuum gripper is designed for pick and place operations where the products are located in a flat plane with respect to each other. Additionally, an ideal gripper design allows product(s) to be handled even if they do not cover the complete surface of the gripper. In the event where a product does not completely cover the gripper's vacuum ports, there needs to be a way to maintain vacuum to handle the product. The three most common gripping technologies of vacuum maintenance are check valve grippers port metered grippers, and foam valve grippers (JOULIN, n.d.). There are advantages and disadvantages to each method. The check valve gripper (JOULIN, n.d.) is capable of maintaining a very high vacuum when there are uncovered ports, because the vacuum flow closes the check valve when the port is uncovered. However, it has many moving parts making it more expensive to manufacture and cannot be inverted as the check valves will block the air flow. Port metered grippers (JOULIN, n.d.) have no moving parts and limit airflow with small orifices. Yet, require the product to cover more than half the surface for handling, because the design will have a continuous vacuum leak from uncovered ports. Foam valve grippers (JOULIN, n.d.) have smaller ports in the foam that are used to limit air flow. When these ports are not covered the vacuum flow pulls the small foam ports closed giving it the effect of a check

valve, but it has the advantage of functioning inverted, where a check valve gripper cannot. However, the foam valve gripper requires a relatively high airflow to close the orifices. It should also be noted that both port metered, and foam valve grippers have very small orifices that can be clogged by debris and prevent vacuum, a check valve gripper on the other hand can pass larger debris and as a result can be used in more rugged environments.

The vacuum limiting method chosen for the research-based model design, development and implementation for this graduate student project was the port metered gripper. This is due to the check valve gripper being too complex to manufacture and out of budget for the project. The foam valve Gripper was a desired candidate but proved to be difficult to source. As the foam gripper replacement foam suppliers did not manufacture foam with small enough vacuum ports to function as foam valves. The port metered gripper on the other hand could be manufactured using the universities 3D printing and metal machining facilities, as seen in Figure 1.

Figure 1. Manufacturing Processes: CNC Mill Machining and 3D printing.



The system is constructed around a FANUC CERT Cart which employs an LR-MATE 200iD robot. The gripper's pneumatic system consists of the research-based gripper model, a venturi vacuum generator, and a digitally controlled pneumatic directional control valve. The supply pressure, is controlled by a directional control valve that is actuated by a digital output on the robot controller, is set to 60 PSI. When the pressure is allowed to flow through the directional control valve it enters into a venturi vacuum generator which uses the pressurized air to create a low-pressure high flow vacuum. The vacuum outlet of the venturi is connected to the foam gripper that is attached to the end of the robot.

2. Design

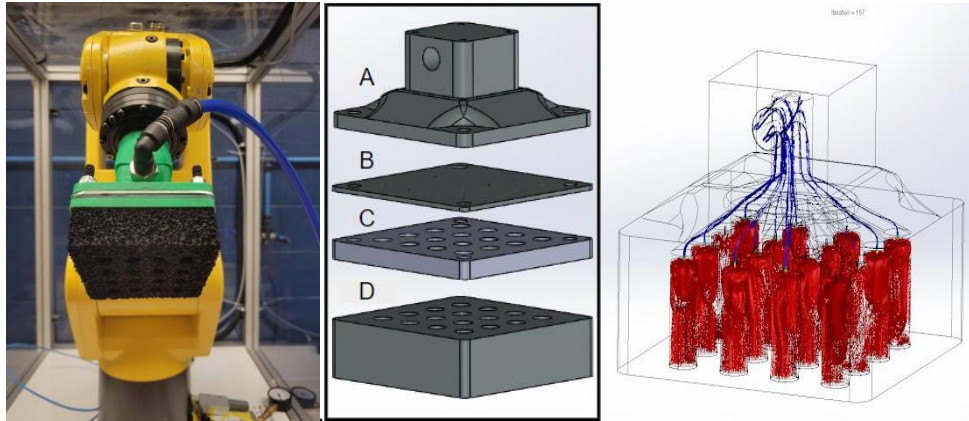
There are ten components that make up the vacuum gripper. These components are made up of various materials including polylactic acid (PLA), 6061-T6 aluminum, specialized engineered foam and various bonding adhesives. The main body is made up of PLA, 3D printing would allow for a lighter part and also allow a more complex structure. The orifice plate is made up of 6061-T6 aluminum, a CNC mill was used to properly locate the 0.5 mm holes in the plate. Several different plates with different size offices were tested in order to select the best fit for production. It was determined that the best size orifice for this gripper was 0.5 mm in diameter. The foam used was ordered from Millibar Robotics, this foam is a specialized foam used for robotic vacuum grippers. There are four grade 8 M-8 bolts that hold the assembly together which makes it easy to disassemble the gripper to make simple design changes. There is a coating of rubber gasket on each side of the orifice plate, this is to ensure there is no air leakage throughout the gripper assembly. The max payload at 100% coverage was calculated to be 1.25 Kg, at 75% coverage it was 0.48 Kg, and at 50% it was 0.01 Kg. Additionally, a computational fluid dynamics (CFD) simulation, shown in Figure 2, was conducted to analyze the air flow through the gripper. The environmental pressure is shown in red and the vacuum flow streams are shown in blue, it can be seen that there are no obstructions to the flow.

3. Fanuc robot programming and production

Several programs have been created to achieve palletizing function utilizing the developed soft vacuum end effector. The team tested several objects to palletize cardboard and foam boxes, breadboards, and 3D printed apples. To handle each type of parts, individual programs were created and successfully run in production. The overall results followed the initial expected outcome of the vacuum foam gripper.

The decisions of material choice and gripper choice proved to be successful and superior to other options. The CFD proves that the design and testing worked as advertised. The robotic workcell before and after palletizing processes is shown in Figure 3. Various objects have been picked from the floor and palletized in the cardboard container.

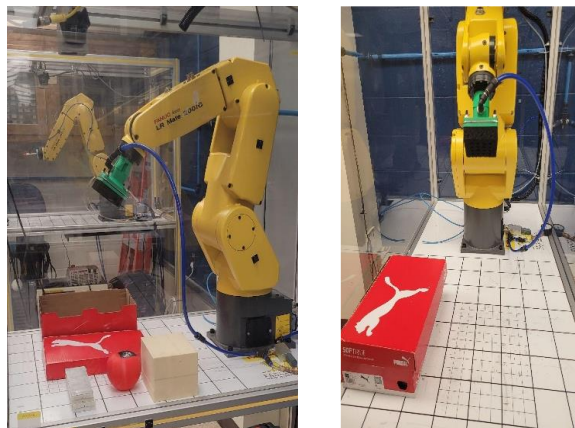
Figure 2. Gripper Design and Construction Features. A) Main Body (Polylactic Acid (PLA)), B) Orifice Plate (6061-T6 Aluminium Plate), C) Mounting Plate (Polylactic Acid (PLA)), D) Engineered Foam (Ethylene Propylene Diene Monomer. Right picture shows CFD Simulation Results.



4. Conclusion

Despite the challenges and limitations faced in this research, the project contributes valuable insights to the field, laying the groundwork for future developments in foam vacuum gripper technology. It was concluded that at least half of the grippers foam must be covered to get the proper vacuum force to lift items. The majority of this issue was alleviated after installing an orifice plate with smaller orifices and a venturi vacuum generator. Also, the versatility of the vacuum gripper is superior to suction cup grippers. Foam vacuum grippers can be used in a larger range of applications than a suction cup gripper. The foam gripper is also less sensitive to deformation and porosity than conventional suction cups. The findings presented herein provide a basis for further exploration, encouraging future research endeavors to refine and expand upon the capabilities of foam vacuum grippers in industrial settings. As industries increasingly adopt automation and robotics, the knowledge gained from this project becomes instrumental in enhancing the efficiency and versatility of gripper technology. The details provided in this article will allow other schools around the world to build and incorporate in the robotics and mechatronics curriculum the proposed end-effector expanding experiential learning opportunities to the students.

Figure 3. Robotic Workcell before and after Production.



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POST-COVID-19 PANDEMIC ONLINE EDUCATION IN LATIN AMERICA: A SYSTEMATIC REVIEW OF LITERATURE

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Abstract

The COVID-19 pandemic has forced higher education institutions to implement virtual education activities without being prepared for it, which has represented a challenge for the traditional educational model. This has been exacerbated in higher education institutions in Latin America, as they do not have the adequate resources and infrastructure for this purpose. The objective of the study was to identify trends in research on online education in Latin America in the wake of the COVID-19 pandemic. To achieve the research objective, a systematic literature review was carried out. Documents published in the Scopus database between 2008-2023 were analyzed using the Biblioshiny and VOSviewer software. Forty-seven documents have been found, of which 40 were published in the period 2019-2023. The keywords have been analyzed according to their co-occurrence. Three hundred and seventy-six were found and forty-seven have been selected with a minimum of two co-occurrences. The documents have been associated into four clusters, which have been analyzed. The results have pointed out the impact on university education during and after the pandemic in Latin America. Online education has continued after the pandemic, which has allowed new forms of learning to be exploited. Distance learning has made it possible to access higher education to sectors of the population that traditionally could not join it, due to the geographical and economic characteristics of Latin American countries. Challenges are noted in the creation of infrastructures and processes that allow this teaching method to be promoted.

Keywords: *Online education, virtual education, e-learning, COVID-19, Latin America.*

1. Introduction

Universities experienced an unprecedented shift from traditional face-to-face teaching and learning to online learning in response to the COVID-19 lockdown (Marinoni et al., 2020). Particularly, many universities in Latin America are experiencing a serious lack of resources that has plunged them into a deep financial crisis and the COVID-19 pandemic has increased this calamity (Quispe-Prieto et al., 2021). More than 160 million students from Latin America (LATAM) and the Caribbean were affected (Bárcena & Uribe, 2020). The authorities of educational institutions initiated online learning strategies through virtual online learning environments, which has been called “emergency remote teaching” (Barbour et al., 2020). Although many higher education institutions already had virtual learning environments, which were used for face-to-face teaching, the challenge for teachers was to provide adequate teaching materials through e-learning tools that kept students highly engaged (Tadesse & Muluye, 2020). On the other hand, students also faced obstacles of the digital divide to access technology and relevant digital tools, considerably affecting learning. Access to the Internet and optimal electronic devices are just some of the challenges they faced (Litchfield et al., 2021).

2. Design

To achieve the stated research objective, a Systematic Literature Review (RSL) was carried out, an adaptation of that proposed by Tranfield (2003).

3. Objectives

The objective of the study was to identify trends in research on online education in LATAM in the wake of the COVID-19 pandemic.

Acknowledgment

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CHALLENGES AND OPPORTUNITIES IN FACULTY TRAINING ON ACTIVE LEARNING TO DELIVER CRITICAL THINKING FOR UNDERGRADUATE BIOLOGY STUDENTS

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Abstract

Compared to traditional lecturing, active learning (AL) provides a more effective way to achieve higher cognitive levels in all areas of science, technology, engineering, and mathematics (STEM). Paradoxically, in many universities worldwide, training of faculty in STEM fields on AL is very limited or completely absent and lecturing remains as the most commonly used instruction method. We developed an unbiased training program for biology faculty on evidence-based AL tools and supervised the planning and implementation of activities to assess critical thinking in undergraduate biology students. We present preliminary data on faculty perceptions and expectations of this training program. Particularly, we report that 90% of faculty members involved in the training either did not know or did not have the tools to implement AL in their courses. Furthermore, we report on the challenges, obstacles, limitations, and strategies that faculty experience after participating in the program.

Keywords: Active learning, undergraduate education, STEM, faculty training.

1. Introduction

In 1956, Bloom and Kratwohl proposed a conceptual framework to design learning objectives for increasing cognitive levels (Bloom and Kratwohl, 1956). Achieving top cognitive levels in this framework is essential for higher education in STEM fields, where students are expected to acquire skills such as scientific reasoning, abstraction, and critical thinking (Bailin, 2002). Scientific evidence has shown that these skills are much more easily achieved through active and student-centered practices rather than traditional lecturing (Handelsman *et al.*, 2007). Active Learning (AL) is a student-centered model of learning that engages students in self-reflection, discussion, writing, and/or problem-solving activities (Prince & Fedler, 2007). In several studies and meta-analyses, AL has been shown to improve student performance (Freeman *et al.*, 2014), reduce the gap for underrepresented students (Theobald *et al.*, 2020), and even improves mental and emotional health among students (Ribero-Silva *et al.*, 2022).

Despite that AL is beneficial for students, teaching innovations towards AL methodologies are still not widely adopted (Miller *et al.*, 2008), particularly in STEM courses with rich conceptual contents such as genetics or anatomy. One of the reasons why AL methodologies are not widespread in undergraduate STEM education is the lack of faculty training (Umbach & Wawrzynski, 2005; Nguyen *et al.*, 2021). A study by Andrews *et al.* (2011) found that faculty participation in professional development increased the use of AL, suggesting that access to resources can improve the likelihood that faculty will implement them in their courses. In Mexico's main university, Universidad Nacional Autónoma de México (UNAM), traditional lecturing remains a common practice in STEM teaching, despite efforts of faculty professionalization programs (Sánchez Mendiola *et al.*, 2019). We implemented an AL training program for biology faculty at UNAM to improve critical thinking skills in an undergraduate genetics course. Here, we report on the perceptions of the faculty participating in this training program.

2. Methods

We invited a group of faculty members teaching a Genetics course for second-year biology students at UNAM to participate in a program that involves: (1) To take an intensive workshop on AL

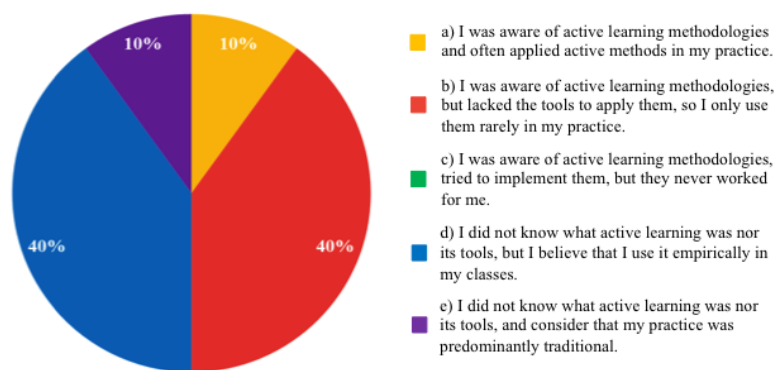
concepts and skills. The workshop provides participants evidence-based tools and confidence to implement AL strategies effectively in their classrooms using hands-on activities and discussions including problem-solving tasks, case studies, peer discussions, and interactive demonstrations; (2) To participate in weekly consultation sessions to design, and effectively deliver at least one highly-structured AL module in their courses; (3) To evaluate students with an instructor-blind critical thinking assessment. The evaluation of students' critical thinking is still in progress and will be reported in a follow-up study.

In order to evaluate the perceptions of faculty participating in this program, we designed a survey to identify prior experiences as well as the challenges, obstacles, limitations, and strategies that participants faced when implementing AL methodologies in their teaching practices. While sample size in this study is relatively small ($n=10$), it reveals key points for identifying areas for improvement and developing strategies for faculty professionalization in evidence-based teaching.

3. Results and discussion

The survey revealed that most (90%) of the faculty participating in this study did not have the concepts and/or tools to implement AL (Figure 1, blue, red, and purple). While the sample is too small to generalize this result, we found it deeply concerning that most participants reported having no prior training or practice on evidence-based teaching, confirming that the lack of appropriate faculty professionalization on innovative teaching methods is a barrier to effective learning (Sánchez Mendiola *et al.*, 2019; Nguyen *et al.*, 2021). The fact that 40% of participants consider employing AL empirically (Figure 1, blue) suggests that they already find AL engaging, exciting, and/or useful for their students.

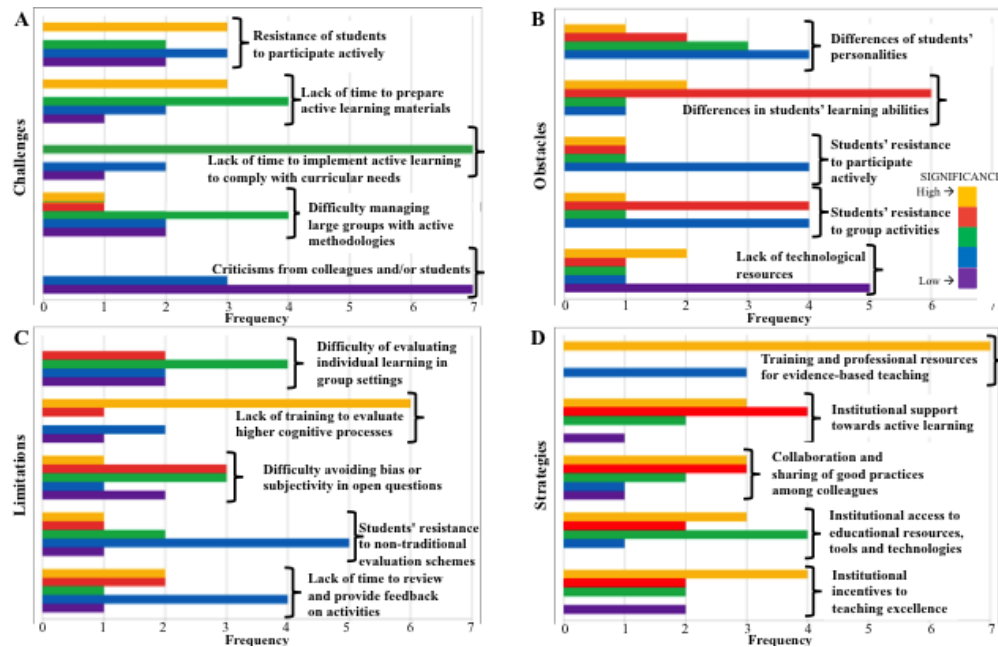
Figure 1. Faculty members' experiences with AL prior to their participation in the program. $n=10$.



We then asked participants to rate among different *challenges*, *obstacles*, *limitations*, and *strategies* that they have encountered when implementing AL in their teaching practice following the training program. The answers are presented using a rainbow colormap, ranging from yellow, if they consider the statement highly significant, to purple, if they consider the statement poorly significant (Figure 2). Among the *challenges*, survey participants rated student resistance and preparation time as the most significant items (Figure 2A). Overcoming student resistance to active participation may require strategies such as clearly communicating the benefits of AL, fostering a supportive and inclusive classroom environment, and gradually introducing AL techniques to help students become more comfortable with them over time (Fedler, 2007). Addressing the time constraints for preparation could involve providing teachers with additional support for designing and implementing AL in their classrooms; these tools are becoming more readily available as artificial intelligence tools will become more familiar among faculty. In addition, collaboration among faculty members and sharing can also help alleviate the burden of preparing evidence-based resources. Differences in learning abilities were reported as the most significant *obstacle* among survey participants (Figure 2B). This possibly arises from the high diversity of backgrounds, learning styles, and prior knowledge levels of undergraduate students in Mexico City. To address this obstacle, faculty members require training to accommodate various learning preferences and abilities. Additionally, providing support and resources to help students navigate these differences may enrich the effectiveness of AL approaches in diverse classrooms (Theobald *et al.*, 2020). Among the *limitations*, the most significant item was the lack of training to develop evaluation instruments for the evaluation of higher cognitive processes (Figure 2C). Assessing higher-order thinking skills such as critical thinking, problem-solving, and scientific creativity requires skills that are difficult to evaluate even for trained specialists. Without adequate training and supervised practice in assessment design, faculty members will struggle to create assessments that accurately reflect students' mastery of these skills. Finally, survey participants reported the need for more training to implement efficient *strategies* for AL in the classroom (Figure 2D). This response is consistent with the first question of the survey (Figure 1) that prior to this program, AL methodologies were lacking in faculty professionalization

and demands new programs that implement evidence-based practices at the university (Sánchez Mendiola *et al.*, 2019).

Figure 2. Faculty members' perceptions when asked to rate common challenges, obstacles, limitations, and strategies when implementing AL strategies in their classrooms. The color code used in all panels indicates significance and is shown in panel B; when a color bar does not appear, it means that frequency is zero. n=10.



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INTEGRATING INNOVATIVE TECHNOLOGIES AND PEDAGOGIES IN HIGHER EDUCATION: ENHANCING PROBLEM-SOLVING ABILITIES

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Abstract

In the contemporary educational landscape, integrating innovative technologies and pedagogical methodologies represents a promising approach to bolstering problem-solving abilities among higher-education students (Means et al., 2009; Dillenbourg, 1999). This presentation delves into the synergistic relationship between cutting-edge technologies and pedagogical strategies, aiming to cultivate critical thinking, analytical skills, and creative problem-solving capabilities among learners (Hmelo-Silver, 2004).

Keywords: *Pedagogic innovations, technology in teaching and learning, challenges and transformations in education, critical thinking, higher education.*

1. Introduction

Educators today face the challenge of preparing students for an ever-evolving world that demands adaptability, critical thinking, and problem-solving skills (Jonassen, 2000; Svinicki & McKeachie, 2014). Traditional teaching methods may need to improve in equipping students with the competencies necessary to navigate complex real-world challenges effectively (Mayer, 2009; Hattie & Donoghue, 2016). However, by harnessing the potential of innovative technologies and pedagogical approaches, educators can create dynamic learning environments that foster the development of robust problem-solving abilities (Siemens, 2005; Mishra & Koehler, 2006).

2. Design and objectives

This presentation is designed to elucidate the multifaceted relationship between innovative technologies and pedagogical methodologies in enhancing problem-solving skills among higher-education students. The objectives include:

1. Exploring how advanced technologies such as virtual reality (VR), artificial intelligence (AI), simulations, and data analytics can be integrated into educational settings to create immersive learning experiences (Slavin, 1996; Dalgarno & Lee, 2010):
 - Virtual Reality (VR): Students can explore historical sites, scientific phenomena, or complex engineering structures through virtual reality simulations. For example, they can virtually visit ancient civilizations, observe chemical reactions at the molecular level, or engage in virtual field trips to explore ecosystems.
 - Artificial Intelligence (AI): Introduce AI-powered tutoring systems that adapt to individual student learning styles and provide personalised feedback. Students can interact with AI chatbots to reinforce learning concepts, receive instant assistance with homework, or engage in simulated conversations to practice language skills.
 - Simulations: Incorporate interactive simulations to illustrate abstract concepts or real-world scenarios. For instance, students can use physics simulations to understand the principles of motion, conduct virtual chemistry experiments to explore chemical reactions or simulate business environments to learn about entrepreneurship and decision-making.
 - Data Analytics: Utilise data analytics tools to analyse real-world datasets and draw meaningful insights. Students can work with datasets from various fields, such as economics, healthcare, or environmental science, to develop analytical skills, identify patterns, and make data-driven decisions.

2. Examining the role of pedagogical approaches such as problem-based learning (PBL), inquiry-based learning, and collaborative learning methodologies in fostering students' problem-solving acumen (Van Merriënboer & Kirschner, 2013; Barron et al., 1998):
 - Problem-Based Learning (PBL): Present students with authentic, complex problems requiring critical thinking and collaboration. For example, in a biology class, students can collaborate to develop solutions to environmental challenges facing their local community, integrating knowledge from ecology, genetics, and sustainability.
 - Inquiry-Based Learning: Encourage students to ask questions, conduct investigations, and draw conclusions based on evidence. In a history class, students can research primary sources, analyse historical documents, and construct arguments to explain the causes and consequences of significant historical events.
 - Collaborative Learning Methodologies: Foster teamwork and communication skills by assigning group projects or problem-solving activities. For instance, in a mathematics class, students can work in teams to solve mathematical puzzles, design experiments, or create multimedia presentations to demonstrate mathematical concepts to their peers.
3. Investigating the impact of reflective practices and metacognitive strategies on students' ability to assess, refine, and improve their problem-solving processes (Vygotsky, 1978; Schraw et al., 2006):
 - Reflective Journals: Encourage students to maintain reflective journals where they can record their thoughts, experiences, and insights about their learning process. Prompt them to reflect on their problem-solving strategies, identify challenges encountered, and propose improvement solutions.
 - Metacognitive Exercises: Integrate metacognitive exercises into classroom activities to help students develop awareness of their thinking processes. For example, before starting a problem-solving task, ask students to outline their approach, predict potential obstacles, and reflect on their problem-solving strategies to identify areas for improvement.
 - Peer Feedback and Self-Assessment: Incorporate opportunities for peer feedback and self-assessment into group projects or presentations. Encourage students to provide constructive feedback to their peers, reflecting on the strengths and weaknesses of their problem-solving approaches and suggesting strategies for improvement.

3. Methods

The presentation includes a comprehensive literature review from diverse disciplines: education, psychology, and technology-enhanced learning. Case studies and examples of successful implementation of innovative technologies and pedagogical methodologies in higher education were analysed to illustrate their effectiveness in enhancing students' problem-solving abilities (Wenger, 1998; Svinicki & McKeachie, 2014; Kirschner et al., 2018; Zawacki-Richter et al., 2019).

4. Discussion

The discussion delves into how integrating innovative technologies and pedagogical methodologies contributes to developing students' problem-solving skills. Specifically, it addresses how immersive learning environments created through VR, AI, simulations, and data analytics facilitate experiential learning and hands-on problem-solving activities.

The effectiveness of pedagogical approaches such as PBL, inquiry-based learning, and collaborative learning in presenting authentic, complex problems and guiding students through structured inquiry processes. The role of reflective practices and metacognitive strategies in promoting self-assessment, iterative improvement, and cultivating a growth mindset among students.

5. Conclusions

In conclusion, the seamless integration of innovative technologies and pedagogical methodologies holds immense potential for enhancing problem-solving abilities in higher education. By fostering a culture of experimentation, collaboration, and lifelong learning, educators can empower students to tackle the multifaceted challenges of the 21st century with confidence and ingenuity.

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DEVELOPING THE EARLY CHILDHOOD PARTICIPATION DATA SET

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Abstract

Because data are crucial to making effective decisions at every level (from the classroom to state policy), it is essential to see data as the connective pipeline running through family decisions about enrollment, programmatic decisions on service delivery, and statewide policy decisions. Our organization provides tools to present and understand early childhood services and demographics. Recently, our organization has been collaborating to design, manage, and implement a statewide longitudinal data system, which includes the Early Childhood Participation Dataset (ECPDS). The ECPDS tracks every child enrolled in several early childhood services, which allows administrators and policymakers to see how children's participation in different programs (childcare assistance to public preschool) and use of services (early intervention to special education) develop over time. It also allows analysis by geography, race/ethnicity, disability, gender, and financial status. In partnership with research groups at other universities, we are developing this system to improve decision-making in education through better data use. Our poster visualizes how the ECPDS will function while articulating specific challenges and advantages of this system.

Keywords: *Early childhood, longitudinal data, state systems, policy.*

1. Introduction

The current trajectory for educational data management in the United States is toward statewide data systems that track the progress of every child that participates in public education. Each state administers its own mix of programs and services, which can be state-funded, federally funded, or a combination of both. Integrated, longitudinal data systems provide a platform for evidence that inform program evaluation, equity, and fairness. Policy decisions based on more granular data can result in better outcomes for children. Over the past several years, the development of the Illinois Longitudinal Data System (ILDS) has been slow but steady. The Illinois Early Childhood Asset Map (IECAM) has become the data steward to work with multiple state agencies and partners to coordinate and provide technical implementation of the early childhood component of the ILDS.

The Early Childhood Participation Data Set (ECPDS) creates new data pathways from state agencies, primarily the Illinois State Board of Education (ISBE) and Illinois Department of Human Services (IDHS). We discuss our progress in implementing the ECPDS and discuss the challenges that we and our partners have faced in this process. In short, child-level data has been developed across multiple programs by which researchers will soon be able to track anonymized data. Challenges include designing privacy protections, incomplete data, inconsistent data, technical limitations of large datasets, and versioning.

2. IECAM background

IECAM was founded in 2006 to provide comprehensive early childhood data to local and state agencies, other stakeholders, as well as the public, to improve outcomes for Illinois children. IECAM receives funding from ISBE and IDHS but is not part of any state agency. IECAM was developed in part to facilitate accountability and transparency in state government during the first phase of development of state-funded preschools. IECAM has functioned primarily as a data portal that acquires, cleans, processes, and shares early childhood service and demographic data. IECAM also works to provide helpdesk-like services for those with questions related to early childhood data. Most other states do not have a dedicated entity like IECAM to act as a steward for statewide early childhood data. IECAM's position adjacent to, but not within, state agencies allow its data practices to reliably persist through different political administrations.

3. The ILDS

Legislation passed by the Illinois state government in 2009 enabled creation of the ILDS, a statewide system that eventually will provide data to help to track the outcomes of Illinois children as the progress from preschool through postsecondary education — and as they enter the workforce. This will help guide policymakers on where to invest time and energy to most effectively improve achievements in Illinois. The state has implemented a statewide student identifier system that can be used to link student records along their academic path. This unique identifier removes the need to use personal identifiers to help track individuals. Once fully implemented, this system will track each child that participates in the public care and education programs from as early as prenatal through their entrance into the workforce.

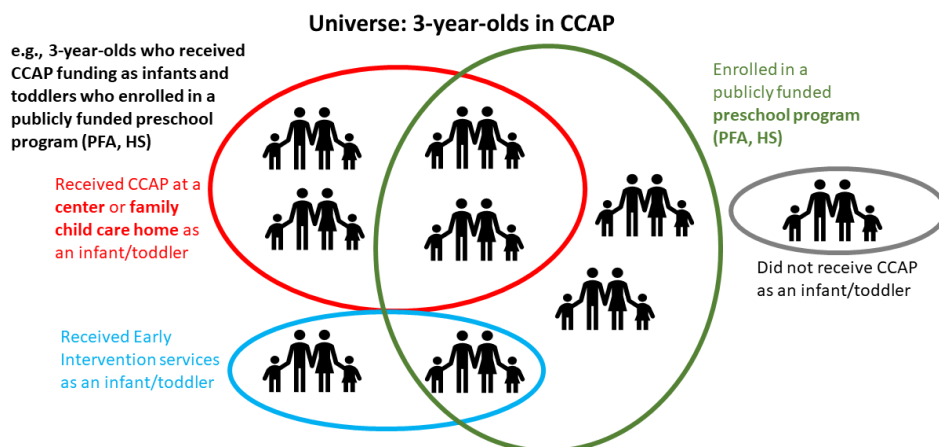
4. The ECPDS

The ECPDS is one element of ILDS focused on early childhood programs. The ECPDS is a massive merged dataset across agencies that can be used to track and analyze early childhood learning from birth through preschool (age 4 or 5). Because in the United States early childhood education and services are made up of a collection of disparate programs, this part of the ILDS poses organizational and logistical challenges that education data for later years (kindergarten through 12th grade) do not pose. Several services have funneled their databases into this common system, but there are more in progress. Programs already participating include:

- Preschool For All (PFA, preschool for ages 3 and 4 and some 5-year-olds; ISBE)
- Prevention Initiative (PI, mostly home-based services for children ages 2 and under; ISBE)
- Early Intervention (EI, screening and services for children ages 2 and under with disabilities or developmental delays; IDHS)
- Child Care Assistance Program (CCAP, child care subsidy for qualifying families; IDHS)
- Head Start (HS, preschool and early care services; U.S. Department of Education)

It is a uniquely scattered set of data because programs are housed under three different agencies. As a result, in the past early childhood data remained in silos with data only on the capacity to serve so many children in individual programs (PFA, PI, HS) and where (counties, cities, school districts). This system does not provide administrators and policymakers with any information on how many children have participated in more than one program or how many have been connected or “handed off” from one system to another. For example, two priority populations for PFA and HS are children living in poverty and children with disabilities, but the current system has no way to determine how many children who participated in EI or CCAP as infants and toddlers are being placed in those two preschool programs. So far, any data or information on this has been disjointed or anecdotal.

Figure 1. Tracking participation between programs.



Each of these three agencies track demographic data on children participating in their programs but do not disseminate these data widely. This has prevented advocates, policymakers, and outside administrators from evaluating whether certain demographic groups are being underserved and where. Questions often posed include:

- Are children living in poverty or children of some races/ethnicities proportionately participating in early childhood programs? Is their participation better in or worse some parts of the state?
- Are children from some immigrant communities participating in programs more than others? This could lead to the sharing of successful recruitment practices among immigrant communities.

- Are there areas/school districts where children participating in EI services are more often enrolled in publicly funded preschool programs where children can receive consistent early childhood special education services.

5. Implementation

Recent estimates put the population of children age 5 and under in Illinois at close to 870,000 (U.S. Census, ACS 2022). The ECPDS now contains data on all children participating in the above-mentioned programs, with monthly data for each participant extending back at least to 2015. In other words, the ECPDS is so far composed of millions of records, with millions more yet to be added.

A complex system of restricted access has been implemented to protect these data. Select Illinois state technical workers, IECAM, and their partner Chapin Hall (at University of Chicago) can access, manipulate, analyze, and repackage data in the ECPDS environment but cannot edit, download, nor share any ECPDS data. Differing levels of access are built into the design. “Curated files” will include child-level data with all pertinent demographic data available for specific agency use only. These files include relevant data such as the month and year of participation, as well as the program in which the participant took part.

For broader use by researchers, advocates, and the public, aggregated data will be accessible across the entire system and will not include any uniquely identifying data. Instead, participants are coded with a cross-program identifier that changes over time and enables tracking of individuals across programs. Aggregated data will be produced based on these identifiers. This design solves the problem of tracking individuals across programs while simultaneously ensuring anonymity.

6. Challenges faced in implementing the ECPDS

In addition to institutional delays, the data managers who are engaged in the process have run into several obstacles to creating the ECPDS.

- **Different reporting practices.** Some agencies report the same data differently. For example, ISBE reports Latinos only as a race while IDHS reports them as an ethnicity, preventing a direct comparison between the two agencies.
- **Geocoding children’s locations.** Critical to analyzing the participation of children in different parts of the state is being able to know where each child lives or has lived, which requires geocoding their addresses. However, the state system’s built-in geocoding system has problems geocoding addresses in some parts of the state. A more accurate system is available, but it would be cumbersome and would require downloading data off the main system, which is not allowed under project restrictions.
- **Data-sharing agreements.** An important part of the system is being able to share data between agencies and systems, which requires long, intricate agreements that often involve several rounds of sending drafts back and forth between agency administrators and, even more time consuming, lawyers. Even what seems like a minute change in an agreement can delay its approval for months.

7. Concluding thoughts

While this data system will soon become a vital part of the management of Illinois’s education resources, Conaway, Keesler, and Schwartz (2015) remind us that a state data system can address some of the needs for policy research, but not others. The system itself is an important component in a larger ecosystem that should also include a directed research agenda and state capacity for research. Conway et al. note that there are important questions that simply cannot be addressed by any data system, no matter how smoothly managed. For example, stakeholder perceptions about a program are not coded into state data systems. A program may appear one way with respect to what the data suggest, but that does not always indicate full workforce, or parental, endorsement. Nor can a functioning longitudinal data system provide direct answers to questions about resource allocation. For example, “should a state invest in providing direct services to its lowest performing districts, or should it instead provide those districts with grants? Should it expand after-school and out-of-school programming for the students with the greatest needs, or should it expand the school day for all students?” (Conway et al., 2015, p. 26s). Addressing such decisions may require deeper qualitative knowledge than a complex longitudinal system can provide.

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GENERATIVE MECHANISM IN SCHOOL IMPROVEMENT – A PROCESS STUDY

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Abstract

This study aims to identify how planned organisational change processes can be combined with unpredictable emergent change processes and be used in the organisation to manage organisational change in school. A process study was conducted to understand better how two schools struggle with improvement work using a specific strategy for school improvement and leadership. The data consisted of interviews, observations, and documents, with 13 sequences of events and 46 episodes identified in the empirical material, analysed according to Van de Ven and Poole's four ideal types of process studies, each with different generative mechanisms driving the process. Narrative strategy, episodes, and graphic representation were used in the analysis process. The result shows that the various motors, seen as driving forces that support or challenge each other, operate in planned and emergent processes and create two different forms of result: development and change. The study concludes that with more knowledge about what hinders and supports different mechanisms—that stimulate different actions—improvement processes can be more controlled, underpinning the process constructively. Practical implications: Leaders and pedagogues can use the tools presented in the study to understand, stimulate, and steer improvement work in their organisations. The theoretical presentation of generative mechanisms and their practical impact on improvement work explains how actions and behaviour influence the change process

Keywords: *Change process, emergent change, generative mechanisms, planned change, school improvement.*

1. Introduction

In the study of organisational change, there has been a growing interest in studying and understanding processes for improvement work in organisations, including schools. The interest has been focused on the process that the organisation undergoes and why and how events evolve in the way they do (Czarniawska, 2006). Schools are intended to promote student learning; however, schools are not traditionally designed to facilitate professional learning for those in systems change; they are not built for continuous improvement (Resnick & Kazemi, 2019). However, schools are nowadays continuously confronted with various forms of change. The past decades have seen a tidal wave of proposals to improve educational organisations (Ball & Cohen, 1999). It is essential to understand the organisation's processes when working with improvement in schools, and school systems across the globe face challenges in their improvement work (Hopkins & Woulfin, 2015).

School improvement can thus be understood through theories that are based on knowledge of systematic mechanisms that lead to effective schooling in combination with knowledge of context in local school improvement journeys. As an organisational process, school improvement is aimed at influencing the collective school capacity to change, which also includes the skills of the members of the organisation and the student's learning and outcomes (Hopkins, 2001). Greany and Waterhouse (2016) argue that continual reform and change have become elements of daily school work, and there are constant pressures to change and innovate.

2. Theoretical framework

A theory cannot be used directly in a study - a model is needed as an intermediary between theory and data (Morgan & Morrison, 1999). If a process perspective is used, the organisation is constituted by the different interaction processes of its members (Cooren et al., 2006; Taylor & Van Every, 2000; Tsoukas & Chia, 2002). Process studies that identify and show how changes in practices are implemented and how

their impact spreads and interacts with existing organisational contexts gives a closer dynamic understanding of how to improve the organisation (Langley & Tsoukas, 2010). The process model is event-driven, and explanations are built from observed events to some form of result. The model needs a detailed narrative that describes how the course of events proceeds and changes over time. The model looks for patterns and causal relationships, and the explanations are based on the course of events (Poole & Van de Ven, 2004). Two types of definitions of change are often used in organisational studies: 1) observed difference over time in an organisational unit on selected dimensions or 2) a narrative that describes a sequence of events about how development and change unfold (Poole, Scott, Van de Ven, Dooley & Holmes, 2000). The first definition can relate to a change that is studied with a variance theory methodology. The change is represented as a dependent variable explained by a set of independent variables that statistically explain variations in the dependent variable of change. The second form of change takes an event-driven approach where change events occur based on a narrative. Process theories can have several effects on their explanations, including critical events and turning points, influences from context, and causal factors that affect the sequencing of events (Van de Ven & Poole, 2005). The design can 1) identify and test temporal links between activities and also overall temporal patterns (Poole et al., 2000) and 2) handle the multiple time scales that arise in processes, where some events linger for years, other activities may be embedded in a run for shorter periods (Langley, 1999). The most influential work in organisational studies uses narrative history, which tells a detailed story with a process in detail (Bartunek, 1984; Pettigrew & Meertens, 1995). Van de Ven (1992), Langley (1999) and Poole et al. (2000) identified different types of change and innovation studies that follow the process approach. These theories provide fundamentally different accounts of the sequence of events that explain the change process in an organisational entity. Within each process theory: 1) a process is viewed as a different cycle of change events, 2) it is driven by a different "motor" or generating mechanism that 3) operates on a different unit of analysis and 4) represents a different mode of change (Van de Ven & Poole, 1995, pp. 519-520). *Life cycle* - which is based on the regulated change by, for example, a strategy for improvement; 2) *Teleological process* - that shows development as a cycle when there is some form of dissatisfaction, and the entity finds consensus in new goals. 3) *Dialectical theory* - when there is a conflict between in the organisation, and at last, 4) *Evolutionary theory* when competition arises in the entity.

3. Data sources and analysis

The empirical material includes observation notes, interviews and documents and it was analysed according to Van de Ven's and Poole's (1995) four ideal types for process studies. Narrative strategy, episodes, and graphic representations were used since they provide partly different perspectives of the material. The narrative approach gives a chronological and rich story, making it possible to compare various events. The episodes have precise timing, and the graphical representation is a way to visually show patterns. Pentland's (1999) structural levels based on narrative theory inspired the theoretically interpreted narratives. The course of events, constructed to enable the analysis, contains one or more episodes, where defined activities are carried out according to an intention worded at the beginning of each episode (Jacobsson, 2017). The events that were analysed were shown by events that contained one or more episodes that were stated with an intention followed by resistance or support. Different activities lead the processes forward and identify changes or improvements in the chain of activities, actions, and statements over time. In this study, change is understood as a change within the existing framework (Watzlawick, Weakland & Fisch, 2011). Change is a difference in an organisational unit's form, quality, or state. Development is, in this study, defined in this study as something that has created some form of improvement in relation to an intention and that is something new for the organisation or is carried out in a new way, that is, doing in addition to the existing.

4. Result and conclusions

All four ideal types (Van de Ven & Poole, 1995) are present during the improvement work, and the result shows that only the teleological motor was able to create development in the school organisations. The episodes driven by this motor are based on emergent initiatives to reach intentions. However, the result also shows that planned improvement governed by the life cycle theory and the evolutionary theory seems to be a fundamental condition that inspires constructive theories to carry on the process. Sequences of events that contain dialectical theories where a conflict has arisen in the improvement work can contribute to the sequence of events ending in a development. This means that both prescribed and constructive processes have a useful function in the improvement work, which confirms Van de Ven and Poole's (1995) result. The analysis shows that the events were driven by different motors, both single-, double-, triple- and quadruple motors. The various combinations of motors mean that they have relationships with each other

and influence each other. As an example, a sequence of events that ends in change shows that the improvement work is initially driven by a teleological motor that is replaced by an evolutionary motor that complicates the process; stop it and forces the organisation to choose an action alternative that is currently judged to be the most beneficial. This occurs when there is competition for time, resources, and knowledge, and this whole sequence of events it ends with an episode of development.

There are also motors that challenge each other, which happens when conflicts arise in the workplace. This can stop the process, but it can continue as the engines can also replace each other. This happened at one of the schools, where the theological process was driven but disrupted by a conflict and replaced by the dialectical engine. This could have ended the course of events, but when the staff reached a unanimous decision, the teleological motor again took over and drove the process forward towards an evolution. The use of motors can be an indicator of implementation errors that may be actual in the practical work with school improvement, and knowledge about the theories and their driving motors can be helpful to understand why a process stops or continues. The study is based on empirical data and the use of theoretical explanations in the implementation process could guide teachers and leaders working with improvement processes and don't be afraid of conflicts and competition thinking in the working team – both these situations among the staff can bring the process forward, instead of breaking it down!

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IDENTIFYING KNOWLEDGE GAPS IN MANAGING PREMATURE CHILDREN: A PARENTAL PERSPECTIVE STUDY

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Abstract

Introduction: The study, conducted as part of the PreNat HUB ERASMUS+ program, aimed to identify the main knowledge gaps of parents due to the lack of information provided by professionals involved in the management of premature children. It focused on the experiences of parents in dealing with health, educational, and social aspects of prematurity from birth to adulthood. **Methods:** A comprehensive questionnaire was developed and distributed to 187 mothers from five European countries. This survey aimed to assess the information and support provided by various professional groups, including healthcare, education, and social services, and to identify the main areas where parents felt they lacked necessary knowledge. **Results:** The study identified significant knowledge gaps among parents of premature children, covering health, developmental issues, and educational challenges. Only 39.6% were informed about developmental disorders like attention deficit disorders. Notably, 47.6% of children faced unexpected learning problems, often uncommunicated to parents. Awareness about support systems was limited; 22.5% knew of psychological support groups, and 11.2% about medical groups for parents. In education, just 9.1% believed school nurses understood their child's needs, and 13.9% felt schools were aware of these needs. Furthermore, only 19.8% were informed about state benefits, showing a critical information gap. **Conclusions:** There is a critical need for better communication and information sharing between professionals and parents of premature children. Addressing knowledge gaps is vital for managing and supporting these children's development and well-being. An integrated approach involving health, education, and social services is essential to effectively support these families.

Keywords: *Development, education, health, prematurity, support.*

1. Introduction

Premature birth, defined as birth before 37 completed weeks of gestation, is a significant global health issue affecting about 10% of births globally. Premature births are classified into three categories: extreme preterm (before 28 weeks), very preterm (between 28 and 32 weeks), and late preterm (between 32 and 37 weeks). Various factors, including maternal and fetal health issues, environmental exposures, and previous pregnancy history, contribute to the risk of premature birth.

The PreNat HUB initiative, part of the ERASMUS+ program, aims to address these issues by fostering a community of education and collaboration among families, professionals, and parents of premature infants. This study, conducted within the PreNat HUB framework, explores the informational gaps that parents face in managing the health and developmental challenges associated with prematurity.

2. Methods

The study used a mixed-methods approach, combining qualitative and quantitative data collection techniques. Participants were recruited from neonatal units and parent support groups in five European countries: Lithuania, Greece, France, Ireland, and Hungary. Data were collected through semi-structured interviews and a comprehensive questionnaire that covered health, education, and social interaction across three developmental phases: infancy, childhood, and adolescence to adulthood.

Analysis of the qualitative interviews involved thematic analysis to identify patterns in the experiences and informational needs of the parents. Quantitative data from the questionnaires were statistically analyzed to assess the prevalence of reported knowledge gaps and their correlations with demographic and clinical factors. Ethical approvals were obtained from all participating countries, and confidentiality and voluntary participation were ensured.

3. Results

The study included 187 mothers from five European countries: Lithuania, Greece, France, Ireland, and Hungary. This diverse cohort provided a broad perspective on the challenges faced by parents of premature children across different healthcare and social systems.

The findings revealed substantial gaps in parental knowledge. Only about 40% of parents were informed about common developmental disorders associated with prematurity, such as attention deficit disorders. Nearly half of the respondents reported unexpected learning difficulties in their children, indicating a significant communication gap in the education system. Awareness of available support systems was also low, with only 22.5% of parents aware of psychological support groups and even fewer aware of medical support groups for premature children.

Additionally, the interaction between educational institutions and the unique needs of premature children was inadequate, with only a small percentage of parents believing that schools and school nurses fully accommodated their children's needs. Knowledge about state benefits for families with premature children was similarly low, with less than 20% of parents informed about such support.

4. Discussion

The study's results align with international research indicating widespread challenges in communicating essential health information to parents of premature children. For instance, a study in Portugal showed that only about 10% of parents were well informed about the complications associated with prematurity. Similarly, research from Berlin and Sweden linked higher degrees of prematurity with increased incidences of developmental disorders such as autism and learning difficulties.

These findings underscore the need for improved communication strategies and information sharing among healthcare providers, educators, and social service professionals. Effective communication must ensure that parents are not only aware of the complications associated with prematurity but also informed about the available support systems and state benefits.

Future research should focus on optimizing the delivery of information to parents throughout their child's development and assessing the impact of targeted educational interventions for professionals on improving outcomes for premature children.

5. Conclusion

In conclusion, this study highlights a crucial need for systemic improvements in the dissemination of information to parents of premature children to support their immediate needs and enhance long-term developmental outcomes. Addressing these informational gaps is essential for equipping parents to effectively manage the challenges of prematurity. We recruited mothers of premature children through various neonatal units and parent support groups across the specified countries. Eligibility criteria required that participants were primary caregivers of children born prematurely (before 37 weeks of gestation), with these children ranging in age from infancy to adulthood.

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VIRTUAL PRESENTATIONS



FRAMING FAMILY DIVERSITY IN EARLY YEARS: AN INQUIRY-BASED INTERVENTION ON APPROACHING SAME-SEX PARENTING THROUGH PICTUREBOOKS

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Abstract

The article presents a critical reading of four selected PreK-2 picturebooks which narrate and depict family diversity in terms of a same-sex parenting content. More specifically, the following picturebooks: *My two moms* (2015), *Stella brings the family* (2015), *The girl with two dads* (2019) and *Who's your real mum?* (2020), were chosen among a variety of LGBTQI+ picturebooks to represent disruptions of the heteronormative family. Discourses on exclusion from and inclusion in what is defined as normativity and equity are analyzed. Issues of how children who grow up in a diverse family with same-sex parents are treated among their peers within the school settings are raised. Most importantly, definitions of parenting from children raised from same-sex parents are addressed. In supporting kindergarten teachers' attempts on approaching same-sex parented families within early years settings, this article, also, proposes an intervention which outlines an inquiry-based methodology. An interdisciplinary approach of the notion of family diversity is applied through literature, mathematics, natural and social science, arts, and ICT learning areas. The same picturebooks, used for critical reading in the first part of this paper, are recommended in the second part as means for encouraging discussion, promoting empathy and gathering information during the inquiry-based intervention. The contribution of the current work to both the social sciences and the early childhood education fields is that it raises the recognition and at the same time addresses the pervasive social context of family heteronormativity by engaging young children in developing their own understanding of what constitutes a family and attempt their own definitions of parenting. Finally, the paper presents a pedagogical methodology, based on the inquiry method, to approach social issues such as the concept of family diversity.

Keywords: *Family diversity, same-sex parenting, picturebooks, inquiry-based intervention, early childhood education.*

1. Introduction

Attention to gender diversity and non-normative ways of being and doing family has lagged in attention compared to other aspects of difference notable in the sector of early childhood education (Cherrington et al., 2020). Representations of families must be considered in any diversity analysis to ensure all children are capable of seeing families as they appear in our communities. The ways family members' abilities are portrayed, and depictions of parents' gender/ sexuality, are terms that should be acknowledged and analyzed to the extent they are co-informed (Lo, 2019). Contemporary research should recognize the importance of a diverse perspective as part of creating equitable early childhood learning spaces. Attention to gender, sexuality, and other social issues, and their influence on children's identities, is necessary to "bring about social change and improve the lives of all children" (Blaise, 2005, p. 6).

2. Literature review: A reading of picturebooks on family diversity and same-sex parenting topics

Four PreK-2 picturebooks which narrate and depict family diversity in terms of same-sex parenting content were selected for sampling. More specifically, the following picturebooks: *My two moms* (Harrington, 2015), *Stella brings the family* (Schiffer, 2015), *The girl with two dads* (Elliott, 2019), and *Who's your real mum?* (Green & Zobel, 2020), were chosen among a variety of LGBTQI+ picturebooks to represent disruptions of the heteronormative family. All four picturebooks were published within a five-year period and dated from 2015 to 2020. Two of them present a two female parent family and two of them present a two male parent family.

2.1. A reading of picturebooks on family diversity and same-sex parenting topics

2.1.1. The case of “*Who's your real mum?*”. A story of Elvi who has two mums and her friend Nicholas who wants to know which of the two mums is her real mum. What prevails in this narrative is the prejudice young children carry of who a real parent is. Implications of who constitutes a real parent are raised through the dialogue between the two children. Although Nicholas still can't work out the existence of two mothers, Elvi appears to know just how to explain it to her friend. Confrontation and discourse of the term “real” is presented throughout both modes, the text and the picture. The question the narrative attempts to answer is if the real parent can be as sufficient as the adopting or the non-biological one. The framing of the non-traditional family life is captured through the humorous implications of the definition of the real mum, which in this case means every loving, caring, fun, adventurous, extraordinary mum.

As Morgan & Surtees (2022) put it, picturebooks that challenge the status quo can support anti-heteronormative practices. From a list of external characteristics which anyone can have, passing to fantastic acts which no-one can perform, and ending with nurturing and caring attitudes which every parent is supposed to have, the unfolding of definition of the real parent and the act of parenting is presented. A climax of anticipation for the big revelation appears to lead to the following critical thinking: it does not matter who the biological parent is, if they provide for every need of their children (Kelly, 2012).

2.1.2. The case of “*Stella brings the family*”. The story is about Stella who lives with her two dads while her class is celebrating Mother's Day. Stella doesn't have a mum to invite to the party, hence she feels excluded. Definitions of normativity and equity are raised only in terms of a specific social occasion in this narrative. According to Crisp (2018) children's literature discusses political and literary considerations for authentic representations of gay males rather than stereotyped anachronisms. In accordance to that, the narrative portrays her diverse family as equal to others in everyday routine, but when it comes to a culturally and socially constructed institution, the absence of normativity appears to be a problem. The question of whether the nuclear family is suitable to adapt to social constructions, is raised.

Sandretto (2018) talks about the normal/abnormal binary, and how teachers can use queer intent with the deliberate teaching strategy of questioning this binary logic, to allow a different kind of meaning-making to flourish in children's minds. In the same meaning, the solution to Stella's problem is given by the school setting itself where the teacher defines her situation as non-unique since there are a lot of peers who live in diverse families. Towards this direction, framings of the notion of broader family, where relatives act and serve as care givers, are presented. The broader family's responsibilities are referred to as the care and support of making one feel special. But how do these responsibilities differ from those of the parents? Stella is depicted as the child who considers every person who loves and supports her as family, so the narrative redefines Mother's Day, the day when the most precious person in a child's life is celebrated, according to the protagonist's point of view. The shift of the child's perception regarding the meaning of family is implied to be the reason for Stella's inclusion within her school setting.

2.1.3. The cases of “*My two moms*” & “*The girl with two dads*”. The first narrative tells the story of a normal day in Elsie's life, when classmate Lenny as the class reporter visits her home and discovers Elsie has two moms. While Lenny makes his project for Elsie's life, he realizes how daily life with two moms is. The second narrative unfolds the story of Matilda and her friendship with Pearl, who notices her new friend has two dads. As their friendship begins to grow Pearl realizes that Matilda's family is not that different from her nuclear family after all.

What captures the attention in these two cases is that in both narratives it is another child (a peer) not the protagonist, who defines the notion of same-sex parenting. In each case, the framing of diverse family, like the one the protagonist has, is perceived from a child's perspective coming from a heteronormative family. In the first narrative same-sex parenting is portrayed as a documentary -for everyone to learn-, while in the second narrative same-sex parenting definition lies in terms of the anticipation of a different parenting approach. It could be said that a promoting of understandings in variant modes about same-sex parented families occurs here (Kelly, 2012).

Discussion is raised of the extent to which a family with same-sex parents is a diverse one in terms of daily routine, moral and ethical values, attitudes, and habits. Issues of normativity versus extraordinary are implied. Should a family with same-sex parents be different from a heteronormative family? The conclusion the children protagonists draw is the similar ways of parenting in terms of nurturing and caring, in nutritional attitudes and proper behavior manners. In this way, the notion of same-sex parents' family differentiation is contradicted, which agrees with Sandretto's (2018) postulation of which is the better way to create opportunities to revise restrictive norms that constrain the ways we love and live.

2.2. LGBTQI+ picturebooks in early childhood settings

Kelly (2013) has investigated the use of picturebooks to encourage critical thinking and enhance young children's understanding of queer families. The researcher discussed how children's books can encourage children to ponder the existence of social justice issues and their thoughts around these. According to Souto-Manning & Hermann-Wilmarth (2008), children are better able to understand others' perspectives through tools such as picturebooks and this increased awareness can encourage them to act towards social justice and equity. DePalma (2016), also, valued the use of picturebooks in exploring gender and sexuality diversity. She aimed to address sexualities equity in primary schools due to concerns over school-based homophobic bullying.

Miller (2019) identified and analysed an emerging category of children's literature representing transgender and gender creative child characters. She suggested that an ambivalent reading of these texts and images can help children understand the queer present at its most affirmative. That lies in accordance with Sandretto (2018) who argued that when queer theory and critical literacy band together they can be used by teachers and students to resist Warner's "regimes of the normal" (1991, p. 16). Taking all of the above into consideration, it seems that a great number of researchers support the use of picturebooks on approaching social matters, such as family diversity, and that they value picturebooks' potential as powerful teaching tools to shape attitudes and behaviors among children of early ages.

2.3. Aim of the current study

The article aims to frame definitions and notions of family diversity in early stages through a critical reading of four selected PreK-2 picturebooks which narrate and depict same-sex parenting content. In supporting kindergarten teachers' attempts on approaching same-sex parented families within early years settings, the article, also, proposes a teaching intervention, based on an inquiry-based methodology, which can be applied in early childhood education and can bridge the gap between theory and practice.

3. Methodology

For the purposes of the study an inquiry-based intervention is proposed. The inquiry-based teaching method unravels through 5 phases: orientation, conceptualization, investigation, conclusion, and discussion (Stacey, 2018; Siraj-Blatchford, 2010). Through these phases an interdisciplinary approach of the notion of family diversity is applied. More specifically, students attempt to explore the notions of family diversity through literature, mathematics, natural and social science, arts, and ICT learning areas (Institute of Educational Policy, 2021). The same picturebooks, used for critical reading in the first part of this paper, are recommended in the second part as means for encouraging discussion, promoting empathy, and gathering information during the intervention. A detailed outline of the structure of the intervention phases is proposed, as an inquiry-based teaching approach in early years.

3.1. Framework: An inquiry-based intervention on family diversity and same-sex parenting

Table 1. The inquiry-based intervention phases.

INQUIRY-BASED INTERVENTION						
Orientation/ Observation	The topics of "Family Diversity" and "Same-Sex Parenting" is addressed by using specific LGBTQI+ picturebooks. The books can be either placed in the library corner to offer the students the space to explore them, or they are used in read-aloud sessions by the teacher.					
Question/Conceptualize	Literature	Mathematics	Social Science	Natural Science	Arts	ICT
	<i>What does family diversity and same-sex parenting mean?</i>	<i>In what ways heteronormative parenting differs from same-sex parenting?</i>	<i>How many types of family exist nowadays?</i>	<i>Does same-sex parenting exist in the wild?</i>	<i>How is family diversity depicted through art?</i>	<i>Are there any documentaries and videos presenting notions of parenting?</i>

	Literature	Mathematics	Social Science	
	<p>Reading LGBT parenting picturebooks and family books.</p> <p>(e.g., picturebooks: “My two moms”, “Stella brings the family”, “The girl with two dads”, “Who’s your real mum?” and knowledge books: “The family book”, “All about families”, “My family your family”, “The great big book of families”)</p> <p>Brainstorming definitions of family diversity and same-sex parenting.</p>	<p>Sorting heteronormative families and same-sex families according to parental responsibilities.</p> <p>Crafting family portraits through tessellation or repeating patterns of the same shape.</p>	<p>Exploring the different types of families through family books and the web.</p> <p>[e.g., traditional nuclear family, symmetrical family, extended family, beanpole family, reconstituted family, single parent, foster parent(s), adoptive parent(s), blended family, unmarried biological parents, polyamorous parents, LGBT parent(s), non-parent- relative(s) as guardian(s)]</p> <p>Taking interviews from same-sex parents’ families within the school setting.</p>	
Investigation	Natural Science	Arts		ICT
	<p>Exploring the true story of two male penguins at the Central Park Zoo who raised a chick together.</p> <p>Gathering information about the wide range of species of same-sex penguin couplings (e.g., Gentoo, Humboldt, King, African, Chinstrap, Magellanic penguins), their performing mating rituals, their incubating of eggs, parenting responsibilities, the chick’s raising – Create an album for same-sex penguin families.</p>	<p>Studying paintings depicting family diversity.</p> <p>(e.g., Diverse Family Christmas Illustrations by Royalty-Free Vector, Artworks That Celebrate The Importance Of Family – Mojarto blogs, etc.)</p> <p>Crafting parent’s awards to nominate the categories of “The loving parent”, “The caring parent”, “The fun parent”, etc.</p>		<p>Watching audiovisual representations of diverse families and notions of parenting.</p> <p>(e.g., CG short film about love and family: “Maĵja”, CGI 3D Animated Short Film HD: “Two Different Kinds of Love”)</p> <p>Creating digital family trees/ genealogy or pedigree charts.</p>
Conclusion	<p>Conclusions are drawn regarding:</p> <ul style="list-style-type: none"> • The diversity of family types around the world • Definitions of parenting & parenting responsibilities • Inclusion’s significance for children raised in any type of family 			
Discussion/ Sharing	<p>Intervention’s outcomes could be shared in the following ways:</p> <ul style="list-style-type: none"> • An exhibition of children’s virtual family trees/genealogy charts and family portraits • An open day family fair within the school setting with family activities and workshops • Establishment of Parents’ School with weekly sessions for discussion and therapy 			

4. Discussion

Early childhood education centers are important cultural and social spaces where young children learn to interact with others different from themselves. According to the Curriculum for Preschool Education (Institute of Educational Policy, 2021) themes of diversity and inclusion are central in the meaning that PreK children have a fundamental right to a sense of belonging in early childhood education settings. The new curriculum constitutes an inclusive curriculum and encompasses diversity of family structure and values with the promise that all children will be empowered to learn with and alongside others by engaging in experiences that have meaning for them. One way for early childhood educators to work towards this goal of an inclusive curriculum is, according to previous research (Sandretto, 2018; Kelly, 2013), by actively encouraging acknowledgement of diverse family structures within the school setting. Children’s picturebooks can be invaluable in supporting these themes by challenging heteronormative discourses and deepening young children’s understanding of themselves and others (Morgan & Surtees, 2022).

Given that the potential power of picturebooks to combat heteronormativity in early childhood education comes into sharp focus (Morgan & Surtees, 2022), the critical reading of the selected LGBTQI+ picturebooks offers discourses on exclusion of and inclusion in what is defined as normativity and equity. Through these narratives, issues of how children who grow up in a diverse family with same-sex parents are treated among their peers within the school settings are raised. The highlighting of such discourses and issues could, according to previous research (DePalma, 2016; Souto-Manning & Hermann-Wilmarth,

2008), increase awareness and encourage children to act towards social justice and equity. In addition, definitions of parenting from children raised from same-sex parents are captured. Most importantly, the reading analysis could accompany practice recommendations for teachers who support efforts to challenge heteronormativity through the deliberate use of picturebooks as pedagogical tools (Morgan & Surtees, 2022).

The inquiry-based learning method offers all the necessary stages for children to orientate and observe, question and conceptualize, investigate, conclude, discuss and share their new knowledge and their newly shaped attitudes and behaviors on social matters. Their learning occurs through personal, individual, and co-operative exploration; hence the learning becomes experiential (Stacey, 2018; Siraj-Blatchford, 2010).

5. Conclusion

The contribution of the current work to both the social sciences and the early childhood education fields is that it raises the recognition and at the same time addresses the pervasive social context of family heteronormativity by engaging young children in developing their own understandings of what constitutes a family and attempt their own definitions of parenting. Finally, the paper presents a pedagogical methodology, based on the inquiry method, to approach social issues such as the concept of family diversity.

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AUGMENTED REALITY GLASSES IN CLASS – BLESSING OR CURSE

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Abstract

This paper focuses on the current state of augmented reality (AR) usage in university teaching and the impact of AR on student workload. Universities need to engage with new technologies and developments at an early stage. An empirical experiment was conducted with two independent groups to investigate the effects of Microsoft HoloLens 2 on students' subjective workload when solving a Sudoku puzzle. The experimental group used the Microsoft HoloLens 2, and the control group used a tablet. The NASA Task Load Index measured workload and its dimensions. The experiment was based on previous research on AR in higher education and Cognitive Load Theory. HoloLens users' workload was significantly higher (average 70.356/100) than tablet users (average 55.896/100). HoloLens users rated the physical demands higher in the individual components of the workload, and their subjective performance was significantly worse than that of the control group. Furthermore, the workload was mainly related to the HoloLens 2 experience, but students' affinity for technology did not influence these scores. No differences in gender-based workload could be found when using HoloLens 2.

Keywords: *Augmented reality, NASA TLX, teaching, practical training.*

1. Introduction

Colleges and universities are recognized as catalysts for innovation and are essential in driving advancements in various fields. The influence of digitalization extends to education and research activities at universities. Hence, it is crucial for these institutions to proactively engage with emerging technologies at an early stage, develop concepts, and formulate potential use cases, as emphasized by Lilligreen and Wiebel (2019). Augmented reality (AR) is one such technology already applied in research, despite its conceptual existence since 1970, showcasing constant evolution (Knoll & Stieglitz, 2022). Various applications and scenarios can be developed and implemented using AR (Tolba, Elarif & Taha, 2022, p. 53). While AR has been extensively explored in the literature, a research gap still needs to be explored, particularly concerning AR glasses and their correlation with student workload. The workload of students significantly influences their well-being and, consequently, their academic performance (Salmela-Aro & Read, 2017). The escalating relevance of digitalization and its associated impact on student workload is gaining attention in the research community (Van De Velde et al., 2021, p. 114). Therefore, investigating this aspect concerning the Microsoft HoloLens 2 is deemed crucial.

The paper begins by defining the research objectives and questions in section 2. They were followed by the theoretical background, which describes the concept of AR and workload. Then, the research method is explained, split up into hypotheses, a sample of the experiment, data collection and empirical setting, questionnaires, and the concepts of affinity of technology and the NASA Task Load Index (NASA TLX). Then, the result will be discussed and wrapped up by a research conclusion.

2. Objectives

On the one hand, the theoretical part of this paper aims to explain the concept of AR and workload to the reader. Furthermore, an empirical experiment is set up based on the literature. In the empirical part, the following research question is examined by an empirical experiment: "What are the effects of using the Microsoft HoloLens 2 on students' subjective workload when solving a Sudoku puzzle?" Further questions that can be derived from the research question and are investigated in this context: (1) How does the workload differ between the experimental group (using the HoloLens) and the control group (using a tablet)? (2) Is there a connection between students' affinity for technology and their subjective workload when using the HoloLens, and (3) Is there a correlation between objective performance (score achieved) and the subjectively assessed performance of students when using the HoloLens?

3. Theoretical background

Azuma (1997) defines AR as a technology that enhances or overlays the real world with virtual objects. The foundation of AR is the physical reality, which is then enriched with additional elements and AR components (Saxena & Verma, 2022). In addition to supplementing reality, AR can remove virtual objects or conceal portions of the actual environment. These virtual objects contain information that is invisible in reality and help users accomplish tasks in the real world. Users experience a sense of coexistence between the real world and augmented objects, intensifying their perception of reality and fostering increased interaction with it (Azuma, 1997). Azuma's (1997) definition does not confine itself to a specific technology. Still, it outlines certain properties that characterize AR systems: The application combines the real world with the virtual world, functions interactively in real-time, and registration takes place in 3D. Hart (2006) defines workload as an individual's effort to complete a task. The effort has implications for an individual's physical and mental well-being, with increased effort potentially leading to symptoms of exhaustion, heightened emotional stress, diminished performance, or increased cognitive strain (Hart & Wickens, 1990). However, workload is influenced by the individual's physical, mental, and emotional state, necessitating consideration of factors such as fatigue, stress, or illness in this context (Hart, 2006). Measuring workload involves various methods, often combining subjective and objective data to assess its value (Said et al., 2020, p. 9). One commonly used survey instrument for this purpose is the multi-level National Aeronautics and Space Administration-Task Load Index (NASA-TLX) developed by Hart and Staveland (1988).

4. Methodology and measurements

This section will explain the methodology used for the data collection and give a clear overview of the experiment. The used Sudoku is shown in Figure 1, and the measurement metrics are provided.

A literature review was conducted at the beginning of the research. The keywords "Augmented Reality", "Augmented Reality in Education", "Augmented Reality AND Cognitive Load", "Workload AND Augmented Reality", "Workload in Education" were used, and the term "Augmented Reality" was also replaced by "HoloLens" and "Smart Glasses". EBESCO, PubMed BibSearch, Springer Link, and Google Scholar were used. In addition, an experiment in combination with several questionnaires was carried out for the empirical part of the work.

An empirical experiment was conducted to answer the research question. A two-group design (experimental group vs. control group) was developed to measure the workload using the technologies (Döring & Bortz, 2016, p. 194). The present experiment can be categorized as a laboratory study in a controlled environment. However, this also means that the results could change in a typical environment and everyday situations, examinations, or lecture situations, which harms external validity (Döring & Bortz, 2016, p. 206). Only students who were studying for a Bachelor's or Master's degree were allowed to take part in this study. A total of 31 students, encompassing both Bachelor's and Master's students, took part. The participant breakdown included 17 females and 14 males. Half of the sample specialized in IT studies or pursued IT/computer science degrees, while the remaining half pursued various fields of study. Some participants had prior experience with augmented reality. The experiments were conducted from May 5 to 7, 2023, and took place in the library and study area of the Management Center Innsbruck.

First, the participants answered the first questionnaire for each group. The first questionnaire, part 1 of both groups, contains nine items on affinity for technology at the beginning. The HoloLens group was then asked questions about their experiences with AR and the HoloLens, while the control group was asked the same questions about their experiences with the tablet. In addition, previous experiences with Sudoku were surveyed, with the respective answer options for the different experiences matching between the groups. Then, the students were given the task description and an introduction to the fundamental rules of Sudoku. Following an overview of the technique, the participants had approximately five minutes to familiarize themselves with the respective devices, practice writing, and address any unanswered questions. Subsequently, the actual task was presented. Each participant was challenged to solve a Sudoku puzzle classified as "easy" level. Group 1 utilized the HoloLens 2, while Group 2 completed the task using a tablet.

The objective for the test subjects was to achieve the same Sudoku solution within a 15-minute timeframe or to solve the Sudoku as fast as possible. Participants earned one point for each correctly filled box, with a maximum possible score of 45 points for a fully completed puzzle. To incentivize successful Sudoku completion, the participant with the highest or all correct boxes, irrespective of group, received a cash voucher. After finishing the Sudoku task, all study participants received the standardized NASA Task Load Index questionnaire, designed to assess subjective workload.

Subsequently, the participants answered part 2 of the questionnaire specific to their respective groups. This included personal attitudes toward Augmented Reality (AR) and HoloLens 2 for the HoloLens group and attitudes toward tablets for the tablet group. Additionally, participants from both groups indicated the last time they had played Sudoku. Finally, demographic questions were posed to gather information about the test subjects and draw conclusions about the sample. These questions covered age, gender, academic degree (Bachelor's or Master's), field of study, IT specialization, and whether participants wore glasses. Post-experiment, the NASA TLX was utilized again to determine subjective workload. In the second part of the questionnaire for both groups, assessments were collected regarding the experiences and feelings while using the respective technology in the task, aiming to conclude potential influencing factors. All questions were asked in German, and the experimenter was present during the experiment to resolve any content ambiguities immediately and answer experiment participants' questions. Afterward, results were counted, and points were calculated, counting all correctly filled recognizable numbers.

The participants were tasked with solving a Sudoku, a logic puzzle that requires filling in missing fields. A Sudoku comprises 81 squares, with some fields pre-filled, and the remaining empty fields must be completed to solve the puzzle. The puzzle's difficulty is determined by the number of initially provided numbers, with more challenging puzzles having fewer given numbers. Each Sudoku is individually generated (Delahaye, 2006).

The Sudoku presented in Figure 1 is the puzzle participants had to solve in the experiment using either the HoloLens 2 or the Samsung Galaxy Tab S6. The difficulty level of this Sudoku was classified as "easy," and it contained 49 correct fields that could be filled in.

Figure 1. Sudoku.

9	1	5	7	3	8	2
5	2	8		6	9	4
7	6		4			
	8		3			
2				5	7	1
5	4				6	8
		3	2		4	8
	2	1	8			
7					1	

Other independent variables about the Sudoku task could also be gathered. Firstly, the number of points achieved could be derived from the correctly completed boxes. Secondly, time was recorded, or a time limit of 15 minutes was imposed.

Affinity for technology interaction (ATI) characterizes an individual's tendency to engage with technical systems actively or to avoid them. The score reflects a person's technology utilization and proficiency in using it. It is assumed that the higher this indicator is for an individual, the more efficiently and productively that person utilizes technology. The term "technological systems" in this concept encompasses applications such as apps, software, and all digital devices. Digital devices include cell phones, computers, televisions, and car navigation systems. ATI (Franke, Attig & Wessel, 2019). The ATI score is measured by a standardized questionnaire with nine items on a Likert scale.

The National Aeronautics and Space Administration - Task Load Index (NASA-TLX) is a multidimensional rating scale designed to measure the subjective workload experienced by individuals during or after a task. The questionnaire comprises two parts. In the first part, the dimensions of mental, physical, and temporal demands, as well as performance, effort, and frustration, are examined based on the definition provided by Hart and Staveland (1988).

5. Results and discussion

The evaluations revealed that the subjective workload of HoloLens students was higher than the control group, who were given the same task and used a tablet to solve it. In particular, significantly higher values were recorded in the performance and physical effort categories. The tablet group assessed their performance considerably higher than the HoloLens group, while the HoloLens group perceived the physical effort as significantly more significant than the control group. Furthermore, this study did not find a correlation between NASA TLX and ATI when using the HoloLens. However, the findings from a survey conducted by Attig et al. (2018) suggest that students' ATI scores can still play a crucial role in avoiding the high workload associated with the HoloLens. By adjusting the training intensity based on the ATI score, providing more or less intensive training with this technology becomes possible, thus

improving usability. The study implies that, depending on the ATI score, customized training and support are essential to prevent users from feeling overwhelmed, ultimately leading to improved usability.

This observation is consistent with the finding that students with more excellent experience using these technologies exerted less effort. This could be attributed to technologically adept students approaching the task more quickly and confidently. The connection between high self-confidence and lower workload, as outlined by Said et al. (2020, p. 8), further supports the notion that experience with technology influences user workload. Consequently, the higher workload experienced with the HoloLens may be attributed to the group's lower familiarity with the device than the group using the tablet. A correlation was observed between the attained score and the self-assessed performance in the HoloLens group. The higher the score, the better the students perceived their performance, aligning with findings from previous studies in medical applications. This relationship is also evident in medical studies, such as the one conducted by Said et al. (2020), which employed NASA-TLX to gauge the workload in patient monitoring. Notably, a correlation was identified between test performance and the total and partial values of NASA-TLX. Instances of good performance were associated with lower NASA-TLX scores, indicating a lower perceived workload. Participants tended to rate their performance higher when test results were better, suggesting that increased training and experience with a task can reduce subjective workload and enhance performance. As emphasized earlier, experience and training influence results (Said et al., 2020, p. 8).

This study found a correlation between HoloLens experience and subjective perceived workload. Contrary to expectations, the study revealed that more excellent experience with the HoloLens was associated with a higher perceived workload. While this may seem counterintuitive, a similar finding was reported by Hu, Lu, Tan, and Lomanto (2016, p. 1742), who discovered that simulation training improved estimated performance and individual workload ratings. This suggests that training with the HoloLens may enhance the experience, subsequently impacting subjective workload perceptions. The study also explored whether gender has an impact on workload. No discernible differences were identified in the perceived workload when using the HoloLens based on gender. This outcome could suggest that both male and female students had similar prior experiences with the technology. No significant differences in mental workload were observed between HoloLens and tablet use in this study. However, existing research in education and AR has demonstrated that technology can assist learners in engaging with the material through interactive elements and information on position and shapes (Rios, Hincapié, Caponio, Mercado & González Mendivil, 2011). Studies have indicated that high interactivity in AR applications can decrease cognitive load compared to traditional methods, such as paper-based learning (Klinker, Tabarani, Wiesche & Krcmar, 2020, p. 388). For instance, medical students using mobile AR for anatomy learning achieved better performance and experienced lower cognitive load than their colleagues (Küçük, Kapakin & Göktaş, 2016, p. 419). AR learning materials, with their ability to present complex information compactly and symbolically, focus attention on specific points, thereby reducing mental strain and lowering the load on working memory (İbili, 2019, p. 52). While the study found no significant differences in mental and cognitive demands between the two groups engaged in solving Sudoku puzzles, it is noteworthy that the technology's impact on student workload is influenced by various factors, including the design of AR applications and the interactivity of elements (Lilligreen & Wiebel, 2019).

In summary, the study indicates that AR is suitable for learning, as it enhances motivation and when implemented effectively in the classroom, facilitates learning by providing more interactive opportunities for students, thereby influencing retention (İbili, 2019). While the potential for AR in education is evident, challenges remain, including the need to adapt educational programs and increased application options for students and teachers, and the technology's current limitations make permanent integration into teaching impractical. Nonetheless, as AR devices become more affordable and accessible, there is potential for broader adoption in educational settings (Lilligreen & Wiebel, 2019).

6. Conclusion and future research

To sum up, the use of HoloLens 2 increases the subjective workload in comparison to the use of a tablet. However, workload dimensions should always be examined individually, and the applications' previous experience and user-friendliness should be considered. For further experiments, it would be necessary to enlarge the number of participants and look for a higher diversity.

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TRANSFORMATIVE FAMILY ROLES IN CHILD ADVOCACY: AMPLIFYING RIGHTS THROUGH AWARENESS RAISING AND CAPACITY BUILDING IN LESOTHO

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Abstract

Lesotho's rich socio-cultural tapestry offers a distinctive setting for probing child rights and development. Central to this discourse is the concept of child rights, deeply entrenched within the vast realm of human rights, acting as a linchpin for comprehensive development. Yet, the trajectory of this development is frequently hampered by deep-seated social norms which prescribe gender-specific roles in child advocacy, with an extrapolated impact on family dynamics. This intricate meta-analysis delves into UNICEF Lesotho's research undertakings from 2023, aiming to shed light on the roles of family members, with an accentuated emphasis on men. Their roles are not just dissected as advocates for child rights but also as integral components of the familial structure. Through an exhaustive evaluation of two salient projects from that year – a three-year HIV-nutrition project and a breastfeeding study – the research meticulously navigates patterns of family engagement, leveraging a plethora of resources from inception reports to raw data compilations. Initial findings bring to the fore an intriguing narrative: while societal norms have traditionally marginalized men's active roles in child advocacy, their influence within family structures is undeniable. This dichotomy posits men as untapped advocates for child rights within the familial arena, leading to the pressing need for their more substantive involvement. Central to the study is the assertion that learning, and capacity-building are indispensable in reshaping the contours of male involvement. By equipping family members, especially men, with enhanced awareness, knowledge, and tools, their transition from passive observers to proactive advocates for child rights can be realized. Enhanced awareness and continuous capacity-building initiatives can kindle a profound change, harnessing men's intrinsic familial stature. To conclude, this comprehensive meta-analysis illuminates the complex interweaving of social norms, familial dynamics, gender equality, and child advocacy in Lesotho. It underscores the transformative potential inherent in enhancing the capacities of family members, particularly men. By galvanizing men as pivotal members within families and impassioned advocates for child rights, we are poised to pioneer a transformative shift, heralding a more inclusive and enlightened era for child development in Lesotho.

Keywords: *Child rights advocacy, gender equality, familial dynamics, awareness raising, capacity building.*

1. Introduction

Lesotho stands out globally as the only country perched entirely above the 1,000-meter mark, cradled by the vastness of South Africa. Amidst its soaring highlands, the nation grapples with a gamut of developmental hurdles that span the domains of economic progress, education, healthcare, and the stewardship of its environment (Mairos Ferreira & Muthengi, 2023a; Government of Lesotho, 2023a, 2023b; IMF, 2022; Leenknecht *et al.*, 2021; Paramaiah, Machema, & Gomo, 2020). The youth of Lesotho, set against the country's striking topography and socio-political intricacies, are particularly affected (United Nations Children's Fund & Lesotho Red Cross Society, 2023). The tendrils of governance and stability are strained under these multifaceted pressures, with political volatility not just undermining the pillars of authority but also stifling economic vitality, casting the young into a precarious state that demands solid institutional backing (United Nations Lesotho, 2023; UNDP & UN Women, 2023). The nutritional quandary in Lesotho unfolds as a tangled web of undernutrition, overnutrition, and micronutrient shortages, collectively illustrating a profound malnutrition dilemma. A staggering 34.6% prevalence of stunting among children under five years old serves as a stark emblem of entrenched socioeconomic strife, further exacerbated by a Global Hunger Index score of 32.4 that paints a grim

picture of food security. Concurrently, the nation's battle against HIV/AIDS, marked by one of the highest infection rates worldwide at approximately 19.3% among adults, adds layers to the public health exigencies (UNAIDS, 2023, 2022). This confluence of malnutrition and disease, particularly highlighted by the distressing stunting figures, signals an urgent call for comprehensive health interventions (iQvia, 2023). While Lesotho has attained notable successes in HIV/AIDS management through diagnosis and treatment, the full exploitation of family-based advocacy has not been reached. Despite a 94% rate of awareness among individuals with HIV, the significantly lower rates of early infant diagnosis point to a chasm where the empowerment of families could be significantly beneficial (iQvia, 2023; Schwitters *et al.*, 2022).

This paper embarks on an exploration of family-centric, inclusive, and gender-sensitive modalities as keys to unlocking the complex nexus of HIV and nutrition challenges in Lesotho (iQvia, 2023; Mantsopa Institute & UNICEF, 2022). It delves into a meta-analysis of UNICEF Lesotho's research undertakings from 2023, dissecting the fabric of Lesotho's social conventions, family structures, gender identities, and the championing of children's rights. There's an acute focus on redefining the male role within these paradigms, challenging entrenched gender norms, and recognizing the untapped potential in men to serve as agents of familial transformation. Advocating for a robust initiative in capacity building and consciousness-raising among kin, this research positions the family nucleus, with a renewed emphasis on the pivotal role of men, at the forefront of an evolutionary journey. Thus, it aims to carve a path to an epoch of child development in Lesotho marked by equity, inclusivity, and the collective commitment of all family members.

2. Methodology

This qualitative meta-analysis serves as a confluence of perspectives derived from two complementary studies. The initial study meticulously evaluated a Nutrition-HIV Program extending over three years (2019-2022), utilizing a thematic analysis framework to parse through extensive program documentation, stakeholder discourse, and direct observation (iQvia, 2023). The emergent themes, underscored by longitudinal data, provided an insightful narrative on the program's success in empowering women and girls, as told through the lived experiences of those within the target demographic. These participant narratives are pivotal, shedding light on the nexus between program initiatives and their tangible impact on health and gender empowerment. Complementing the first, the Breastfeeding Study engaged in a descriptive analysis, deciphering the socio-cultural determinants shaping maternal breastfeeding practices (Mairós Ferreira, 2023). Through an iterative coding process, the study ensured that emerging themes dynamically influenced the ongoing data collection, anchoring the conclusions in the authentic experiences of the participants. The meta-synthesis of this data cast light on the complex barriers and enablers of breastfeeding practices, particularly within the intimate setting of family units. It underlined the nuanced balance between traditional practices and women's autonomy in the domain of maternal and child health, a delicate equilibrium of custom and personal agency. Ensuring the integrity of this qualitative meta-analysis, a rigorous triangulation process was integral to substantiate the credibility of the findings. Data triangulation juxtaposed and synthesized results from both studies, despite their distinct focal areas—the overarching health impacts of a Nutrition-HIV Program and the particularities of breastfeeding practices. This cross-examination of data points, especially those concerning the empowerment of women and girls in health-related decision-making, served to reinforce the validity of the themes identified. Methodological triangulation further enriched the analysis, leveraging the unique and collective strengths of the diverse methods employed in each study. This multipronged approach not only provided a more comprehensive understanding of the phenomena but also preemptively addressed potential biases, offering a holistic view of the cultural and social contexts that govern maternal health practices. The iterative coding and analysis cycles assured thematic consistency and authenticity, culminating in a robust and insightful synthesis essential for navigating the intricate landscape of family participation against the backdrop of Lesotho's public health challenges.

3. Findings and discussion

The complex interplay between Lesotho's policy commitments to gender equality and the on-the-ground realities is starkly apparent in the realm of family dynamics, particularly regarding men's roles in health and nutrition. Despite constitutional assurances since 1993 and international ratifications, including CEDAW and the Maputo Protocol, which advocate for women's rights, there persists a dissonance between formal legislative frameworks and the actual lived experiences within households. In fact, Lesotho still has a marked patriarchal culture, which has strong implications for families (Mairós Ferreira & Muthengi, 2023a; UNDP & UN Women, 2023; UNICEF & Lesotho Red Cross Society

Reports, 2023). This gap underscores the need for strategies that not only recognize but actively incorporate men as essential contributors to gender parity within familial settings. Men's roles in Lesotho's families, traditionally characterized by financial control and decision-making authority, continue to significantly shape the structure and function of households. This enduring male dominance, while rooted in cultural tradition, actively influences the aspirations and opportunities available to both women and girls, and men and boys (UNDP & UN Women, 2023; UNICEF & Lesotho Red Cross Society Reports, 2023). The meta-analysis findings, further emphasize this point, revealing the extent of women's economic dependence on men and the limited autonomy that ensues from such a dynamic. The economic dependency highlighted by the Breastfeeding Study, where 66.0% of women rely on maintenance money from male partners, is a critical indicator of the restricted decision-making power of women in Lesotho (Mairós Ferreira, 2023). The role of extended family members, particularly grandmothers, in decision-making processes, remains significant, with the Breastfeeding Study noting that approximately 11.3% of decisions are made jointly with extended family, and 6.2% are made solely by these members. This dependency not only underscores the limited financial autonomy women experience but also serves as a proxy for broader issues of gendered power imbalances within the family unit, namely the lack of autonomy in decisions regarding children health (iQvia, 2023).

Despite these entrenched patriarchal norms, signs of a shift towards more egalitarian family structures are emerging, as evidenced by the promising trend towards increased equality and joint decision-making processes, with around 27.9% of mothers reporting shared decision-making in child-feeding practices with fathers or partners (Mairós Ferreira, 2023). Furthermore, the HIV-Nutrition Program has marked a significant change in male participation in family health, notably in antenatal care and nutrition, reflecting a departure from conventional gender roles and the promotion of a balanced sharing of responsibilities. "The program's findings confirmed that male support is a key factor in facilitating women's and children's access to health services (...) Additionally, men could progressively assume a more active role in household nutrition through farming" (iQvia, 2023, Final Evaluation Report, p. 70). According to the Final evaluation results, the observed shift in male behavior through the HIV-Nutrition Program represents a broader societal transformation. Men's increased involvement in areas previously perceived as female domains, such as child nutrition and HIV awareness, marks a notable departure from previous patterns, where engagement was minimal and gender roles were more rigid. This shift is a testament to the program's success in challenging and changing deep-seated gender norms, paving the way for a new paradigm of inclusive and shared responsibility in family health.

Furthermore, the program's conclusion draws attention to the effectiveness of tailored interventions and health forums in advancing male understanding and engagement in HIV prevention and nutritional health. "This initiative does more than just disseminate health knowledge; it fundamentally addresses gender inequality by empowering men to be enablers in the healthcare journey of their female partners, particularly in accessing antenatal care and PMTCT services" (iQvia, 2023, p. 70). This underscores the potential for education and dialogue to meaningfully involve men in family and community health. By providing knowledge and platforms for engagement, men can significantly contribute to the health and well-being of their families, as demonstrated by the program's findings. Lastly, the impact of the program transcends immediate behavioral changes and sets in motion a process of intergenerational learning that promises to reshape future societal norms. Engaging men in conversations and practices related to health and nutrition, has laid the strong foundations for a continuous, and sustainable, effect of positive change (iQvia, 2023). This engagement not only benefited the current generation but also sown the seeds for future generations to embrace a more equitable understanding of gender roles within the family, as indicated by the promising trends in familial decision-making. As clearly stated in the Final Evaluation Report, this has created a "ripple effect of positive behavioral change that can influence future generations, thereby amplifying the long-term overall impact of the Program" (iQvia, 2023, pp. 14-15).

The challenge now lies in translating these findings into actionable strategies that can close the gap between policy and practice. This necessitates culturally informed interventions that recognize and utilize the influence of men within the family structure to advance gender equality. By engaging men in redefining masculinity and fostering more equitable family dynamics, these strategies can support the health and rights of women and girls while contributing to the broader societal transformation. The meta-analysis serves as an imperative for targeted strategies that align with and seek to evolve the socio-political fabric of Lesotho, reinforcing the pivotal role of men in achieving sustainable gender parity.

4. Conclusion

The empirical data gathered from Lesotho's health and nutrition initiatives articulate a clear finding: the inclusion of men as integral agents of change within family units is not merely beneficial but necessary for the efficacy of health and nutrition interventions. Engaging men transcends traditional gender roles, catalyzing a paradigm shift towards a more equitable intrafamilial dynamic. This recalibration is rooted in a scientific understanding that health outcomes are significantly improved when interventions are family-centric and gender-inclusive. Men's increased involvement in family health practices—ranging from prenatal care to nutritional planning—has been empirically linked to positive outcomes, including enhanced child health and lower incidences of malnutrition. The active participation of men in these roles is more than a mere shift in responsibility; it is a strategic enhancement of the family's health advocacy potential, ensuring that interventions are not only embraced but also sustained across generations. This scientific perspective affirms that by harnessing the full spectrum of familial roles, Lesotho can advance toward its health goals with greater efficacy and resilience.

It is essential that health interventions in Lesotho incorporate strategies specifically designed to engage men as active participants in family health and nutrition. Programs should include targeted educational campaigns that simultaneously address and reshape traditional gender roles, fostering an environment where men are equally informed, strongly supported, and continuously motivated in their path to equally contribute to the health and well-being of their families. Additionally, policy frameworks must prioritize the establishment, and strengthening, of community forums and support groups that provide spaces for men to learn, share, and collaborate on health-related issues. These initiatives should be coupled with monitoring and evaluation mechanisms that assess the effects and added value of male involvement, thereby ensuring that these strategies are refined and adapted to the cultural context of Lesotho. By implementing these recommendations, Lesotho can leverage the full capacity of its familial units, driving forward a more equitable and health-oriented societal transformation.

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EXPLORING THE APPLICABILITY OF THE QUESTION-PROMPTING CHATBOT IN PBL: PRACTITIONER INSIGHTS ON GOAL SETTING AND REFLECTION

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Abstract

This study evaluates the potential of a chatbot, originally designed for language learning, to be adapted for wider applications in self-directed learning settings, specifically within Project-Based Learning (PBL) frameworks. The research focuses on the chatbot's utility in promoting questions regarding goal setting and reflection by providing personalized notifications. Through interviews with new PBL instructors, the study identifies key challenges, including the scarcity of class time allocated for these activities, a lack of training in intervention methods, and a general underestimation of their significance. Addressing these challenges, the study proposes the augmentation of the chatbot's functionality by incorporating access to a case database. This enhancement is anticipated to foster a constructive cycle of goal setting and reflection, thereby offering robust support to instructors in their pedagogical endeavors. The enhanced chatbot aims to bridge the identified gaps, facilitating more effective educational interventions in PBL contexts.

Keywords: *Project-Based Learning, self-directed learning, reflection, chatbot.*

1. Introduction

1.1. Question-prompting chatbot for SDL

It becomes crucial in global language policies to promote Self-Directed Learning (SDL) and leverage assistive technologies. SDL involves identifying learning needs, setting objectives, selecting strategies, and evaluating outcomes. As language learning is a long-term, varied process, proficiency in SDL is essential, yet challenging for many. The lead author teaches a mandatory Japanese course for international students at a Japanese university, typically offered in the first academic year. It's believed that this period is vital for students to develop SDL skills, especially in setting and reflecting on learning goals, which is key to their success (Knowles, 1975). However, guidelines for instructors to support these skills effectively are lacking.

The leading authors developed and implemented an activity model at a university in Japan to support SDL of Japanese as a second language (Kai, Matsuba, Goda, Wada, & Suzuki, 2020). This model involves activities such as recording observations about the use of the target language outside of class, reflecting on these observations in class, sharing with peers, and receiving counseling while revising goal settings. We designed activities based on a Design-based Research framework (McKenney & Reeves, 2019), and developed a chatbot to support continuous recording. The chatbot runs within LINE, one of the most popular communication applications in East Asia, and has the function of sending a series of questions predetermined by the instructor to students (“What was the most impressive thing you learned today”, “Why”, etc.) and recording their responses. One unique feature of our system, distinguishing it from similar platforms, is its approach to notifications. While we encourage learners to actively record their learning, we also understand the importance of reminders to prevent oversights. What sets our system apart is that learners can set the timing of these reminders themselves. By allowing students to decide when they receive these prompts, we make the learning process more personal and relevant to them, thereby making the transition from receiving a notification to making a record more seamless and natural. This system strikes a balance between fostering learner autonomy and providing the necessary structure to ensure consistent and thorough documentation of their learning journey. With this system, learners can write reflections solely through LINE, and their writings are automatically stored in our LMS via LTI integration. This system is designed to respect and encourage learner autonomy. Students have

the flexibility to actively log their learning activities at times they choose, or they can opt to have the system automatically remind them to reflect. The study results suggest that the feature allowing students to set their own notification times may have contributed to a higher rate of continued recording. Furthermore, the results indicate that meaningful reflective activities based on these records can be conducted and that goals tend to improve as a result. The authors believe that this chatbot can be used not only for language learning but also for goal setting and reflection guidance in many fields.

The authors propose that one area where their approach could be beneficial is in Project-Based Learning (PBL), an increasingly popular educational method worldwide (Guo, Saab, Post, & Admiraal, 2020). The second and third authors have served as consultants to integrate PBL in institutions (Ishida & Matsuba, 2019). In PBL, it's common for instructors to request students to write reflections after each activity. However, it has been noted that students often produce reflections of suboptimal quality. Furthermore, instructors sometimes do not thoroughly engage with these reflections, only marking them as 'read,' which can lead to student dissatisfaction. We suggest that the primary reason for this situation is the scarcity in both quality and quantity of reflective records, which are essential for effective consultation in student goal setting and project progression. We posit that if this assumption is supported, the situation could significantly improve by introducing our activity model with chatbot, which would enable students to produce more meaningful reflections. This, in turn, could enhance the quality of tutoring and subsequently improve students' learning outcomes.

The common activity in both cases is to write reflections on the set goals, and if PBL requires students to write these reflections outside of class due to lack of time during class, it is easy to assume that some students will forget to write them down. Our chatbot's easy-to-use writing interface and reminder function will support continuous recording. However, we also found that the SDL support required for this PBL differs from our approach in Japanese language learning. One is that goal setting and reflection involve more skills in collaboration with others, such as leadership, and the other is that instructors are on site where students are working, so they can also intervene with students' reflections in action. It is necessary to consider whether to modify the chatbot based on these differences or to include other strategies. We therefore interviewed instructors to see what interventions they are doing and what they are not doing at each phase of the project.

1.2. PBL course offered at a Japanese *KOSEN*

To grasp the situation more clearly, we will carry out an initial study involving instructors who are new to PBL. We aim to explore how they help students set their goals, execute their projects, and reflect on their progress. This will help determine the chatbot's potential in supporting goal setting and reflection in PBL settings. The survey aimed to identify the interventions instructors are using and the challenges they face. It was conducted in a large-scale PBL course offered at a Japanese *KOSEN* (National Institute of Technology), known for practical engineering education. This *KOSEN* operates on a semester system, with two semesters each year, and the PBL course is a year-long course, spanning across both semesters. The course is mandatory for all 2nd to 4th year students, totaling around 500, from four departments: Mechanical Engineering, Electrical and Computer Engineering, Urban Systems Engineering, and Architecture. Students, grouped into diverse teams across grades and departments, work on selected year-long projects under an instructor's guidance. Despite not choosing their teams, students have autonomy over their project themes. Under this framework, a student typically dedicates themselves to three distinct topics across six semesters, covering the three years until graduation. The curriculum, emphasizing critical reflection and goal setting, aims to cultivate personal growth and a profound understanding, countering the tendency to overly focus on the final product in PBL.

In this course, each semester is structured into three phases: Orientation, Main Activities, and Wrap-up. During the orientation phase of the program, students will participate in activities aimed at understanding the course structure and getting to know their team members. Initially, they will be introduced to the course's objectives, the activities they'll engage in, and the expected outcomes. They will also be guided to set personal goals. The goals to be achieved in this subject are: 1) to be able to self-regulate (autonomy), 2) to work in teams while respecting others (collaboration), and 3) to be able to collect and organize information, identify issues, and make proposals (creativity). Individual goals are set and evaluated each semester by each student, corresponding to the achievement goals (autonomy, collaboration, and creativity). In this course, students use a rubric for self-assessment to critically reflect on their performance. The rubric is centered around three major objectives, each broken down into three specific criteria, resulting in a total of nine criteria which includes goal setting and reflection. Students evaluate themselves on each criterion using a five-level scale, from Level 0 (the lowest) to Level 4 (the highest). Additionally, for each major objective, students select one criterion they particularly wish to achieve and write down action plans detailing what steps they will take to meet this goal. This self-assessment tool empowers students to critically analyze their performance, aligning their

understanding and skills with the course objectives. At this point, instructors review students' self-set goals and action plans. If needed, they discuss with the students to guide revisions. Next, students establish their team's theme. The theme must meet three conditions: it should benefit others, pose a challenge for the team, and align with one of the 17 Sustainable Development Goals (SDGs). After setting a theme, the team members divide roles and create an action plan.

During the activities phase, students carry out the activities according to the plan. Students are required to fill out a reflection sheet each time. This sheet is designed for students to reflect on their weekly progress, what they managed to do well, what they struggled with, and their feelings during the activities. Instructors review these reflections to provide targeted guidance and support. During the wrap-up phase, students will report on their achievements as a team in a final debriefing session. After conducting a self-assessment using the rubric for their individual goals, students have a meeting with their assigned instructor. During this meeting, they receive feedback comments from both their team members and the instructor. From the second semester onwards, students set their personal goals regarding their self-evaluations from the previous term. These activities are designed with the expectation of proactive and self-driven engagement from the students. To facilitate these activities, students are provided with a guidebook. This guidebook is well-organized, detailing the tasks to be accomplished, and is enriched with templates, worksheets, and a collection of reference resources, all aimed at streamlining the activities. While students progress through the activities using the workbook as a reference, they are also welcome to seek support from their instructor if needed. In this course, instructors are not instructed to micromanage tasks. Instead, they are expected to provide educational interventions when students seek support or when the instructor perceives a particular need.

2. Method

The study investigates the types of educational interventions new instructors are implementing during the course and whether these interventions are improving students' skills in goal setting and reflection. It examines the involvement of new instructors in these interventions, their effectiveness in helping students achieve personal goals, the instructors' perceptions of the value of these interventions, and any challenges they face in managing the course. The survey participants consist of six newly appointed instructors who have been responsible for this subject for less than three years. The survey was carried out through individual pre-surveys and semi-structured interviews conducted in November-December 2022, coinciding with the wrap-up phase of the second semester of the full-year course. The interviewers provided written explanations to the interviewees in advance regarding data handling and related matters, and obtained their consent for participating in the research. Before the interviews, interviewees filled out a pre-survey questionnaire on Google Forms as an initial step to pinpoint focus areas for the interviews. This course is a year-long subject spanning over an extended period, and it also aims to facilitate interviewees in recalling events from the first semester by having them respond to survey questions. The pre-survey included the following question items:

[Orientation phase]

- ☞ Do you believe that students improved their ability to set and reflect on goals?
- ☞ At which phase did you intervene with advice or guidance in this course?
- ☞ Did you have students set personal goals (in the first or second semester)?
- ☞ Did you provide advice, guidance, or require revisions during the goal-setting phase?
- ☞ Did you encourage the use of a workbook during the goal-setting phase?

[Main Activities phase]

- ☞ What strategies did you employ to facilitate smooth learning activities for the students?
- ☞ Did you instruct students to write weekly reflection sheets?
- ☞ How frequently did you review the content of the students' reflection sheets?

[Wrap-up phase]

- ☞ Were you able to conduct interviews with the students at the end of the first term?
- ☞ How much time did you spend on interviews per student?

The interview questions were prepared in advance to solicit detailed explanations about the survey results. Specifically, interviewers first asked whether they had taken actions such as encouraging students to read the workbook at each stage. If there was intervention, interviewers inquired about the specific nature of the intervention, the use of resources provided (sheets, senior instructors, etc.), and the outcomes of such intervention. If there was no intervention, the reasons for not intervening were explored. Interviewers also asked about any overall challenges or issues faced. Additionally, to understand the instructors' values, the perceived frequency of the need for advice and guidance was also a topic of inquiry. Interviewers shared the pre-survey results with the interviewees and conducted

90-minute interviews with each participant. The interviews were recorded, and the second author, familiar with the context, transcribed and initially analyzed the content, extracting parts relevant to the main theme. Then, the lead author and the third author, who were not familiar with the setting, analyzed and organized the data from an objective perspective. Finally, all authors collaborated in the discussion and interpretation of the findings.

3. Results

Three reported observing growth in their team's students concerning the goal of goal setting and reflection. Only one believed that the goal was necessary for students. During the orientation phase, all six instructed their students to set personal goals. Of these, four mentioned using a workbook. Only one provided specific advice on the goals set by the students. The reasons for not providing advice included feeling unable to intervene at an early stage when they do not understand the students well, and some were not even aware that they should provide advice or guidance on the students' personal goals. Even among those who did provide advice, there was a sentiment of frustration regarding the students' tendency to set goals below their actual capabilities. Regarding the team activity planning, three offered advice, focusing on building member relationships and assigning roles, with five responding that they provided advice and guidance. The reasons for providing advice included the goals not fulfilling the established criteria, the potential for future challenges if students failed to reach a consensus, and the advisability of planning activities in advance when coordinating with fixed-date college events like a college festival. Other interventions at this stage were primarily related to team-building, like ice-breaking activities and senior students guiding the juniors. During the main activities, three instructed their students to write weekly reflection sheets. However, only one reported consistently reviewing these sheets. Two mentioned reviewing the sheets only at the end of the term, while three did not review them at all. In the interviews, the reasons provided for not utilizing the reflection sheets included the following:

- ☞ Although the benefits of completing the reflection sheets were explained during the orientation phase, I would not check the content, leaving it to the students to decide whether to use them. Based on observations during the classes, it seemed that likely none of the students were writing them.
- ☞ There was neglect in reviewing the reflection sheets.
- ☞ As the hands-on work became more intensive, finding time within the class to complete the reflection sheets became hard.

Other common interventions included asking about the activities and outcomes at the end of each week (five noted), providing encouragement when activities were stagnant (five noted), and encouraging active participation from students (four noted). In the summary phase, all six respondents conducted individual meetings with students. The average meeting time was around 9 minutes, ranging from a minimum of 5 minutes to a maximum of 15 minutes, with the most common duration being 10 minutes. The main focus of the consultations was to convey evaluations from the team members and from the instructor. Additionally, interviewees identified the following challenges and difficulties:

- ☞ Finding it challenging to guide senior students who believe they are performing well.
- ☞ Finding a loosening of the students' tempers around the second month of the first semester.
- ☞ Struggling to determine the appropriate level of control an instructor should exert in this course, which emphasizes student autonomy.
- ☞ Deciding on intervention methods when progress stalls.
- ☞ Noticing a tendency for compromise among senior students who are taking the course for multiple times.
- ☞ Wondering how I should suggest students who intentionally give low self-evaluations at the beginning to produce growth.

4. Discussion

The interview results, centered on the skill of 'setting goals and reflecting,' indicated that despite instructors recognizing a lack of improvement in this ability among students, active intervention was lacking. This finding corroborates the authors' initial hypothesis presented at the outset of the paper. Many of the reasons for not intervening stated by instructors was the lack of time. However, they made sure to carry out their assigned duties, such as setting goals at the beginning and having meetings with their students at the end. Besides, except for one individual, everyone had been intervening as needed since the orientation phase, such as managing time and encouraging active participation. It would not be difficult to find enough time for instructors to encourage students to write reflections, so there must be another reason why this was not done. It might be that the new instructors were proactive in offering

interventions for tasks that were straightforward or could be taught through experience, yet they were uncertain about how to effectively intervene in the process of 'goal setting and reflection.' Statements from instructors expressing uncertainty about the extent of their intervention and their confusion regarding students deliberately providing low self-evaluations further substantiate this perspective. Despite having access to a guidebook to understand the overall flow of the course, the new instructors were not fully utilizing the formats, such as the weekly reflection sheets, provided in the guidebook, though they were aware of their existence. A senior instructor was available in the same room to address any questions or uncertainties on an ongoing basis. Nevertheless, the fact that these resources were not being utilized suggests the possibility that the resources provided are insufficient or that there may be other reasons for the lack of utilization. We deduce that the neglect of 'goal setting and reflection' may stem from a limited number of instructors recognizing the importance of cultivating this skill.

5. Conclusion

In this study, we explored the challenges instructors face in implementing educational interventions during different course phases. The survey identified three main issues: instructors not recognizing the need for intervention, uncertainty about intervention methods, and the challenge of finding sufficient time for effective intervention. Firstly, time constraints make it challenging for instructors to provide adequate intervention. In this institution, students must monitor project progress and reflect on personal growth, often prioritizing the former due to time limitations. Facilitating reflection and ensuring instructors have access to students' reflective records prior to class can help in preparing effective intervention strategies. However, creating these analyses and plans is time-consuming, emphasizing the need for systems to alleviate instructors' workload. As a solution to this issue, our proposed chatbot is expected to play a significant role by enabling recording outside of class hours and facilitating easy referencing when needed. Secondly, many educators, especially the inexperienced, lack coaching skills for effective intervention in goal setting and reflection. They tend to rely on personal educational beliefs rather than systematic methods. Sharing successful case studies and insights could quickly enhance their intervention capabilities. Integrating with an instructional case database might be one solution. Lastly, in this institution, instructor interventions are optional, often limited to those with sufficient time and motivation. To encourage more proactive engagement, the institution could formalize these interventions and require outcome reporting, while ensuring this process doesn't overly burden instructors. It's essential to foster intrinsic motivation by showcasing the positive impact of interventions through instructor exchanges and student feedback. As previously discussed, if the chatbot can collect students' reflective records and refer to similar cases in the case database to suggest appropriate interventions, instructors can then use these suggestions for their educational interventions. The outcomes of these interventions can be fed back into the database as new insights, creating a beneficial cycle. Such a cycle is essential for enhancing instructors' motivation by providing them with practical, evidence-based strategies for intervention. We recognize the need for this positive feedback loop and will continue to consider enhancements to the chatbot's functionality to facilitate this process.

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HOW TO DEVELOP SCIENTIFIC THINKING IN PRIMARY STUDENTS BY INVESTIGATIVE ENVIRONMENT

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Abstract

The objectives of the ONU Agenda 2030 (designed to accompany schools in the ecological and cultural transition) and the actions outlined in 2020 in the European agenda for skills underline the importance of bringing students closer to STEM (Science, Technology, Engineering and Mathematics) subjects, and consequently promote scientific education. According to a socio-constructivist perspective, we can understand how students develop scientific thinking by observing their relationship with the social, cultural and environmental situations they experience (Fleer, 2021). Among innovative teaching strategies, the "inquiry-based learning" approach can represent a methodology suitable for stimulating the development of scientific thinking in children, as it places inquiry at the center of the learning process (Worth & Grollman; 2003; Belland, 2017). In this work, we will present some preliminary data from a case study that aims to experiment with innovative pedagogical models to stimulate the interest of children in primary school in scientific reasoning of STEM disciplines. The first phase of the project involved a class of pupils attending the last year of primary school who participated in an educational experimentation activity on learning physics based on an inquiry-based learning approach. The analysis of the data collected, using observational tools, highlighted that the activity has stimulated the flexibility of reasoning; children have built knowledge collaboratively and have shown a high motivational involvement.

Keywords: *STEM, scientific thinking, inquiry-based, scaffolding, collaborative learning.*

1. Introduction

The international debate on education during recent years has certainly paid a lot of attention to the importance of promoting STEM (Science, Technology, Engineering and Mathematics) disciplines in schools right from the early years of the education path (ONU Agenda 2030¹; European Commission, 2018²).

Science education is a fundamental aspect in the development of both disciplinary and transversal skills (such as creativity, critical thinking, and reasoning skills) that can promote citizenship skills (i.e., social, economic and environmental skills) (Edwards-Schachter et al., 2015). The new generations will increasingly find themselves living with scientific discoveries and related technological transformations, and it is, therefore, essential to think about learning paths that respond to emerging educational needs. It is critical that students develop skills to participate in discourses that incorporate scientific concepts and be able to evaluate the argumentations involved critically.

It therefore becomes fundamental to assume a theoretical and methodological perspective on which to base the learning paths of STEM disciplines in order to support the development of scientific thinking, the capacity for hypothetico-deductive, inductive and analogical reasoning in order to increase the ability to use the critical thinking in understanding reality.

The socio-constructivist perspective can represent a valid theoretical framework of reference as it considers learning as a knowledge construction process in which the learner plays an active and creative role (Fleer, 2021). This educational approach favours participatory forms of learning, which stimulate the initiative of children, sharing and collaboration between peers. The aspect of interaction therefore becomes

¹ Transforming our world: the 2030 Agenda for Sustainable Development. <https://sdgs.un.org/2030agenda>

² European Union (2016). *STEM skills for a future-proof Europe: Fostering innovation, growth and jobs by bridging the EU STEM skills mismatch*. EU Stem Coalition.

central in the learning process both with respect to the relationship between peers and the relationship between teacher and students.

The role of the teacher in this process is to provide a "support structure" or "scaffolding", which sustains the children's learning process by helping them to acquire a higher level of skills than they initially possessed (Bruner, 1990; Belland, 2017; Hsu et al., 2015; Lee & Tee, 2021) and stimulate reflection, reasoning and argumentation through innovative teaching strategies. Among these, the "inquiry-based learning" approach can represent a suitable methodology for stimulating the development of scientific thinking in children, as it places inquiry at the center of the learning process (Worth & Grollman, 2003). The teacher encourages free exploration and experimentation by the children of a particular scientific phenomenon, invites them to ask questions and share them with the group; the teacher participates in the process of building knowledge, welcomes their reflections and helps them structure more advanced and complex forms of argumentation.

2. Develop scientific thinking through embodied investigation

According to Jonassen et al. (2004), learning environments that are designed according to a socio-constructivist perspective differ from traditional teaching approaches because they offer multiple representations of reality that reflect the complexity of the world; they encourage active knowledge construction by students, propose authentic and meaningful tasks, connected to children's experience and the real world; they encourage reflection, reasoning and collaborative forms of learning, where negotiation rather than competition is encouraged.

The learning environment should therefore be built to stimulate investigation and encourage children's active participation and direct experience. Traditionally, the frontal methods of teaching have resulted in learning practices in which communication in the classroom is based on sitting students, where the teacher frames the topic and sets the pace of the lessons, encouraging students to express their opinions and ask questions, but always remaining in a static position. According to this view, the use of movement and bodily experience is not considered a factor connected to the learning process. Thought processes have been considered closely linked to cognitive processes but less to the sensorimotor processes. It follows that teaching does not encourage children's movement in the classroom and does not incorporate it into the learning experience, instead supporting the importance of maintaining a sitting position in class, considered a good indicator of the ability to concentrate and focus on the task.

However, the studies that have developed the theme of embodied cognition undermine this traditional conception, highlighting the central value of bodily experience in the process of building knowledge. Based on the theoretical framework of bodily cognition, action and perception are inextricably linked: the sensorimotor experiences derived from the environment contribute to grounding the cognitive processes (Glenberg, Witt, & Metcalfe, 2013).

Therefore, the thinking process can be built starting from concrete experiences that children have in learning contexts, since cognitive aspects and sensorimotor processing are closely linked (Wilson, 2002). Scientific evidence has highlighted a correlation between activities such as observation, simulation of other people's gestures and imitation and the activation of brain areas that are central to learning (Rizzolatti & Craighero, 2004; Meister et al., 2003). For example, some studies highlight how attention and memory improve when the use of the hands is associated with the learning process (Weidler & Abrams, 2014). Other studies support evidence that highlights the positive effects of movement and the use of gestures in learning mathematics (Riley et al, 2016).

This evidence underlines how learning processes can be supported by practical experience and how theoretical STEM concepts can be understood more easily by designing learning environments that involve experimentation through the use of the body and movement (Schmidt et al 2019).

3. Objectives

In this work, we will present some preliminary data from a case study that aims to experiment with innovative pedagogical models to stimulate the interest of children in primary school in scientific reasoning of STEM disciplines. The first phase of the project involved a class of pupils attending the last year of primary school who participated in an educational experimentation activity on learning physics based on an inquiry-based learning approach.

4. Methods

A fifth class of primary school (composed of 10 children) participated in the investigation. The activity proposed to the children concerned the motion in one dimension (introduction to the study of

kinematics in Physics, description of motion and its patterns) and took place in 2 meetings for at least 3 hours. These features sampled what was needed for conducting a case-study research design (Creswell & Poth, 2017).

The activity was prepared together with the teacher according to an inquiry-based approach and was characterised by the following aspects:

- Structuring student-centered learning environments;
- Learning process based on active learning;
- Centrality of student participation to encourage a process of knowledge construction.

These three aspects were shaped using the Investigative Science Learning Environment (ISLE, Etkina et al., 2019) approach. The ISLE process guarantees that it will fulfil the aspects we require for our activity design (Brookes et al., 2020). This is a crucial methodological point in conducting our research: the content design has to be thought in a well-defined disciplinary framework to ensure we achieve research outcomes. An ISLE-based learning activity is an authentic inquiry experience where children learn Physics by mirroring scientists' practices (Etkina et al., 2019; Brooke et al., 2020). In making science, children are engaged in scientific cognitive processes: the same ones they need to develop scientific abilities (Etkina et al., 2006). Furthermore, the teaching/learning ISLE sequence is designed in order to activate and connect different brain areas, providing a complete cognitive learning cycle (Etkina et al., 2019; Zull, 2004; Weidler & Abrams, 2014), enhancing embodied cognition (Schmidt et al 2019; Gregorcic et al., 2017).


The children's learning experiences were video recorded; then, all the videos were transcribed, and the transcriptions were used as a starting point for the analysis's insight. The transcribed dialogues have been framed into clustering of discourse sequences, which should recognise a particular structure, depicted using vignettes (Skilling & Stylianides, 2020), like snapshots from the video frames.








The analysis of the vignettes highlighted the learning and thinking processes that the children developed during the teaching experience. The purpose of the analysis of the contents of the vignettes was to identify significant aspects of the process of scientific thought formation, linking them to the participation processes and the structure of the learning environment. Specifically, the following indicators were considered: the different levels in the scaffolding process, the construction phases of the scientific thinking process (in terms of reasoning), and the emotional/motivational aspects (in terms of embodied engagement).

5. Results

In the following table, we report an extract of the analysis conducted. This is a sequence of the entire activity we analysed. The extract should show how we collected information about the indicators we were investigating. Here, eight examples are presented: this sequence is representative of many others, as meaningful for the learning process they depict in terms of scaffolding, reasoning, and embodying.

Table 1.

Vignette	Learning sequence	Process Indicators		
		Scaffolding	Reasoning	Embodying
	<p>Pulling a ball, following the path using sand packets falling down while the ball passes, listening to the metronome pulsing at 60 BPM (on the interactive whiteboard)</p>	<p>Procedural tips for carrying out the activity, preparing the learning environment</p>	<p>Activating reasoning processes by teacher's guidance; finding patterns for generating analogies</p>	<p>All kids are actively engaged playing different roles and embodied the activity: immersive and exploratory characters</p>

		Encouraging children's engagements, enacting procedural scaffolding.	Recognising patterns and a space-time relation, making cognitive connections (slow-fast ball, more or fewer packets).	Moving arms, clapping hands, and stepping feet for "embodied measurement" of the time repeating aloud
	Repeated trials of pulling the ball, beating the time, observing the patterns	Guiding children in changing roles during the activity, reinforcing.		Collaborating process, exchanging roles.
		Removing procedural scaffolding, improving children's self-empowerment in conducting the activity alone.	Reinforcing conceptual building and achieving conceptual stability	"Embodied technique" in conducting the activity
	Describing using words what observed	Procedural tips for guiding children towards verbal representation enhancing discussion	Activating reflection as part of reasoning process (internalization)	Embodied attention, gestures for explaining ideas while speaking
	Representing drawing a sketch what observed	Procedural tips for guiding children towards pictorial representation, sharing ideas	Conceptualizing coherent representation of real facts and generated ideas (externalization)	Immersive postures controlling the writing process on whiteboard
	Discussing to match and evaluate consistency between representations by words and sketch	Procedural tips for guiding children towards evaluating processes of different representations	Reasoning based on searching consistency and activating evaluation process	Artifact realised shared by children's group
	Communicating and presenting by words pictorial representation	Promoting time for telling and discussing all together, sharing representations	Verbalisation as the tool for giving reason and sense making between different representations	Gestures indicating the meaning of sketches described using spoken language

6. Discussion and conclusions

The analysis of the data collected, using observational tools, highlighted that the activity:

- has stimulated the flexibility of reasoning;
- The children have built knowledge collaboratively through the transition between experiential and conceptual levels and have shown a high motivational involvement;
- The scaffolding processes were supported by the structure of the activity itself and the organization of the learning environment.

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A SYNERGETIC DESIGN PROJECT TO FORTIFY THE UNIVERSITY-COMPANY COLLABORATION

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Abstract

On a global scale, universities have recently emerged from the lingering impact of the pandemic. However, as university campuses gradually reopen, university administrators must acknowledge the inherent challenges of reverting to a pre-pandemic situation. Universities today face mounting expectations to revitalize their curricula by emphasizing real-world learning. This paradigm not only entails heightened classroom engagement but also imparts an essential contextual framework for nurturing enduring social competencies, the capacity for critical analysis and decision-making, and the proficient articulation of ideas. Over the years, the establishment and fortification of collaborative ties between universities and companies have been the subject of thorough discourse, and there is a widespread acceptance of the notion that companies can genuinely contribute to teaching content by sharing cutting-edge knowledge, expertise, and resources. According to a study conducted by Deloitte in 2017, it is evident that designers will only be partially characterized by their creative and innovative capabilities shortly. Business acumen is increasingly considered a precious attribute for professionals in this field. Integrating design and business principles has emerged as a pivotal determinant of achieving superior dynamic performance in diverse industries. Consequently, augmenting the synergistic relationship between university and company and ensuring constant and constructive long-term dialogue has become an urgent need in contemporary education. This paper investigates the disparity between universities and companies within the realm of design, aiming to shed light on potential solutions for fortifying the collaborative bonds between these two sectors. The authors introduce a design project executed in collaboration with a prominent global high-technology company, featured consistently on the Fortune Global 500 list for the fifth consecutive year, as a case study to demonstrate the efficacy of such endeavors in bridging the university-company divide. Drawing upon their distinct vantage points, the authors offer innovative insights into the interrelationship between academic research and design application. They delineate strategies for seamlessly integrating these domains to stimulate innovation and advance scholarly knowledge. The authors aspire to furnish fellow researchers in cognate fields with a valuable reference point, informed by the experiences gained from this project, to explore further and enhance design practice, achieving more substantial and consequential outcomes.

Keywords: *Design education, university-company collaboration, design practice.*

1. Introduction: University-company collaborations

The global higher education landscape has recently navigated the challenges posed by the pandemic, prompting a return to pre-pandemic norms. However, this transition is not without substantial challenges, as the academic realm undergoes a paradigm shift driven by the imperative for business reinvention, heightened workplace requirements, and evolving student aspirations (Euromonitor International, 2022). A discernible emphasis has emerged in recent years on fostering stronger linkages between university and company, particularly within the dynamic design sector, necessitating effective collaboration to prepare a competent workforce capable of sustaining internal company capabilities (Burnside & Witkin, 2008). Oliver et al. posited that the innovative university-company partnership is based on "interactions between university and industry scientists working on translating academic science with commercial potential towards market applications" (2019). Deloitte's research (2017) also emphasizes that, shortly, business acumen will be deemed an invaluable proficiency alongside creativity and innovation for designers, identified as a critical success factor for dynamic performance across industries. McKinsey & Company (2018) further asserts that companies with optimal financial returns embrace a design-centric vision, highlighting the urgency of enhancing the interconnectedness of design

and business in contemporary education. Traditionally, the university prioritizes theoretical knowledge dissemination, while the company focuses on profit-driven product development. Nevertheless, recognizing the potential synergies when these distinct spheres converge is crucial, offering mutually advantageous outcomes that address pressing needs fostering socio-economic growth and development.

This paper introduces a design case study, illustrating effective solutions to fortify the university-company ties. The authors provide insights into the interplay between academic research and design practice through unique perspectives, offering strategies to integrate these domains for innovation and knowledge advancement. The authors anticipate that the experiences shared in the case study will serve as a valuable reference for fellow researchers, encouraging a comprehensive exploration of design practices and yielding more impactful outcomes.

2. A synergetic design project with Midea

2.1. Midea: Humanising technology makes life better

Midea, situated within the home appliance sector of the Midea Group, an eminent global high-technology enterprise holding the 245th position in the 2022 Global Fortune 500 ranking, encompasses a diverse portfolio of over ten brands. Aligned with the overarching ethos of "Humanising Technology" shared across all Midea Group businesses, Midea's operational philosophy prioritizes consumer-centricity and proactive problem-solving. The company is committed to exceeding current expectations while anticipating and addressing evolving consumer needs through continuous exploration and innovation. Under the Midea Home Appliances brand, the company presents an extensive array of products within the home appliance industry, specializing in air treatment (encompassing both commercial and residential air conditioning solutions), refrigeration, laundry, large kitchen and cooking appliances, small kitchen appliances, water appliances, floor care, and lighting. This comprehensive product range underscores Midea's dedication to offering multifaceted solutions to the dynamic requirements of consumers, thereby positioning itself as a significant player in the global market (Figure 1).

Figure 1. Left: Midea logo. Right: A Midea water dispenser product for the Chinese market.



2.2. Midea design workshop: Soda and water dispenser for the EU market

The product/platform under consideration represents the latest development by Midea, featuring a distinctive attribute known as ICE-BANK, facilitating an uninterrupted supply of chilled carbonized water. The primary functionality of the product lies in delivering purified water, chilled purified water, and chilled carbonized water. It is important to note that the platform is fixed and immutable. The company must enhance its market standing in Europe, incentivizing consumers to adopt the SODA water dispenser. This strategic move aligns with the growing significance of SODA and purified water dispensers in mitigating the environmental impact associated with plastic bottle consumption, transportation, and storage.

Given the escalating popularity of water purification systems and evolving perspectives on SODA utilization in various contexts (e.g., social gatherings, culinary activities, health-conscious practices), the workshop sets forth the following objectives:

- Collecting pertinent data and information concerning the European market to identify potential innovative scenarios.
- Propose design solutions that capture customer attention by enhancing visual engagement with the SODA function.
- Strengthening the overall user experience associated with the SODA water dispenser.

- Augmenting the visualization and perception of the dispensing process, mainly focusing on the user interface (UI) aspects.

Specifically, the workshop aims to address the following thematic areas:

Visual Engagement:

- Strategies for effectively communicating and showcasing the SODA function in retail settings.
- Design expressions that convey the SODA function and emotionally engage potential customers.
- Techniques to evoke interest and prompt purchase decisions.

User Experience (UX) Physical Interaction:

- Improving the overall user experience during the SODA dispensing process.
- Enhancing interaction aspects during maintenance operations.
- Addressing considerations such as the type of vessels used, timing of usage, and diverse user needs.

UX Interface-UI:

- Exploring methods to engage users emotionally in the SODA process.
- Enhancing user interface design to improve the overall utilization of the SODA dispenser.
- Encouraging users to perceive SODA as a compelling beverage choice through thoughtful interface design and interaction.

2.3. Design team structure

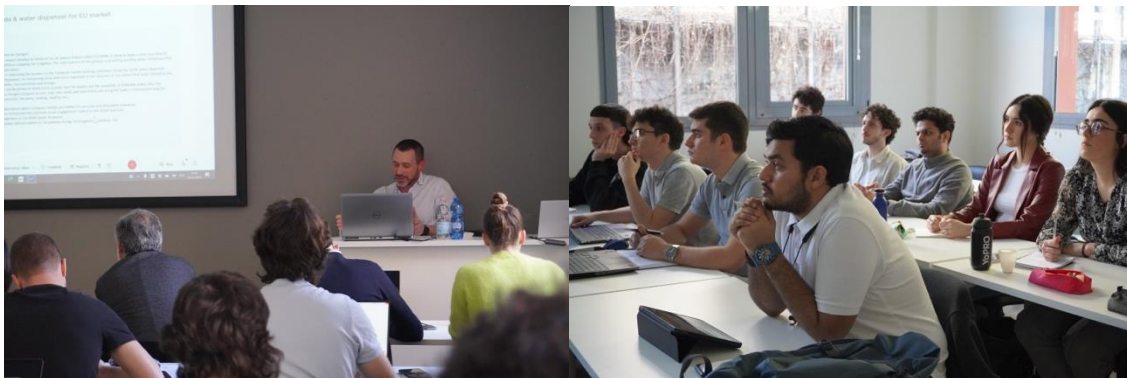
The design team comprises a diverse and multi-disciplinary group of professionals with varied design expertise. Senior professors with substantial knowledge in the relevant field oversee the scientific direction. Complementing their leadership, mentors, junior designers, and structured researchers contribute with their distinct perspectives and approaches to the project. The six operational groups consist of 19 master-level students of international origin, hailing from different countries and possessing diverse design backgrounds. These students were selectively chosen from the School of Design at Politecnico di Milano and POLI.design, the consortium established by Politecnico di Milano. In addition to the academic constituents, corporate partners affiliated with Midea play a pivotal role by imparting invaluable contributions to the project. This contribution involves sharing technical specifications, offering suggestions, and infusing artistic and creative inputs. The collaboration extends beyond academic boundaries, fostering an international and interdisciplinary environment that facilitates the generation of innovative and cutting-edge ideas within the design team. This collaborative effort provides a unique learning opportunity for students and enables them to glean insights from experienced professionals in the field.

2.4. Design workshop process

The workshop began on the 24th of March 2023 and concluded on the 15th of May 2023, followed by three stages.

Initiation and briefing: The first stage of the design process involves comprehensive project initiation and briefing. The design team thoroughly examines the project's requirements, objectives, and contextual constraints at this step. A clear understanding of the company's expectations and the broader socio-cultural context is established. This stage necessitates effective communication between the scientific team, corporate partners (experts from Midea), and design students to ascertain project goals, constraints, and any specific considerations that may inform the subsequent design phases. Empowered with this foundational knowledge, participants embarked upon the critical step of discerning and delineating the fundamental problem statements inherent to the project.

Figure 2. Project initiation and briefing with Midea representatives.



Design development: After the briefing phase, the design process advances into the conceptualization and design development stage, marked by synthesizing ideas, exploring design possibilities, and formulating preliminary design concepts. In the second phase of the workshop, a studio-based collaborative approach is systematically employed to assess the quality, feasibility, and alignment of design concepts with the specified project objectives. This pedagogical strategy is rooted in an intersubjective exchange between students and their academic mentors, embodying a democratic and open collaborative ethos. It fosters the seamless transmission of knowledge while concurrently catalyzing the emergence of innovative pathways toward expertise cultivation. Within the studio-based framework, students are actively encouraged to participate in experiential learning, applying theoretical knowledge to practical design challenges. This pedagogical environment facilitates an iterative process wherein the initial, ambiguous understanding of product requirements gradually transforms into refined and superior outcomes, aligning with the observations of Green and Bonollo (2003). A critical stage of this phase entails the active involvement of Midea representatives, who are invited to participate in the mid-term presentations. Within this collaborative context, students have the distinctive opportunity to articulate and present their evolving design proposals, thereby opening themselves to constructive critique and invaluable feedback from industry professionals. Collaboration and feedback loops among team members and stakeholders throughout this stage are crucial in refining the design concept before the finalization phase.

Final delivery: The design workshop's conclusive phase involves refining the proposal and developing comprehensive design specifications. Students are responsible for presenting their finalized design concepts to a discerning audience of company representatives (Fig. 3). This ultimate stage represents a valuable opportunity for students to subject their work to the criticism of industry professionals and mentors. The feedback during this evaluative process prompts profound self-reflection among the students, facilitating a methodical dissection and evaluation of their designs' inherent strengths and weaknesses. Following an intensive discussion and assessment, Midea representatives selected a singular proposal that most closely aligns with the stipulated objectives of the project. This chosen proposal is earmarked for further development, ultimately culminating in its finalization.

Figure 3. The final presentations of the project.



3. Observation and conclusion

Ensuring the alignment of university curricula with industrial needs is critical to addressing the mismatch of students' skills. This involves adopting a flexible delivery model, accommodating contemporary study and work responsibilities, as highlighted by Spang (2014). Departing from the prevailing design education model, this paper advocates for a paradigm shift, fostering a dynamic relationship among academia, associations, companies, and professionals to cultivate an environment conducive to design culture. Facilitating students' desired outcomes can be achieved through collaborative partnerships within educational pathways, emphasizing participatory teaching and learning, where students actively shape their learning process, encouraging experimentation and interdisciplinary perspectives.

In the academic context, the role of a company partner extends beyond collaboration to that of a trained instructor, possessing the necessary skills and knowledge to facilitate active student participation. Through engagements such as meetings, visits, and presentation critiques, students gain a mutual understanding of the subject matter, enhancing their overall educational experience. Intermediate facilitators are pivotal in university-company collaboration, acting as intermediaries between internal teams and external partners. These facilitators foster communication and cooperation, translating diverse

perspectives into a common language, thereby promoting the exchange of knowledge and expertise between academia and industry.

As businesses undergo reinvention in response to changing workplace demands and evolving student expectations, enhancing collaborations between design and industry becomes crucial in the globalized era. This paper presents a representative case study as an illustrative solution to fortifying university-company synergy. The authors contribute unique perspectives on the interplay between academic research and design practice, offering insights into their effective integration to foster innovation and advance knowledge. The authors aspire to furnish fellow researchers in cognate fields with a valuable reference point, informed by the experiences gained from this project, to explore further and enhance design practice, achieving more substantial and consequential outcomes.

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PEDAGOGICAL MODEL FOR TEACHING SUSTAINABILITY IN HIGHER EDUCATION: ENGAGING HEAD, HANDS AND HEART

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Abstract

This study aims to build a pedagogical model that engages both head, hands, and heart in the transformative learning of sustainability. We built our pedagogical model for teaching sustainability by integrating the theories of transformative learning (Mezirow 2006; Hoggan 2016), transformative learning for sustainability (Sipos et al., 2008; Rodríguez Aboytes & Barth, 2020), sustainability competencies (Redman & Wiek, 2021) and education for sustainability leadership (Haney et al., 2020; Novy et al., 2021). Our study contributes by integrating the theory into a coherent pedagogical model with learning activities that are designed to engage both the learners' thoughts, identity, and agency. By using empirical data from the first implementation in the advanced master's level course in the fall 2023, we tested its transformative potential through pre- and post-surveys (n=25) and student feedback (n=19) and demonstrated the learning outcomes as well as the evaluation of the implementation practices.

Keywords: *Education for sustainable development, sustainability competencies, transformative learning, pedagogical model, higher education.*

1. Introduction

Exceeding the planetary boundaries that sustain life on earth indicates how we as a humankind need to radically change our course and break with unsustainable social and cultural structures, norms, and practices (Boström et al., 2018). Against this background, many scholars have recognized the necessity of transformative learning to solve our deep-rooted sustainability challenges (Sipos et al., 2008; Rodríguez Aboytes & Barth, 2020).

In this study, we aim to answer the research question: *How to build a pedagogical model that engages both head, hands, and heart in the transformative learning of sustainability?* Our focus is on learning activities. We aim to build a transformative pedagogical model for higher education that not only aims to develop sustainability competencies but also to advance the identity of a sustainability expert and leader. Through action-oriented case study, we explore how students develop sustainability competencies, sustainability leader identity and empowerment to act through engaging in active learning exercises. These learning activities are designed to engage both the learners' thoughts, identity, and agency.

2. Transformative learning for sustainability

The concept of transformative learning was introduced in 1978 in the field of adult learning by Jack Mezirow (Mezirow 2006), who developed it through various revisions into an established learning theory (Kitchenham 2008). Mezirow (2006, p. 92) defines transformative learning as "the process by which we transform problematic frames of reference (mindsets, habits of mind, meaning perspectives) – sets of assumptions and expectation – to make them more inclusive, discriminating, open, reflective and emotionally able to change." The key elements of transformative learning are the critical reflection on the assumptions and the participation in discourse (Kitchenham 2008). For creating fruitful conditions for transformative sustainability learning, Rodríguez Aboytes & Barth (2020) emphasize the importance of time and space for reflection and discourse as well as the social interaction among learners. Recent reviews have pointed out the superficial use of the term *transformative learning* and the danger of becoming empty of meaning when it is used to refer to almost anything (Hoggan 2016; Rodríguez Aboytes & Barth, 2020). Hoggan (2016, p. 77) argues for broadening the meaning of transformative learning from Mezirow's specific definition focusing on people's meaning making processes and

epistemic shift, into a metatheory or overarching paradigm, where transformative learning is understood as “processes that result in significant and irreversible changes in the way a person experiences, conceptualises and interacts with the world.” Based on the synthesis of previous literature, Hoggan (2016) presents a typology of transformative learning outcomes, which illustrates that transformative learning does not only refer to cognitive changes but also engages emotions, identity, and agency. Similarly, the framework of transformative sustainability learning by Sipos et al. (2008) is organized on the principle of head (engagement, cognitive), hands (enactment, psychomotor) and heart (enablement, affective) to facilitate behavioural change.

Research on sustainability competencies and sustainability leadership have furthermore considered the preferred learning outcomes in sustainability education. There is a high level of agreement among scholars over the competencies needed for advancing transformations towards sustainability (Redman & Wiek, 2021). The framework of key sustainability competencies developed by Redman & Wiek (2021) is based on the systematic review of the previous literature and centers on eight key competencies in sustainability, five of which are established and gained widespread use in the literature (systems thinking, futures thinking, values thinking, strategic thinking, and interpersonal thinking competence), and three of which are emerging ones (intrapersonal, implementation, and integration competence). With emerging aspects, the framework better acknowledges the need to address emotional development along with the intellectual (intrapersonal) and put more focus on doing and acting on sustainability (implementation). Even though the term ‘competence’ is understood broadly to include knowledge, skills, understanding, values, attitudes, and desire (Redman & Wiek, 2021, p. 3), it seems to emphasize cognitive and practical abilities, instead of focusing on the agency and identity development of the learner. The research of sustainability leadership development complements this by highlighting the importance of personal development element in sustainability education and the need to address emotional and motivational aspects and not only the intellectual (Savage et al., 2015; Haney et al., 2020; Novy et al., 2021). For example, Haney et al. (2020) found out in their study how making sustainability personal for participants led to deep learning and feeling committed to and empowered to act for sustainability. In conclusion, the previous literature on sustainability education implies that we need to design the learning activities in a way that engages both thoughts, identity, and agency for sustainability.

3. Research context and method

This study was conducted in a Finnish university for a master’s level course, for which a new pedagogical model was built and tested. The course is an advanced course included in the Degree Programs of Information and Knowledge Management and Environmental Engineering. We, the authors of this paper worked as the teachers and developers of this course while simultaneously studying this sustainability education and reflecting on it as researchers. The course had already been launched in 2020 and has been implemented twice in an academic year. We as the original designers and teachers of the course, wanted to renew the course and carefully consider what kind of learning activities would support the emergence of sustainability expertise and leadership. Building up the new pedagogical model started in the spring of 2023 by studying the literature on sustainability education, reflecting experiences on previous implementations, and drafting a pedagogical model to be tested in the fall 2023.

The designed pedagogical model was then implemented and tested by using feedback from the course participants in the form of pre- and post-reflection surveys (n=25) and official course feedback system (n=19). By using pre- and post-reflection surveys, we assessed the transformational learning in sustainability (based on changes in environmental perceptions, intentions, and behaviours) as well as the development of sustainability leadership and sustainability competencies. Both surveys included 38 statements to be answered in Likert-scale. We used validated statements from previous literature (mostly from Saari et al. 2021) to measure environmental knowledge, environmental concern, environmental risk perception, behavioural intention for environmental protection and sustainable consumption behaviour. Sustainability leadership was measured based on the sustainability leadership meter: “Rate on a scale of 0 (Not at all) to 10 (fully) the extent to which you see yourself as a sustainability leader”. This idea of measuring leadership identity was derived from Clapp-Smith et al. (2019) but applied to the sustainability leadership context (Haney et al. 2020). Sustainability competencies were measured based on the statements in the survey by Savage et al. (2015) as well as on the definitions by Redman & Wiek (2021) and Annelin & Boström (2022). In addition to the statements, the post-survey included two open-ended questions: “How has the course affected the way or the extent you see yourself as a sustainability leader?” and “How has the course affected your sustainability competencies?”

Answering the surveys was anonymous to strengthen the validity of our research. Using identification number that the respondent self-created, we combined the respondent’s pre- and post-answers. 32 students participated in the course, of which 25 answered both surveys. Because we

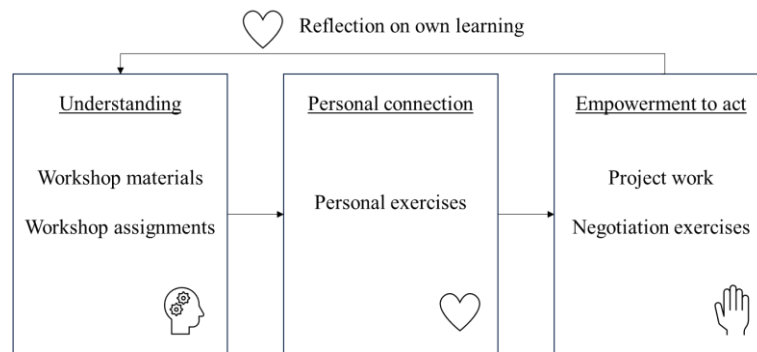
were interested in changes in students’ perceptions due to learning in the course, for the analysis, we only included responses from respondents that answered both surveys (n=25). Although the sample is rather small, it well represents the participants in the course. In addition to the surveys, we analysed the students’ numeric and verbal feedback received from the university’s official feedback system (n=19). The course implementation in the fall 2023 was held in English and the participants represented several nationalities in addition to Finnish.

4. Results and discussion

4.1. Transformative pedagogical model for teaching sustainability

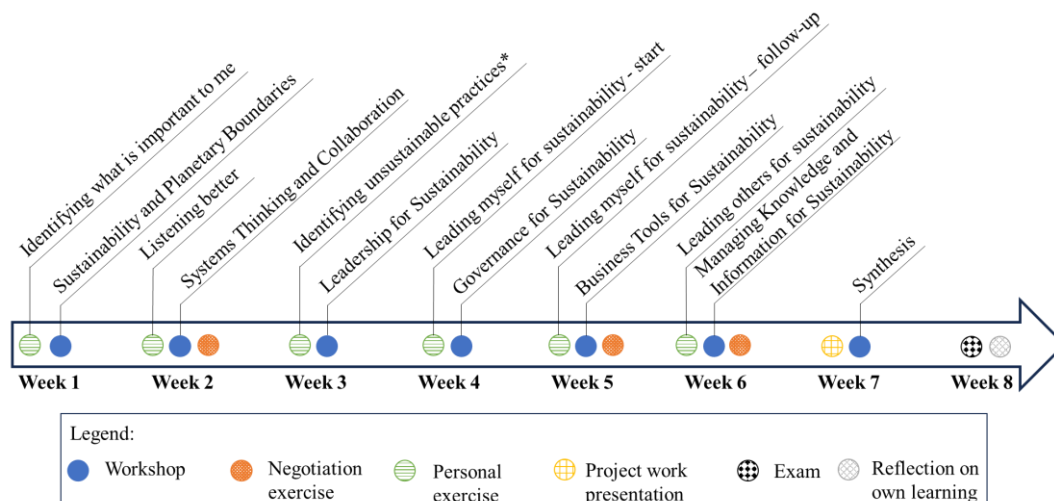
The overall framework of our pedagogical model builds on the idea that we need to develop not only thoughts but also identity and agency (Figure 1). It is in line with the organizing principle of head, hands, and heart for transformative sustainability education proposed by Sipos et al. (2008), and furthermore reflects the sustainability leadership education framework by Haney et al. (2020) consisting of three interlinked elements of understanding, personal connection, and empowerment to act.

Figure 1. Transformative pedagogical model for teaching sustainability (modified from Haney et al. 2020 with references to Sipos et al. 2008).



The course “Knowledge-based and Collaborative Decision Making for Sustainability” was taught over a period of eight weeks, out of which seven weeks consisted of preparative and in-class assignments (Figure 2). Students prepared for the classes by familiarizing with the workshop materials and by conducting personal exercises. The personal exercises aimed at engaging students’ own motivation and to see their own role as a leader for sustainability. In the workshop, the personal exercises were discussed along with the workshop materials. In addition, project work assignments were carried out. Negotiation exercises were organized three times during the course. At the end of the course, students reflected their own learning based on the learning objectives of the course, which highlighted the change in students’ sustainability skills brought on by the materials and assignments in the course.

Figure 2. Timeline for the assignments during the course. The personal exercise marked with an * will be added on following implementations.



The workshop materials consisted of short lecture videos on the key topics of the course and related scientific articles. The discussions in the workshops were to deepen the understanding about the topic and share knowledge and understanding between students. At the end of the course, the main learning points were discussed in a synthesis session. Workshop assignments were related to the project work on backcasting (based on Quist et al., 2006) that addressed transition towards defined sustainability vision using the backcasting steps. The project works were presented in a final poster session. The purpose of the negotiation exercises about complex sustainability issues (purchased from Program on Negotiation at Harvard Law School) was to introduce the collaborative approach to negotiations and to apply it in practice. Students had to prepare for the negotiation exercises by reading the general instructions of the negotiation context and their own role, and by familiarizing themselves with the chosen theoretical material (e.g., videos and texts by Program on Negotiation) that was discussed first in the session. One of the main learning goals of the negotiations was to change the mindsets from win-lose mentality into seeing a negotiation more as an opportunity to make up win-win solutions in contexts containing many contradictions and tensions related to the informational uncertainty, to the perceptions of risks, to the short-/long-term perspectives and to the ecological, social, and economic development.

4.2. Evaluation of implementation and learning outcomes

Students' answers were categorized in head, hands and heart, to reflect the sustainability knowledge and understanding, empowerment to act for sustainability and personal connection to sustainability, respectively. The course induced a positive change in all three categories.

Prior to the course, 48 % of the students claimed to know at least quite a lot of the causes of environmental problems. This value increased to 72 % after the course. Even larger difference was in the knowledge of the solutions of environmental problems: prior to the course 20 % claimed to now at least quite a lot, while after the course 60% knew at least quite a lot. After the course, the written answers revealed the increase in students' confidence in sustainability issues: "I am much more knowledgeable in sustainability context and now I have a better and wider perspective on how to assess the issues and solutions related to these." The results showed also that the futures thinking abilities clearly increased. Especially the ability to predict and consider the possible repercussions of our actions and decisions improved: prior to the implementation 28% agreed or strongly agreed of being capable of this in comparison to 80 % being of that opinion after the course. Analysing complex systems was rehearsed in workshops and in the backcasting project work. However, both prior to and after the course, students evaluated their ability to analyse complex systems to average (44% of the students agreed or strongly agreed). It is possible that when the understanding about the complexities of the sustainability problems and solutions increased, it decreased confidence in their own system analysis skills.

The ability of values thinking requires both knowledge and intrinsic motivation, and hence represents both head and heart. The course helped students to apply sustainability norms, principles and goals to solve sustainability problems (Strongly agree or agree changed from 48 to 84 %), to articulate a vision of a just and sustainable society (Strongly agree or agree changed from 56% to 80 %), to understand their own strengths and weaknesses as sustainability leader (Strongly agree or agree changed from 48% to 76 %) and to construct action plans that can help solve sustainability problems and create transformation for sustainability (Strongly agree or agree changed from 44 to 80 %). The increase in motivation to act for sustainability was also demonstrated after the course. The improvement in the intrapersonal skills was shown by the increased positive feeling about being able to induce change: "The course has given me confidence and provided me knowledge regarding sustainability tools and approaches and that now I feel positive about myself and prepared to work towards sustainability."

The behavioural intention to protect the environment by paying higher taxes or prices or accepting cuts in the standard of living stayed nearly unchanged (a change from 56 % to 61 % being at least somewhat willing), whereas the sustainability consumption behaviour increased somewhat (a change from 48% to 62% being at least often). The course increased the feel of being a sustainability leader by 26%. After the course, the average score was 6,7/10, while for some there was a clear difference: "It [the course] has increased my knowledge about sustainability and given me confidence to see myself as a sustainability leader." The course developed students' strategies thinking skills. The ability to develop practical tools for advancing a sustainability agenda increased (Strongly agree or agree changed from 36 to 64 %). The students rehearsed their interpersonal skills in workshops, project work and negotiation exercises. They evaluated that their ability to use collaborative approaches to problem solving increased clearly (Strongly agree or agree from 56 to 88 %) and to work together across e.g., different disciplines or perspectives increased (Strongly agree or agree changed from 72 to 84%). After the course, they also felt better at motivating positive change in others (Strongly agree or agree changed from 56 to 76 %) and at collaborating with diverse stakeholders (Strongly agree or agree changed from 52 to 80 %).

The mean of the overall assessments (n=19) given to the course was “very good” (4.00 on the scale 1–5). Versatile, participatory learning activities were appreciated. The model for negotiations: 1) pre-material, 2) in-class discussion based on the material, 3) negotiation, 4) debriefing and reflection on theories, worked well. Students were able to form syntheses on issues in the class discussions, and the final learning café-based synthesis tied issues together. However, some students hoped for more teacher-led overall syntheses on issues. Presumably, the whole potential of personal exercises was not achieved, because the exercises were launched for the first time and the actual implementation practices (e.g. instructions) were not well-established. Afterwards, with our intentional focus on solutions, we noted a need for the additional personal exercise of critical questioning where students would identify collective unsustainable practices and what kind of social norms, habits, structures, and power relations maintain those practices. Overall, based on the results, we could identify shifts in thinking, but we could not verify deeply rooted changes in students' worldviews, e.g. towards more ecologically grounded worldview.

5. Conclusions

Our study contributes by integrating the theory of transformative learning, sustainability competencies and education for sustainability leadership into a coherent pedagogical model with learning activities that are designed to engage both the learners' thoughts, identity, and agency. Based on the results, the course increased environmental awareness and many sustainability competencies, such as futures thinking, strategic thinking and interpersonal skills, improved. The course increased students' motivation to work towards positive change and to lead others. In the future, the pedagogical model needs to be further developed to encourage even more agency and empowerment to act for sustainability.

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LEARNING TRADITIONAL HAWAIIAN OPEN-OCEAN NAVIGATION THROUGH IMMERSIVE VIRTUAL REALITY STORYTELLING

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Abstract

In recent times, there has been a growing interest in Hawaii to acquire knowledge of traditional Hawaiian open-ocean navigation techniques, yet practical canoe experiences remain limited. Our virtual reality simulation, Kilo Hoku VR, aims to address this gap by offering users the opportunity to develop and refine their skills in a simulated environment before embarking on an actual canoe journey. Departing from conventional navigation tools, our simulation utilizes the elements, creatures, and celestial bodies as guiding tools, as outlined by Low (2016). In the pursuit of authenticity, we are currently developing VCs to serve as guides, drawing on the rich tradition of Hawaiian storytelling to impart knowledge. This qualitative pilot study focuses on exploring the values and processes inherent in storytelling, such as eye contact, drawing the listener into the narrative, and the appropriate use of body language. The study aims to evaluate the effectiveness of storytelling as an instructional tool for teaching traditional Hawaiian navigation techniques within a virtual reality environment (VRE). The research methodology involved in-depth interviews with three participants selected from diverse backgrounds: a seasoned storyteller, an individual affiliated with the Polynesian Voyaging Society (PVS), and a native Hawaiian with experience in PVS. Preliminary findings from this pilot study highlight the significance of incorporating storytelling strategies, including sustained eye contact, drawing the listener into the narrative, and judicious use of body language. These elements collectively contribute to engaging learners in active listening and effective learning within the VR storytelling environment, and these conclusions point to the necessity of incorporating artificial intelligence to achieve this immersive experience properly.

Keywords: *Virtual reality, storytelling, virtual characters, cultural heritage.*

1. Introduction

Embark on a celestial odyssey amidst the stars and immerse yourself in the foundational skills of traditional Hawaiian open-ocean navigation through the captivating medium of immersive storytelling. Introducing Kilo Hoku VR, a meticulously crafted virtual reality (VR) simulation that faithfully recreates the experience of navigating a Polynesian double-hulled canoe, specifically the iconic Hokulea, conceived in 1974 with the mission of reviving the ancient Hawaiian art of open-ocean navigation without the use of instruments (Figure 1).

Figure 1. Various scenes from Kilo Hoku VR. kilohokuvr.com



In the traditional Hawaiian context, language was primarily oral, and education revolved around storytelling, a method expertly employed in teaching and learning various skills, as documented by Low (2016) and Karjala et al. (2021). This narrative approach extended to Hawaiian open-ocean navigation,

where the kumu (teacher) shared ancestral stories and life wisdom, allowing practitioners to apply acquired skills on real canoes.

Colonial influences diminished the sharing of Hawaiian arts, including storytelling and non-instrumental, open-ocean navigation. The latter was nearly lost until the Hawaiians sought guidance from Papa Mau of Satawal in Micronesia, whose teachings on Hokulea in 1976 reignited the art (Low, 2016). Despite historical storytelling in the Hawaiian Navigation class at the University of Hawaii at Manoa, limited opportunities exist for students to sail on a double-hulled canoe (waa kaulua) due to logistical constraints. Kilo Hoku VR aims to bridge this gap by providing a platform for learning and applying traditional wayfinding skills before venturing into the real-life ocean.

The incorporation of virtual characters (VCs) within the simulation is envisioned to guide learners and convey the wisdom of traditional wayfinding through storytelling. This pilot study delves into the values and processes integral to storytelling, aiming to inform the development of characters within the simulation who can effectively share wayfinding stories, fostering skill acquisition among participants.

This study assesses the efficacy of storytelling to teach traditional wayfinding, or open-ocean navigation techniques within a VRE, seeking answers to two key questions:

1. How effective is storytelling in transmitting traditional Hawaiian sailing techniques in a VR setting?
2. What role do VCs play in conveying wayfinding knowledge through storytelling?

2. Related Work

2.1. Storytelling-based training

A study conducted by Sarica and Usluel (2016) explored the impact of digital storytelling on visual memory and writing skills in grade school children over a period of fourteen weeks. Their findings indicated a positive correlation between storytelling and increased visual memory retention. Gallets (2005) arrived at a similar conclusion through a comparative study. Their research compared the effectiveness of sharing information through traditional reading methods versus presenting it in an engaging storytelling format. The study revealed that children not only demonstrated better comprehension of the content but also exhibited improved memory recall, attributed to the inherent engagement associated with storytelling.

2.2. Combining storytelling and VR

Doolani et al. (2020) developed a VR vocational training system, acknowledging the proven efficacy of storytelling in knowledge transfer. However, they asserted a lack of comprehensive understanding regarding the effectiveness of combining VR and storytelling. Their system seeks to bridge this gap by creating an immersive virtual workplace environment and employing a creative, non-interactive, fictional narrative. I contend that incorporating interactivity into the system, as suggested by Zhao et al. (2019), could enhance engagement, subsequently leading to increased cognitive benefits.

Wood and Reiners (2015) conducted a comparison between traditional learning methods and a virtual environment enriched with storytelling elements. Their study demonstrated how storytelling contributes to heightened engagement and self-directed learning.

2.3. Virtual characters (VCs)

I find it necessary to provide some clarification on terminology. The term *Virtual Character* denotes a digital entity that may exhibit traits and characteristics of a human but operates autonomously without human control from behind the scenes. The level of engagement and interaction of a VC is determined by its coding. There is a lack of consistency in naming conventions across the papers I have reviewed. Terms like digital agent, digital character, and virtual guides (Carrozzino et al., 2018) have been used. In contrast, the more commonly used term is virtual human or avatar, which implies entities controlled by a human from behind the scenes.

3. Methods

I designed a qualitative study with in-depth interviews to assess the efficacy of storytelling in teaching traditional Hawaiian open-ocean navigation techniques within a VRE.

3.1. Participant selection

A purposive sampling was chosen since it was necessary to identify and recruit participants with diverse backgrounds relevant to traditional Hawaiian open-ocean navigation and storytelling. Individuals with experience in the PVS, seasoned storytellers, and those with a cultural connection to Hawaiian navigation were included.

Three people with varying backgrounds were interviewed; a storyteller that has in-depth knowledge of the Hawaiian culture, someone who is currently working with the PVS to learn Hawaiian navigation, and a native Hawaiian that has worked with PVS in the past, but currently interviews people to better understand cultural heritage. As shown in Table 1, the backgrounds of these three people, offer a holistic view into my study.

Table 1. Unique Perspectives of Participants.

Participant	Area of expertise	Perspectives
#1	professional storyteller, has lived in Hawaii all her life	Understands the values and processes of storytelling, and from a Hawaiian perspective
#2	Member of the Polynesian Voyaging Society (PVS), experience with VR	Understands the application of traditional Hawaiian navigation, and the capabilities of VR
#3	Native Hawaiian, Professional interviewer	Can communicate from the viewpoint of a Hawaiian, and as a PVS practitioner

3.2. Data collection methods

To help answer the research questions, a data collection approach employing semi-structured, in-depth interviews was adopted to gain comprehensive insights into the unique experiences of each participant. This method facilitated an exploration of individual motivations, knowledge, and subjectivity, providing a nuanced understanding of the research questions. The choice of semi-structured interviews allowed for a balance between specific queries guiding the conversation and participants freely sharing their personal narratives.

The effectiveness of this approach was particularly evident during the interview with a professional storyteller participant. The semi-structured format accommodated her storytelling style, allowing her to respond to the questions in her own distinctive manner. While only a few explicit questions were posed, the participant conveyed a wealth of information through her narratives, sharing valuable insights into the world of storytellers.

Similarly, another participant preemptively addressed several questions, prompting a skip in the interview sequence. In such instances, participants were encouraged to provide additional information as needed for clarification, ensuring a comprehensive understanding of their experiences. This flexible and adaptive approach to semi-structured interviews proved instrumental in capturing the richness and depth of participants' perspectives.

3.3. Data analysis methods

I employed diverse coding techniques, encompassing in vivo, descriptive, process, and value coding, to analyze the data. Notably, the coding approach evolved with each research question, displaying variations and, at times, a combination of coding styles within responses. For example, while question one primarily featured in vivo codes, subsequent questions incorporated a blend of in vivo, descriptive, process, and value codes.

To ensure a thorough analysis, I meticulously reviewed each transcript multiple times. In the initial pass, I focused on reading and rectifying any misspellings. Subsequent rounds were dedicated to specific coding lenses—first identifying in vivo codes, then descriptive codes, followed by process codes, and concluding with value codes. This sequential approach allowed for a more focused and manageable coding process.

Once the coding phase concluded, I undertook the task of categorizing the codes to create cohesive groups. This categorization facilitated a higher-level organization of the data. Finally, I delved into identifying overarching themes within the established categories and codes, thereby providing a comprehensive understanding of the patterns and insights encapsulated in the dataset.

4. Results

During the coding of my transcripts, several prominent themes emerged from the interviews, with one noteworthy insight standing out: for genuine learning to occur, participants must actively engage in the learning process. This involves not only participating in the activity being taught but also applying it to their own lives, a concept aligned with place-based learning (Doolani et al., 2020). This realization led me to believe that a simulation involving participant interaction with VCs could foster active learning. Strategies such as eye contact, drawing the listener into the story, and the effective use of body language could be employed to enhance engagement and encourage active participation. The VC could pose questions, and vice versa, with the option for participants to select from a list of questions, each with pre-set responses.

The emerging themes from the pilot study further elucidated the characteristics of effective storytelling within the context of traditional Hawaiian narratives. These themes include:

- **Significance of Eye Contact** - The storyteller emphasized the importance of eye contact, describing it as making a connection with the audience, akin to "making love to the camera."
- **Engagement and Interaction** - An effective storyteller must actively engage, understand, react to, and interact with the listener. Drawing the audience into the story and making them feel a part of it is crucial.
- **Adaptability to Audience** - The storyteller should have the ability to adapt engagement and the story itself to meet the audience's needs. This includes reinforcing key points as needed and adjusting the narrative based on audience response.
- **Immersive Storytelling** - Successful storytelling involves making listeners feel like they are part of the story, actively engaged rather than passively listening. A skilled storyteller uses body language effectively to convey the narrative.
- **Passion for the Story** - The storyteller must genuinely care about the story being told and have a desire to share it with others. In the context of traditional Hawaiian storytelling, this act becomes a means of sharing history and passing down ancestral knowledge.
- **Cultural Sensitivity** - A storyteller should be sensitive to the culture and place they are in, creating a connection with the audience by respecting their background and incorporating elements that resonate with their sense of place.
- **Listening Skills** - A proficient storyteller knows when and how to listen. They function as mentors, recognizing the importance of listening as an integral aspect of effective storytelling leadership.

These themes collectively underscore the multidimensional nature of effective storytelling, emphasizing the dynamic interaction between the storyteller, the audience, and the cultural context, all of which can be considered valuable insights for the development of storytelling strategies within a VRE. A VC will not have these innate abilities without the incorporation of artificial intelligence (AI).

5. Discussion

A crucial distinction must be made between avatars and VCs in the context of my research. While an avatar serves as a representation controlled by a human, a VC operates independently. A professional storyteller shared with me that a VC within VR may not achieve the same level of engagement and connection with the audience as a live storyteller. I propose that a well-designed VR system, integrating VCs with artificial intelligence (AI), could assess each learner individually using tools such as eye-tracking software, haptic feedback, and cerebral measurements. This personalized approach would enable the system to dynamically adjust and update content for each learner, addressing the limitations identified by Doolani et al. (2020) regarding immersion and engagement in VR storytelling.

Zhao et al. (2019) highlighted the need for further exploration of non-verbal communication in VR, a sentiment echoed by my research participants. The advantages of exposure to non-verbal communication were consistently emphasized during interviews, aligning with Doolani et al.'s (2020) assertion that body language plays a pivotal role in human communication.

Insights from Zhang and Bowman (2021) on immersive digital storytelling in VR align with my research findings. They observed that incorporating rich characters enhances learner engagement and immersion. My participants echoed this sentiment, emphasizing the value of rich interactivity in VR for a more engaging experience.

Previous research consistently suggests benefits of incorporating storytelling by VCs in a virtual reality environment, including increased engagement, a heightened sense of presence, and a more immersive learning environment. My research aligns with and complements these findings.

Zhang and Bowman's exploration of multi-character storytelling experiences having instructional advantages raises an intriguing point that I have not investigated. They propose that dialogue between characters is more interesting than monologues. This aspect merits further exploration in future research to enrich our understanding of the instructional dynamics within immersive digital storytelling in VR.

6. Conclusions

In the long term, I aspire for this research to evolve into a comparative study, contrasting the acquisition of traditional wayfinding skills in a VRE against the conventional classroom approach. This envisioned study would adopt a more quantitative methodology, with the evaluation criterion focused on students applying their acquired knowledge in practical scenarios aboard a waa kaulua. The primary objective of subsequent research endeavors is to unearth the underlying values and cues within storytelling that effectively facilitate the learning and application of traditional wayfinding skills.

Furthermore, the anticipated outcomes hold the potential to unveil best practices for engagement and online learning within a VRE educational system, transcending the specific context of traditional wayfinding. These findings could be generalized and applied to diverse subjects, enhancing the overall effectiveness of virtual learning environments. To bridge existing gaps, a subsequent study integrating AI into the VCs may prove instrumental. This advancement aims not only to enhance engagement but also to contribute to the ongoing improvement of online learning experiences within a VR setting. If ACs are to play a role in conveying knowledge through storytelling, the data points to incorporating AI for best results.

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INVESTIGATING STUDENTS' PERSPECTIVES AND ATTITUDES TOWARDS MOBILE LEARNING AT A NIGERIAN UNIVERSITY

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Abstract

Mobile learning is a type of education that has significant potential and offers new opportunities for education and learning assessment. As such, it plays a critical role in the development of quality education in Nigeria, which aligns with the fourth Sustainable Development Goal. Despite its advantages as an emerging learning method and its adoption in education, research into its use in teacher education in developing contexts like Nigeria is still in its early stages. This paper discusses the use of mobile learning (m-learning) in teacher education in Nigeria. This study, therefore, investigates the perception and attitude of preservice teachers towards using m-learning for their teacher education course. The study uses a survey instrument with a 4-point Likert scale to collect responses from 54 preservice teachers registered in an ICT in education course at a university in Southwestern Nigeria. The responses are analyzed using descriptive and inferential statistics, as well as regression analysis. The results show that preservice teachers have a positive attitude towards using mobile apps and tools for learning, with females scoring higher than males. The study also found that perceived usefulness significantly influenced their attitude towards mobile learning. The results of this study indicate that preservice teachers who perceive the use of mobile apps/tools for learning as beneficial are more likely to have a positive attitude towards their use, as long as they receive the necessary educational training to improve their proficiency in utilizing such mobile learning tools/apps. As a result, it is recommended that teacher education programs implement effective technology-assisted training programs that will familiarize pre-service teachers with the pedagogical skills and experiences required to build their confidence in using mobile apps/tools in their teaching practices. Furthermore, teacher education programs should introduce preservice teachers to the ideas of mobile learning and provide learning opportunities that can foster their knowledge and effectiveness in utilizing mobile apps/tools for teaching and learning.

Keywords: *Attitudes, mobile learning, perceptions, preservice teachers, university students.*

1. Introduction

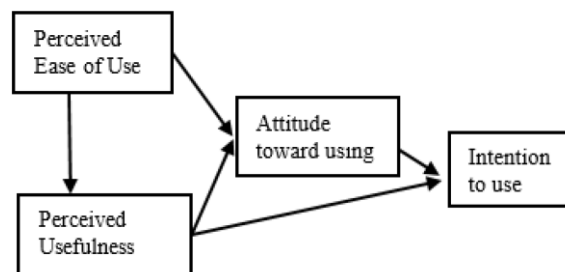
The use of mobile technologies has become increasingly widespread globally, with many people incorporating them into their daily lives, especially since the COVID-19 pandemic (Alaba et al., 2022; Al-Emran, 2016). As a result, mobile learning has become a significant aspect of education at all levels, including higher education. Mobile learning is a type of education that utilizes mobile technology such as smartphones, PDAs, netbooks, tablet PCs, and various applications/tools to facilitate learning. It has significant potential and offers new opportunities for education and learning assessment. Mobile learning allows learners to access relevant information/teaching materials, connect with others and systems, reduce cognitive load, and encourage asynchronous/synchronous communication between students and teachers (Chen et al., 2015; Campbell, 2018). As such, it plays a critical role in the development of quality education in Nigeria, which aligns with the fourth Sustainable Development Goal (Ajayi et al., 2019). Despite the high ownership of mobile devices, longitudinal data indicates that the use of mobile technology in learning is not as widespread as the devices themselves (Chen et al., 2015). Moreso, research indicates that students are not as adept at using mobile technology as the devices' popularity suggests (Chen et al., 2015). Despite the advantages of m-learning as an emerging learning method and its adoption in education, research into its use in teacher education in developing contexts like Nigeria is still in its early stages (Alaba et al., 2022). The study's focus, therefore, was to explore the perception and attitude of preservice teachers in Nigeria to utilize m-learning for their teacher education course. To achieve this goal, the following research questions were addressed:

- What are the perceptions and attitudes of preservice towards using mobile learning?
- Is there any significant difference between the perceptions and attitudes of preservice teachers towards using mobile learning by gender and age?

2. Conceptual framework

This study employs the Technology Acceptance Model (TAM) of Davis (1989) as a conceptual lens. TAM explains how people form attitudes and make decisions about using technology. According to the TAM model, a person's intention to use technology is determined by an evaluation of the trade-off between the perceived usefulness of the technology and the perceived ease of use of using it (Davis, 1989). Perceived ease of use refers to how easy a person thinks it is to use the technology, while perceived usefulness refers to how beneficial they think it is (Davis, 1989). The model suggests that the more a person perceives technology as easy to use and useful, the more likely they are to accept and use it. This implies that realizing the perceived usefulness (PU) and perceived ease of use (PEOU) of mobile technologies in education can positively impact the attitudes toward usage (ATU) of mobile technologies (Chen et al., 2011). Moreso, it is maintained that a user's positive attitude will lead to a greater intention to use technology for learning (Orgaz et al., 2018). The use of TAM in this study underlies the fact that the usefulness and desire of students to utilize mobile technology for educational purposes is not solely determined by their individual willingness or unwillingness to use the devices but rather by the technical limitations inherent in the devices themselves (Mugo et al., 2017). Hence, the use of TAM in this study was divided into four distinct components: perceived usefulness, perceived ease of use, attitude towards using the technology, and intention to use the technology, as depicted in Figure 1.

Figure 1. Conceptual Framework.



3. Method

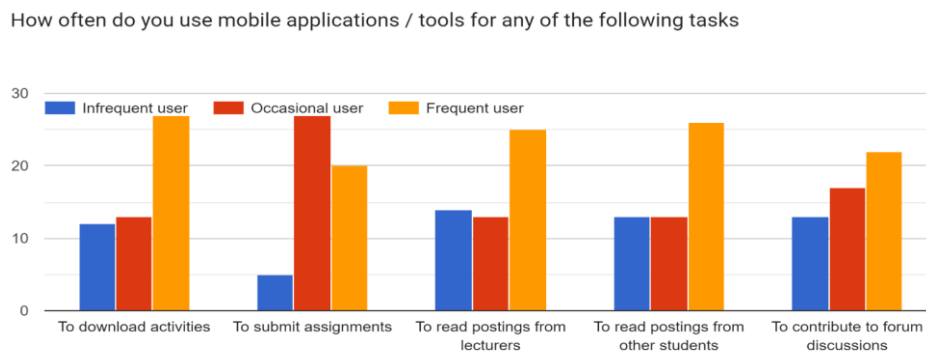
This study utilized survey research with a quantitative approach to elicit responses from 68 preservice teachers registered in an ICT in education course at a University in Southwestern Nigeria via a Google form. The TAM questionnaire was modified and then given to participants to complete. The questionnaire comprised 26 questions that required pre-service teachers to indicate their degree of agreement or disagreement on a four-point Likert-type scale, where 1 corresponds to 'Strongly disagree' and 4 to 'Strongly agree'. 7 dealt with attitudes towards m-learning; 6 with perceived usefulness; 6 perceived ease of use; 4 assessed intention; and 3 dealt with general biography (age, gender and subject discipline). However, the findings reported in this paper were focused on the perceptions and attitude scale utilized in this study. Three experts in the field of education were consulted to ensure that the content and face validity of the instrument were appropriate. A pilot study was also conducted with a small group of 10 pre-service teachers who had similar backgrounds to the target group to test the instrument's validity. The Cronbach alpha reliability coefficients for the three attributes were: m-learning attitude = 0.979, perceived ease of use = 0.961, perceived usefulness = 0.961, and Intention = 0.964. Responses from the survey instrument were analysed using descriptive statistics, independent t-test and regression analysis by using the statistical program SPSS (Statistical Package for Social Science v21). Permission to conduct the study was obtained from the Departmental head, and participants were provided with detailed information about the research to ensure they could make an informed decision about participating. The research sample was made of 54 preservice teachers consisting of Males (28.8%) and females (71.2%). Among the respondents, 53.8% were between the ages of 15, 28.8% were between 21 and 25 years old, and 17.4% were from 26 years and above.

4. Findings and discussion

Figure 2 illustrates that respondents frequently use mobile devices and apps for downloading activities, reading postings from lecturers, reading postings from other students and contributing to forum discussions. However, most of the respondents indicated that they occasionally use their mobile devices/apps for submitting assignments. These findings align with previous research, which shows that students recognize the potential of mobile devices to enhance collaboration, communication, and

information sharing in classroom settings (Ahmad, 2020). Students value the use of mobile devices as a means to increase interaction and engagement, and they prioritize its use for these purposes.

Figure 2. Mobile applications/tools use in different tasks.



Pre-service teachers’ attitudes and perceptions toward using m-learning.

Results of Likert-type statements dealing with pre-service teachers’ attitudes and perceptions towards the use of mobile learning are displayed in Tables 1,2 and 3. The calculation of the mean score results in a value of between 2.37 and 2.56. A score above the minimum of 2.5 points indicates positive perceptions and attitudes. The mean scores in Table 1 revealed that the majority of the preservice teachers agreed that they enjoyed using mobile apps/tools for assignments ($\bar{x}AT2 = 2.52$), considered it a good way to learn ($\bar{x}AT3 = 2.50$), found it made studying more interesting ($\bar{x}AT4= 2.60$), considered studying with mobile apps/tools to be fun ($\bar{x}AT5 = 2.50$), liked studying with mobile apps/tools ($\bar{x}AT6= 2.60$), and liked the idea of using mobile apps/tools for learning purposes ($\bar{x}AT1= 2.50$). However, the majority of the participants expressed that using m-learning for lectures is not satisfying ($\bar{x}AT1 = 2.40$).

Table 1. Statements in the questionnaire on students’ attitudes towards using mobile learning.

Please indicate the extent to which you agree or disagree with each statement below.	Percentage (%)				Mean	Std. Deviation
	SD	D	A	SA		
I like lectures more when I use m-learning (A1).	21.2	28.8	38.5	11.5	2.40	0.955
I enjoy using mobile apps/tools for lectures (A2).	17.3	21.2	53.8	7.7	2.52	0.874
Using mobile apps/ tools in lectures is a good way to learn (A3).	19.2	19.2	53.8	7.7	2.50	0.897
Using mobile apps/ tools makes studying more interesting (A4).	19.2	15.4	51.9	13.5	2.60	0.955
Studying with mobile apps/ tools is fun (A5).	23.1	15.4	50.0	11.5	2.50	0.980
I like studying with mobile apps/tools (A6).	19.2	17.3	48.1	15.4	2.60	0.976
I like the idea of using mobile apps/tools for learning purposes (A7).	23.1	11.5	57.7	7.7	2.50	0.939
Overall attitude	24.2	11.1	55.5	9.3	2.54	0.887

Table 2. Statements in the questionnaire on students’ perceptions (perceived ease of use) towards using mobile learning.

Please indicate the extent to which you agree or disagree with each statement below.	Percentage (%)				Mean	Std. Deviation
	SD	D	A	SA		
Mobile learning apps/tools are easy to use (PEOU1).	23.1	13.5	42.3	21.2	2.62	1.069
Using mobile learning apps/tools makes it easy to access course material for my learning (PEOU2).	21.2	11.5	50.0	17.3	2.63	1.010
Mobile learning apps/tools are easy to operate (PEOU3).	19.2	19.2	38.5	23.1	2.65	1.046
My learning-related interactions with mobile technologies (accessing course content, submitting assignments, etc.) are clear and understandable (PEOU4).	19.2	17.3	40.4	23.1	2.67	1.043
Interacting with mobile apps/tools for learning purposes does not require a lot of mental effort (PEOU5).	15.4	25.0	46.2	13.5	2.58	0.915
Learning to use mobile apps/tools for learning purposes would be easy for me (PEOU6).	19.2	17.3	48.1	15.4	2.60	0.975
Overall Perceived Ease of Use	16.7	18.5	44.4	20.4	2.62	0.913

Table 3. Statements in the questionnaire on students' perceptions (perceived usefulness) towards using mobile learning.

Please indicate the extent to which you agree or disagree with each statement below.	Percentage (%)				Mean	Std. Deviation
	SD	D	A	SA		
Using mobile apps/tools improves my ability to learn (PU7).	21.2	13.5	44.2	21.2	2.65	1.046
Using mobile apps/tools helps me get my work done more quickly (PU8).	19.2	13.5	44.2	23.1	2.71	1.035
Using mobile apps/tools for learning purposes improves my performance in my classes (PU9).	25.0	9.6	50.0	15.4	2.56	1.037
Using mobile apps/tools for learning purposes increases my productivity (PU10).	17.3	15.4	50.0	17.3	2.67	1.964
Using mobile apps/tools in my studies enables me to accomplish learning tasks more quickly (PU11).	23.1	13.5	44.2	19.2	2.60	1.053
If I use mobile apps/tools for learning purposes, it will increase my chances of getting a higher grade (PU12).	19.2	21.2	46.2	13.5	2.54	0.959
Overall Perceived Usefulness	18.5	14.8	50.0	16.7	2.62	0.957

Tables 1, 2 and 3 show that the overall perception and attitude of the sampled preservice teachers towards mobile learning was positive. The overall percentage of sampled preservice teachers' positive attitudes towards mobile learning was 64.6% (Mean 42.54 ± 0.887 SD), while their perceptions in terms of perceived usefulness were (66.1%, Mean 2,62 ± 0.957 SD) and perceived ease of use was (64.8%, Mean 2,62 ± 0.913 SD). This could be explained by the nature of the compulsory computer courses that the University offers for the first two years of study (Orgaz et al., 2018). Nevertheless, research has argued that students still rely on institutions and instructors to provide them with opportunities and encouragement to use mobile devices for academic purposes, even when they acknowledge the potential of mobile devices for academic purposes (Chen et al., 2015). An Independent samples t-test was calculated to analyse differences in the attitudes of the respondents based on gender, as shown in Table 4.

Table 4. Independent Sample Test.

		Levene's Test for Equality of Variances		t-test for Equality of Means				95% Confidence Interval of the Difference		
		F	Sig.	t	df	Significance Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Attitude	Equal variances assumed	1.739	.193	-.256	50	.799	-.07001	.27362	-.61960	.47957
	Equal variances not assumed			-.233	21.658	.818	-.07001	.30081	-.69442	.55439
Perceptions	Equal variances assumed	.225	.637	-.220	50	.826	-.06411	.29089	-.64839	.52016
	Equal variances not assumed			-.212	23.936	.834	-.06411	.30291	-.68938	.56115

The findings in Table 4 show that Levene's Test for Equality of Variances is not statistically significant since the P value is greater than 0.05, which indicates that the variances between males and females are equal. The effect of assuming equal variances is evident in the last two rows in Table 4 where a slight reduction in the value of the t-statistic and a large reduction in the degrees of freedom (df) is observed. The t-test for equality of means was also used to check whether there is a difference between perceptions and attitudes towards using mobile learning for males and females. Findings for the t-test for Equality of Means in Table 4 show that the p-value (Sig.2-tailed) = 0.818 for attitude and 0.834 for perception, which is greater than 0.05. Thus, indicating that there is no significant difference between males and females when looking at their perceptions and attitudes towards the use of mobile technologies for learning, supporting the findings of Al-Emran (2016). However, the females (M = 2.54, SD = .831) scored significantly higher than the males (M = 2.47, SD = 1.04) on their attitude towards the use of mobile learning.

In addition, a multiple regression analysis was conducted to predict preservice teachers' perceptions and attitudes towards the use of mobile apps and tools for learning by gender and age. According to the results, attitudes of preservice teachers were not significantly associated with their age $F(1, 50) = 3.802, \beta = -.177, t = -1.950, p = .057, R^2 = .071$ and gender $b = .070, t = .256, p = .543, R^2 = .001$. However, pre-service teachers' attitude towards the use of mobile learning was found to be significantly influenced by their perceived usefulness (see Table 5). This supports the findings of Orgaz et al. (2018), which claims that student attitude toward technology influences their perception about technology.

Table 5. Multiple Regression Analysis.

Coefficients ^a						
Model	Unstandardized Coefficients			Standardized Coefficients	t	Sig.
	B	Std. Error	Beta			
1	(Constant)	.209	.118		1.778	.082
	PU	.706	.176	.774	4.019	<.001
	PEOU	.174	.184	.181	.942	.351

a. Dependent Variable: ATTITUDE

5. Conclusion and recommendation

The results of this study showed that preservice teachers who perceive the use of mobile apps/tools for learning as beneficial are more likely to have a positive attitude towards their use as long as they receive the necessary educational training to improve their proficiency in utilizing such mobile learning tools/apps. Moreover, findings reveal that pre-service teachers' perceptions and attitudes towards the use of mobile apps/tools for learning do not differ regarding age and gender. As a result, it is recommended that teacher education programs implement effective technology-assisted training programs that will familiarize pre-service teachers with the pedagogical skills and experiences required to build their confidence in using mobile apps/tools in their teaching practices. Furthermore, teacher education programs should introduce preservice teachers to the ideas of mobile learning and provide learning opportunities that can foster their knowledge and effectiveness in utilizing mobile apps/tools for teaching and learning.

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STUDENTS 21ST CENTURY SKILL CHALLENGES: ZIMBABWEAN HIGHER EDUCATION

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Abstract

This research explores the skill challenges faced by students in the 21st century at a Zimbabwean higher education. The concept of 21st-century skills has emerged in recent years as a way to describe the skills that are necessary for success in the modern world. These skills include not only traditional academic skills, such as reading, writing, and mathematics, but also a range of other skills, such as critical thinking, creativity, communication, collaboration, and digital literacy. The study employs a qualitative method to investigate the extent to which students have the necessary skills to navigate the world of the 21st century, and the factors that may be contributing to skill gaps. The findings suggest that while students are generally confident in their digital literacy and ability to use technology, there are areas where they need further support, such as critical thinking, problem-solving, and collaboration. Additionally, skill challenges faced by students in the 21st century at a Zimbabwean higher institution include lack of access to technology and digital skills, lack of training and support for using technology for learning, lack of alignment between curriculum and 21st-century skills, and impact of cultural and social factors on technology use. These findings have implications for the university and other educational institutions and highlight the need for a comprehensive approach to addressing skill challenges. Recommendations for addressing skill challenges faced by students in the 21st century at a Zimbabwean higher institution include the provision of adequate resources, such as computers, internet access, and digital literacy training, adoption of a learner-centered pedagogical approach that encourages the use of technology for learning, a collaboration between universities and other stakeholders, such as government and industry, to ensure that 21st-century skills are developed and utilized effectively and development of policies that support the integration of technology in education and promote digital literacy.

Keywords: *Critical thinking, higher education, problem-solving, skill challenge, 21st-century skills.*

1. Introduction

In the 21st century, students at Zimbabwean higher institutions face a unique set of skill challenges (Chimbunde, 2023; Garwe & Thondhlana, 2023; Tawanda & Tsara, 2022). The skills required to succeed in the modern world are increasingly complex, and students must be able to navigate a rapidly changing technological landscape. While there is a growing focus on equipping students with 21st-century skills, such as digital literacy, critical thinking, and problem-solving, it is unclear how well students are prepared to meet these challenges. The purpose of this study was to explore the skill challenges faced by students at a Zimbabwean higher institution and to identify potential solutions to address these challenges.

2. Background

The concept of 21st-century skills has emerged in recent years as a way to describe the skills that are necessary for success in the modern world (Benvenuti et al., 2023; Kennedy & Sundberg, 2020). These skills include not only traditional academic skills, such as reading, writing, and mathematics, but also a range of other skills, such as critical thinking, creativity, communication, collaboration, and digital literacy (Amin et al., 2023; Purwanto et al., 2023; Voda et al., 2022). In Zimbabwe, as in many other countries, there has been a push to incorporate 21st-century skills into the curriculum, with a particular focus on the integration of technology into teaching and learning (Muyambo-Goto, et al. 2023, Tandi et al 2023).

3. Theoretical framework

This research is based on the theoretical framework of sociocultural learning theory, which emphasizes the importance of social and cultural contexts in the development of skills (Henderson, & Cunningham, 2023; Kilag et al., 2023). This framework posits that learning occurs through interactions with others and that cultural and social factors play a significant role in shaping an individual's ability to learn and use skills (Walker & Venker Weidenbenner, 2019; Whiteside et al., 2023). In the context of 21st-century skills, this framework suggests that the success of students will depend not only on the development of individual skills, but also on the ability of individuals to collaborate, communicate, and problem-solve in a social and cultural context.

4. Research questions

- (i) What are the specific skill challenges faced by students at a Zimbabwean higher institution in the 21st century?
- (ii) How do students perceive the impact of these challenges on their academic and career success?
- (iii) What resources and support do students believe are needed to address these challenges?
- (iv) How does the current curriculum and pedagogy at the university address the skill challenges faced by students?
- (v) What role does the broader cultural and social context play in shaping students' ability to develop and use 21st-century skills?

5. Literature review

5.1. Specific skill challenges faced by students at a Zimbabwean university in the 21st century

In the 21st century, students in Zimbabwean universities face a variety of challenges related to their specific skills. These challenges include a lack of access to technology, a lack of qualified lecturers, and a lack of facilities and resources. Many students do not have access to computers or the internet, which makes it difficult for them to acquire the necessary digital literacy skills. Additionally, there is a shortage of qualified lecturers who can effectively teach these skills. Finally, the university lacks the facilities and resources that are needed to effectively teach digital literacy, such as computer labs and updated software. Goto (2021) and Bomani et al. (2019) found that Zimbabwean higher institution students lack specific skills related to critical thinking, problem-solving, information literacy, and collaboration. A study by Muyambo-Goto et al. (2023) and Katuli-Munyoro & Mutula (2019) found that Zimbabwean university students face challenges in the areas of information literacy, digital literacy, and communication skills, problem-solving, and time management.

5.2. Students perceptions on the impact of challenges on their academic and career success

The study explores the perceptions of students on the challenges that impact their academic and career success. The study examined a variety of factors that may impact students' perceptions, including financial constraints, cultural barriers, and lack of support from family and friends. The study also considered the effects of these perceptions on students' academic performance, as well as their future career goals. The goal of the study was to gain a better understanding of the factors that influence student success and to identify potential solutions to address the challenges that students face. Dube (2019) and Mhlanga et al. (2022) found that Zimbabwean higher institution students perceive that skill challenges have a negative impact on their academic performance and their future career prospects. According to Varaidzai-Makondo & Makondo (2020) and Marongedza et al. (2023) found that Zimbabwean higher institution students believe that skill challenges have a negative impact on their career prospects, but they are less clear about the impact on their academic performance.

5.3. Resources and support needed to address challenges

The study focuses on identifying the specific needs of students and determining what type of resources and support would be most effective in addressing these needs. It also examines the barriers that may prevent students from accessing the resources and support they need and considers how these barriers can be overcome. Ultimately, the goal of the study is to identify effective and practical solutions to the challenges faced by students. Pondiwa et al. (2022) found that Zimbabwean higher institution students believe that the provision of adequate resources, such as internet access and training, is essential to addressing the skill challenges they face (Brenya, 2023; Kilag et al., 2023). A study by Anderson et al.

(2015) and Mellow et al. (2023) found that university students believe that support from faculty members and other students is crucial to addressing skill challenges. Another study by Assan et al. (2018) found that university students in Africa believe that government policies and support are also important in addressing skill challenges.

5.4. Addressing current curriculum and pedagogy skill challenges

The study examines how the current curriculum and pedagogical approaches may be falling short in terms of meeting student's needs and preparing them for the workplace. It also considers how these challenges can be addressed through changes to the curriculum, as well as through the development of new pedagogical approaches. The study explores how technology can be leveraged to enhance the curriculum and improve pedagogical practices. A study by Olumuyiwa et al. (2023) found that the curriculum at universities in Africa does not adequately address the skill challenges that students face. Altbach et al. (2009) and Kanyane (2023) found that higher institutions in Africa are struggling to keep up with the rapidly changing technology landscape and that this is impacting the ability of students to acquire 21st-century skills. According to Ferreira et al. (2017), the pedagogical approach used in higher institutions in Africa is not always conducive to the development of 21st-century skills.

5.5. Role of Cultural and social context to develop students' 21st-Century Skills

The study investigates how the cultural and social norms in a student's home, school, and community can influence their learning and development. It also considers how factors such as poverty, discrimination, and family dynamics can impact a student's ability to acquire the skills needed to succeed in the 21st century. The study explores how these factors can be addressed to create an environment that is conducive to learning and development. Bourn (2018) found that the cultural and social context plays a significant role in shaping students' ability to develop 21st-century skills. The study found that cultural and social factors, such as family background, gender, and socioeconomic status, can influence students' access to technology and their ability to use it effectively. According to Adegunju (2023), cultural beliefs and practices in Nigeria can influence students' attitudes toward technology and their willingness to use it for learning.

6. Methodology

The study employed a qualitative research method. A case study design of a Zimbabwean higher education institution was used for data collection. The population of the study was all the lecturers and students at the university under study in seven faculties. Seven lecturers were randomly selected from each faculty. Two students were also randomly selected from each faculty. Instruments used were face-to-face interviews were carried out with lecturers and students on one-to-one to get views on the 21st-century skill challenges faced in higher education. For ethical consideration, consent was sought from the university under study. Participants were also assured that their information would be kept private.

7. Findings

The findings from the lecturers suggest that while students are generally confident in their digital literacy and ability to use technology, there are areas where they need further support, such as critical thinking, problem-solving, critical thinking, and collaboration. Additionally, skill challenges faced by students in the 21st century at Zimbabwean institutions include a lack of access to technology and digital skills; training and support for using technology for learning; and alignment between curriculum and 21st-century skills. There is an impact of cultural and social factors on technology use. Most lecturers and students mentioned that these challenges can impact students' academic performance, career prospects, and overall quality of life. It is therefore important to address these challenges to ensure that students are able to fully benefit from 21st-century skills.

Lecturers and students suggested the resources and support needed to address challenges as provision of adequate resources, such as internet access, computers, back up of power outages like generators and solar systems put in place and training. Addressing current curriculum and pedagogy skill challenges the lecturers noted that student's skill challenges are not addressed and with the rapidly evolving technologies the university is failing to keep abreast with it. On the role of cultural and social context to develop students' 21st-century skills the lecturers and students shared the same sentiments that lack of computers, gender and their background influenced their access to the technology used in the teaching and learning.

8. Conclusion

Based on the findings and discussion, the following conclusions were drawn: There are several skill challenges facing students in the 21st century at a Zimbabwean institution like critical thinking, problem-solving, and collaboration. These challenges have a significant impact on students' academic performance, career prospects, and overall quality of life. It is important to address these challenges through the provision of adequate resources, training, and support, as well as the development of a curriculum that is aligned with 21st-century skills.

9. Recommendations

Recommendations for addressing skill challenges faced by students in the 21st century at a Zimbabwean institution include the provision of adequate resources, such as computers, internet access, and digital literacy training; back up mechanism to ease power outages, adoption of a learner-centered pedagogical approach that encourages the use of technology for learning; collaboration between universities and other stakeholders, such as government and industry, to ensure that 21st-century skills are developed and utilized effectively and development of policies that support the integration of technology in education and promote digital literacy.

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THE ROLE OF INTERACTIVE APPLICATIONS – DISCUSSION ABOUT FLEXIBILITY IN MODERN LEARNING ENVIRONMENTS

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Abstract

Modern learning environments have learning material accessible in a centralized location. They provide large amount of reading material, exercises or learning content in a way that it is available for students anywhere and anytime. This type of flexibility can become a critical factor for learners. As an example, combining work and family with studying can be overwhelming without the flexibility of modern learning environments. Today technology allows access to digital learning material. In addition, there are applications that boost interaction and allow working in groups. Technology can have an important role in integrating students into learning process and helping students in studies during the pandemic. In this article we look at the role of social media applications as part of a modern learning environment. The findings and notions are based on empirical evidence from a case university where studying and digital learning has been the norm already before the pandemic. The learning environment is built on Moodle, but students use also different social media -based applications in studies. We found that social media can bring added flexibility to learning process, it helps in keeping in contact with others. Interaction and collaboration with others can be more straightforward as learning environment and other learners may be contacted directly with each student's smartphone.

Keywords: *Learning, modern learning environment, flexibility.*

1. Introduction

There has been lot of changes in education, especially in the role of technology in the learning process. The changes have occurred in relatively short time, in last 20 years. Now technology is a vital part of education, having computers and access to internet are considered vital for learning today. Learning methods have changed from a teacher-centred, classroom-based teaching to learning, where the student can access learning material, interact with teachers and other learners wherever and whenever. Clearly, the roles of teachers and students have changed. Now students are expected to be active learners in the learning process. Information technology is in this context a tool that makes everything possible.

Information technology has many roles in education. In addition, technology is more than a tool in the learning process, it has changed learning environment in a way that learning has become possible for learners that earlier could not be study, or it would have been very difficult. It can be argued that modern education relies on technology, as teachers and students use information technology and networks in a wide range of learning situations. (Wagner et al. 2008; Lim et al., 2014)

In this study we look at the role of interactive, social media applications in modern learning environments. The findings are based on empirical evidence from university-level courses and notion how learning technologies are used in learning.

2. Elements of modern learning environments

Learning environment is defined as a place or environment, setting or infrastructure where learning takes place. The emphasis is here on learning, not primarily on educational institutes, or different learning paradigms or methods. Therefore, learning environment can refer to a classroom at the university, but it can also be a cozy café where students work together with a group assignment, or learning environment could refer to dormitory where student prepares for an exam. Traditionally, learning takes place at the university, in classrooms where the lecturer and students are in the same physical place, all at the same time. Today learning environments use technology and networks, and so learning environments can be more virtual, places in the network where information on learning goals, material

and exercises can be accessed. It is also a space for meeting lecturers and other students. In a modern learning environment, it is possible that the learner can study from a distance, access learning material, and interact with others without the need to physically be in a classroom (Jonassen et al., 2008; Facer, 2011).

Technology has an important role in modern learning environments. It can be used in different teaching and learning situations, and in many ways (Anderson, 2007; Jonassen et al., 2008; Wagner et al., 2008). Information technology allows development of learning material that can be accessed from distance, without the need to travel to classroom, university library or campus, for example.

Firstly, technology and networks are used in creating a digital repository of learning material, providing course files like reading material and exercises in a centralized site that can be accessed with computers from a distance, whenever and wherever. Technology may also function as a cognitive tool in the learning process (Reeves & Laffey, 1999). For example, when the learner is analyzing research material, technology may be used in retrieving and managing literature, but it may also help in mapping and better understanding the research area. In this way, technology becomes an integral element in the learning process.

Secondly, technology has an important role in accessing and delivering information. Information delivery refers to technology or system which makes it possible to access, retrieve or send digital information. A typical example is downloading or uploading files from or to a digital storage area. This requires the user to have a terminal that can access the storage area, working network access and a valid user account. Generally, technology which is used in information delivery is part of the information technology infrastructure, which is the underlying platform for all systems and applications in the organization. Therefore, it tends to be reliable and straightforward to use. Because its criticality for all information systems is information technology infrastructure maintained and developed in a way that systems function as expected, and there are minimal interruptions in operations.

Technology is not only used in storing digital material or in accessing it. There are also many applications for interacting, changing ideas, and working together that can be used in the learning environment. The goal is to make participating and interacting possible, even though the participants are not in the same location. Furthermore, learners can interact asynchronously, referring to the idea that participants do not need to be online at the same time.

Interaction can be seen as a critical element in the learning process. It refers to the possibility to ask questions, comment, argue and present ideas to teachers and other learners. It is here believed that information technology can have an important role in enabling and empowering interaction (Jonassen, 2000). Typically, a person can interact, for example ask a question, even though there are no other persons online using the same application or environment at the same time.

Modern learning environments make it possible to work with common assignments, without the need to be in the same location at the same time. This brings flexibility to studying, and allows combining working and studying, which would have been almost impossible in more traditional classroom-based education. Modern learning environments make it also possible to use different types of media in interacting, in most applications are text, audio and video supported in communication.

Modern learning environment is a setting that uses technology and networks, an infrastructure that combines physical locations like classrooms with virtual space. A modern learning environment allows different learning styles and activities. The role of technology can be critical, a fact that is best noticed should there be a technical malfunction or issue that stops normal actions. In this kind of situation information and files in the learning platform cannot be accessed, which makes it impossible to continue normal teaching and learning activities. This is an issue that needs to be addressed in planning the environment. Robustness and reliability are key elements in the learning environment, and they have to be goals when choosing, installing, and developing infrastructures in the learning environment. The role of technology should be to enable, improve and empower, not to become an obstacle to the learning process (Gros, 2002).

3. Managing the learning environment

Technology has an increasingly important role in modern learning environment. However, a modern learning environment can also be a challenge to some users. Ideally, the learning environment should be such that it makes it possible for differently skilled users to take advantage of the interactive elements and features of the environment. The users should be able to use different technical devices, applications, and networks in order to successfully manage in the environment. This can be challenging, even overwhelming to some users.

In teaching and education can technology be used in many ways, and for various purposes. Often there is a digital environment which acts as a digital storage area for various learning material. This environment can be accessed with different computers and terminal devices, at the campus and from student's home.

The learning environment is developed by the university, faculty or school that is responsible for education and teaching. It is also the body that sets guidelines for digitalization in this domain. Typically, digitalization takes is a long process, and therefore needs to be based on strategy. As a result, development activities can become better goal-oriented, and the learning environment is likely to become the basis for learning material in different schools and disciplines. In contrast, if there would not be common strategy or policy the learning environment might be more fragmented, with all kinds of different technologies, systems, and application, and teachers working together with these tools (Leonard & Leonard, 2010). Even in a centralized learning environment there can be plenty of variation between individual faculties, disciplines, courses, and lecturers. At the end of the day, it is the teacher who decides how and what technology will be used in each course, lecture, and exercise (Pani et al., 2015). The way technology is used also reflects the demands of learners. The real-life applications are mutual agreements between teachers and students in each course, seminar and learning situation. For example, it may be agreed that next week's lecture will be held as a video stream, and the assignment must be uploaded to Moodle before Friday. Furthermore, students can agree by themselves what technology and applications they use in working together in group assignments. It is not uncommon that they use other than "official" university applications, instead use mobile phones and instant messaging apps when working in groups (Sirkemaa & Varpelaide, 2021). As a result, the learners and teachers are facing a learning environment, which has numerous technologies, systems, and applications.

4. Discussion

In recent years it has become clear that learning takes place in an increasingly technical, networked environment. In modern learning environments a major part of learning happens often outside classroom or university campus area. The geographical location is not critical, it is the access to a learning platform. Today learning environments are platforms that act as a centralized storage of learning material, collection of assignments and information about learning objectives and curriculum. It connects teaching staff and other learners, and here technology and computers have a key role. Education and learning are made available wherever the student is roaming and accessing with his or her terminal device. Here we have looked at the role of social media applications and found that they can provide flexibility to learning process. These applications are easy, straightforward, and very intuitive to use, and they allow connectivity and access to information directly from user's smartphone.

In this paper we have looked at changes in learning environment and challenges facing learners today. Firstly, Covid-19 has had a huge impact on universities, teaching and learning as everything has gone virtual and distance learning has become basically the only option for learning. Secondly, it has become increasingly typical that students need to combine studying and work, working part-time or even having full-time jobs and studying at the same time. Thirdly, some have small children at home so attending lectures at the campus is not an easy task to organize. In these challenging situations can digital learning environment make studying possible. Technology allows access to learning material, working together with other students, and staying in contact anywhere and anytime (Facer, 2011; Laal & Laal, 2012).

Flexibility allows also different learning styles and approaches to learning. Technology and applications allow development – or tailoring - of learning environment for different learners. In a way, the learner may better choose how to study. As an example, users may select applications that are not part of the "official" learning environment provided by the university. In a group work assignment learners may use social media app in their smartphone for changing ideas, if they find it better for this task than messaging applications in the official learning platform. Flexibility is not only about choosing how, but it also allows selecting when and where. If learning material is digital, it can be accessed at any time, and from any location. As a result, it is possible to combine work, family life, leisure activities with studying in a way that was earlier difficult. For the learner this is a significant possibility, having more control of the learning environment (Dooley et al., 2016).

The empirical evidence comes from a case university where students take advantage of social media -based applications in learning. The learning environment is based on Moodle, which is the official learning platform of the case university. Especially in coordinating and preparing group assignments students use social media -based messaging applications. In the case university the increasing pressure to distance learning – especially because of Covid-19 – has further underlined the importance of technology in learning process.

Our findings reveal that information technology can empower learning, even applications that are not officially supported by the university can be valuable. It has been found that social media -based applications may provide easy and intuitive access to learning material and connect to other learners. To summarize, we believe that social media applications have potential in bringing added flexibility to the learning environment and empower learning process.

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MACHINE LEARNING PREDICTION OF ACADEMIC PERFORMANCE OF LATIN AMERICAN UNIVERSITY STUDENTS. A REVIEW

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Abstract

Machine Learning (ML) is increasingly recognized as a powerful tool in predicting academic performance, providing essential aid to educational institutions in identifying at-risk students, facilitating timely interventions and enhancing overall student retention. This article presents a systematic review of literature over the past ten years from recognized databases with a particular focus on the prevalent ML algorithms employed in Latin American and Higher Education institutions of alike emerging countries for predicting student performance. This review reveals a significant efficacy of supervised learning models, especially Decision Trees and Neural Networks with accuracy metrics above the 80%. The review showed that the accuracy of the method depends on the quality and features of the student data available to train the model. Last, we list the most common student factors that contribute in these algorithms to predict student performance. There is no general rule to choose which student features must be included, but the literature shows that they may depend on the subject are or the specific predictive purpose of the algorithm.

Keywords: *Neural networks, decision trees, student performance, higher education, Latin America.*

1. Introduction

The term “Machine Learning” (ML) was defined by Arthur Samuel in the 1950s as *a field of study that gives machines the ability to learn about something for which they have not been explicitly programmed* (Wiederhold et al., 1990). In general, ML is considered to be a subfield of Artificial Intelligence (AI) whose purpose is analyzing algorithms to identify patterns, relationships, trends and predictions that allow a better understanding of the behavior of data in a certain phenomenon.

Artificial intelligence (AI) is being widely applied in Higher Education (HE) Institutions (HEIs) in Latin America, providing various applications to improve university services. One of these applications is, for instance, offering more personalized and effective help. Especially for those students who find themselves in difficult situations (Chen, 2011), that is, for those students who face learning difficulties, academic lags, or adverse socioeconomic factors. Providing timely student support may influence is beneficial for HEIs since it could contribute towards improving retention rates.

Another relevant application clearly linked to retention rates is the prediction of student academic success in their studies or prediction of the risk of failure in a certain module. Overall, the prediction of student success or failure has become a relevant challenge for academic institutions across the globe since student retention has direct consequences in financial and resource planning.

A possible solution to this challenge is the use of ML algorithms. In the last decade, there has been a growing literature on ML algorithms fed with educational and academic data. Therefore, ML has recently become an invaluable method for predicting student performance. These tools provide an opportunity to identify early warning signs that lecturers, coordinators and managers could use to potentially prevent certain students from dropping out.

Not only ML has shown capabilities from flagging students at risk of dropping out or failing a module, but also it has been able to identify patterns, behaviors, factors affecting this risk (Albreiki et al., 2021). Understanding which factors may have an impact on student’s performance or the student’s decision for dropping out, could help to the design of tailored interventions to mitigate the negative effects of this factors.

Despite the emerging literature in this topic as well as the fast development of new ML techniques, there are neither clear guidelines that suggest which ML technique is more suitable for this purpose nor information about which data should be collected to train the ML algorithms. To overcome this issue, we have developed a systematic review of the literature published in this topic with the purpose of answering the following questions research questions:

RQ1 - What are the most common ML techniques for predicting student drop-out / student performance in HEIs within Colombia, Latin America and similar emerging countries?

RQ2 - Which of these ML techniques happen to be more accurate?

RQ3 - What are the dominant factors affecting student drop-out / student performance according to these ML techniques found in RQ1 and RQ2?

2. Methods

In this section, the procedure followed for the systematic literature review is detailed. See also Figure 1.

In the first step of the literature search, manuscript written in Spanish with ML techniques applied within Colombian HEIs were prioritized. As a result, 11 valid works were obtained; therefore, the search was expanded to other Latin American countries, but not enough references were found in Spanish. Therefore, articles written in English and studies conducted in other developing countries were included in the search criteria. To decide which countries are to be included, the GNI per capita and development and human resources indices were taken into account from WorldData.info. After widening the criterion of the precedence of the study several additional countries were considered. In particular, studies from: Saudi Arabia, Iran, and Iraq from the Middle East; India, Indonesia, Pakistan, Taiwan and Malaysia from South East Asia; and from Bulgaria were included in the review.

A total of 209 articles were retrieved from the following databases: Web of Science (103 articles), Google Scholar (63 articles), Dialnet (28 articles) and SciELO (15 articles). Although the Scopus database was included in the search process, it did not yield any additional articles beyond those already identified in the previous databases. These articles were found by consistently using the search question: ("Student performance" OR "Drop out") AND ("prediction") AND ("Machine Learning"), filtering by Colombia or the Latin American region. The search was conducted in both languages, English and Spanish.

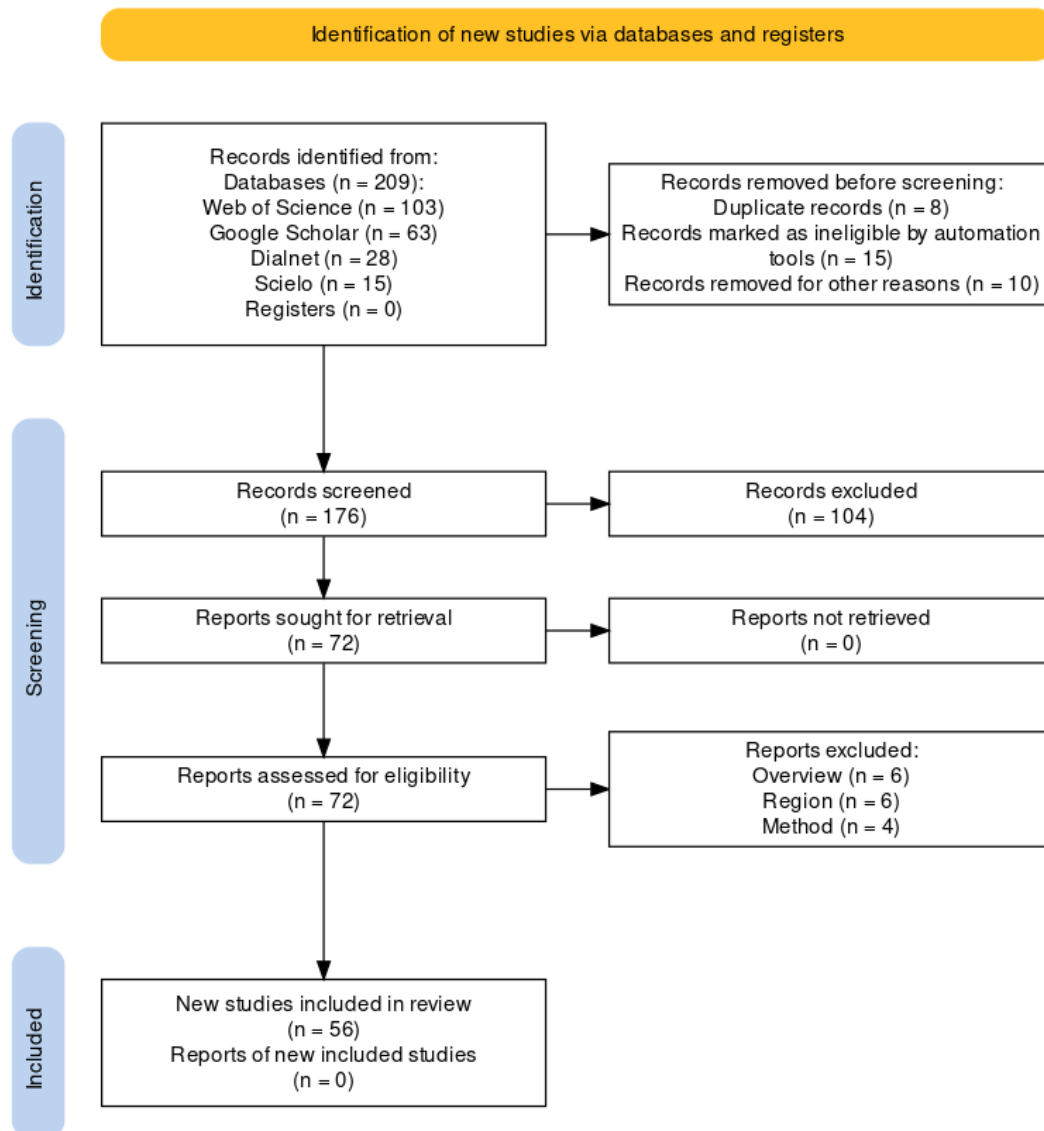
Several filters were applied to the 209 articles found. The first filter consisted of removing 33 articles that appeared duplicated. Then, a second filter of open access was applied and thus, 104 articles were excluded. A rationale for including this filter is a future comparison between algorithms published in open access against those published in traditional form. Finally, a third filter: *the study contributes towards the objectives of this review, i.e., region and methods based on ML* was applied. As a result, 16 articles were excluded. Therefore, a total of 56 articles were included in the review (see Figure 1).

The inclusion and exclusion criteria used to select articles for this review are detailed in Table 1.

Table 1. Inclusion and exclusion criteria.

Criterion	Inclusion	Exclusion
Topic	ML techniques	Qualitative methods
Source	Journal papers	Other sources
Publication year	2013-2023	Other
Language	Español, Inglés	Other languages

Figure 1. PRISMA flow diagram.



3. Key concepts of machine learning for education professionals

In this section, we include the definition, an explanation, and an example of application of the key three concepts of ML that will be required to understand the results of the next section (Mueller & Massaron, 2021). First, we say that a ML algorithm is supervised if it involves training a model with a given dataset with a certain set of input variables and their corresponding associated output. The model learns to map inputs to outputs based on this data and can then predict the output for new, unseen data. It is said to be *supervised* because the process of an algorithm learning from the training dataset can be thought of as a teacher supervising the learning process. Two important examples of supervised techniques are: decision trees and neural networks

On the one hand, decision trees are similar to tree diagrams for decision making. At each node there is a condition which divides the data into two different subsets. The condition is chosen by the algorithm to best separate the data. Then, at each subset, the tree continues to branch until there are no data features which separate the data, i.e., the subset is homogeneous. An example of application is the decision-making process for a bank to grant a loan. The bank will use customer features such as credit score, annual income, employment status, etc. The decision tree will create branches for each of these features, categorizing the applications into different risk classes (e.g., high risk, medium risk, low risk), helping the bank decide whom to offer a loan.

On the other hand, neural networks are inspired by the structure of the human brain and consist of layers of interconnected nodes or neurons. Each connection between nodes has an associated weight, which is adjusted during training. Each neuron works as a logistic-type regression model. What happens in the subsequent layer, depends on the outcomes of the previous layer. Therefore, one can think of a neural network as a complex set of many multiple regression models. One application of neural networks is object recognition within photographs.

4. Results

First, it is worth noting the increasing interest in this topic shown in the rise on the number of publications in recent years. Out of these 56 studies, 38 date from 2020 to 2023. Second, regarding the HEI country of the study, 80% of the studies included in the review are from Latin American countries.

With regards to RQ1, 78.6% of the studies apply supervised ML models. This is because most HEIs own data about students' performance in previous years. Hence, they can exploit their data to train a ML model and then test it with data of subsequent years. After several testing iterations, it is expected that the model is validated and thus, can be applied to accurately predict the outcome of interest.

Moving on to RQ2, the predominant ML algorithms applied within these models use Decision Trees (DT), Neural Networks (NN) and Random Forest (RF). DT appear in 31.6% of the studies while NN and RF appear with a frequency of 23.7% and 10.5% respectively. According to (Natek and Zwilling, 2014) universities may not hold sufficient data to create a sufficiently robust DT based ML algorithm to accurately predict student performance in general. However, when the algorithm is restricted to predict success within a certain undergraduate program it can be successful depending on the amount of data from previous years available to train the algorithm. For example, within Engineering, a DT algorithm was able to accurately predict student performance in 96.5% of the cases (Buenaño-Fernández et al, 2019). Another example applied in a Foundation Year in Education, the DT predicted with an accuracy of 91.67%, see (Díaz-Landa et al., 2021). Nevertheless, some authors defend that the accuracy of the prediction depends on the student ability. For instance, it is easier to predict students at risk of dropping out than excellent students, see (Kabakchieva, 2013). On the other hand, NNs show slightly lower degree of accuracy. For instance, the works (Su et al., 2022) and (Jishan et al., 2015) report an accuracy of 88% -86% respectively.

Last but not least, there is a wide range of variables involved in the prediction of student performance. The variables affecting the prediction depend on what exactly we do intend to predict. For example, a manager or head of school might be more interested in whether a student will drop-out of their program whereas a lecture will rather be more interested in whether a student will fail the module. Out of 522 attributes identified in this review, the factors more recurrent are, in decreasing frequency order: gender, age, first year of undergraduate study, grades, family, parents, finances, demographics, number of passed modules and subject. The effect of this factors has been previously studied in the literature, see e.g. (Ramirez and Grandon, 2018) or (Castrillón et al, 2020) and more references therein.

5. Conclusions and further work

In this study, we systematically analyzed 56 papers related to prediction of student performance in a Latin American and emerging country context. The most widely applied and accurate machine learning model for this purpose is the use of decision trees and neural networks with an accuracy of 90%. It is recommended to develop a model for subject area instead of a general model.

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EDUCATION AS A PATH TO CULTURAL COHESION (HISTORICAL ASPECTS OF THE DEVELOPMENT OF THE BULGARIAN DIASPORA IN THE BALKANS)

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Abstract

It is well known that the Balkans were defined in the 20th century as the powder keg of Europe and the related idea that it was from the peninsula that all troubles and wars for the continent originated. And as paradoxical as it is, this thinking about the Balkans still exists today, but - and this is symptomatic - it also characterises the Balkan peoples' understanding of themselves, but also of their neighbours. Balkan history and culture is indicative of cultural diversity, of the birth and development of separate civilizations: Ancient, Christian, Muslim, of the discovery of approaches for rapprochement and coexistence. The geographical space of the Balkans preserves cultural memories of different times and displacements. In fact, the neighbour of the Balkans remains in the category of "Other", regardless of civilisational, values, cultural similarities and intertwinings. The educational system also does not offer sustainable knowledge on the cultural identity of the neighbour, nor are approaches sought to make the cultural heritage created by the neighbour an object of study for a larger group of Balkan peoples. And in relation to this, of historically formed ethnic groups such as the Bulgarian diaspora. The study of the Bulgarian diaspora, its inclusion in the educational paradigms, it turns out, can be used as an example of expanding knowledge both about oneself and about the other, about the neighbor. Through education and particular organizational and institutional forms, cultural interweavings across eras, productive patterns of dialogue and identity preservation can be highlighted. Because, through education, on the one hand, the tribal identity, the memory of the I and the We of the Bulgarian, but also of any other diaspora, is preserved and developed, and on the other hand, the consciousness of belonging to the host country is enriched. The education of the Bulgarian diaspora in the Balkans includes not only the examination of the different forms - normative regulations, types of schools, but also the clarification of historical aspects related to the cultural mechanisms of existence of the Bulgarian diaspora in the Balkans.

Keywords: Bulgarian diaspora, the Balkans, education, identity, cultural memories.

1. Introduction

The Balkans have been famously described as the powder keg of Europe. The notion that wars and social disorder emanate from the peninsula, as is well known, has its historical reasons. In the 19th century, the Balkans became a space of clash for the Great Powers, who used the unfolding national liberation movements, the natural urge for freedom of the Balkan Christian peoples, to settle their interests. In fact, this external interference is one of the reasons for the distrust between the Balkan peoples themselves, due to the toleration of one at the expense of the other. The great Balkan writer and Nobel laureate Ivo Andric has brilliantly revealed these processes of the temporary Balkan orientation towards foreigners in his classic novel, *The Travniska Chronicle*.

On the other hand, since the late 19th century, works set in a country in the Balkans, as Vesna Goldsworthy (Goldsworthy, 2004) points out, have been mass-produced in Western Europe (Britain). The emphasis in these novels falls on the representation of the Balkans as a place of chaos, senseless confrontations and savage manners. The analysis shows that even today, there are examples of such a reception of the Balkans. However, such thinking about the Balkans characterizes to a certain extent the understanding of the Balkan peoples especially about their neighbours, their manners, culture and way of life. These perceptions are also formed as a result of the centuries-long development of the formation of the Balkan states and the shifting of their borders (Kolev, 2022). During the Middle Ages (until the Ottoman

Empire in the 14th century), the main actors here in the Balkans were Byzantium, Bulgaria and Serbia, i.e., three Christian states, which were in constant war and conflict during this period. At the same time, the internal situation in the states themselves was extremely unstable due to the power ambitions of individual feudal lords. Subsequent generations of scribes and historians would repeatedly highlight these conflicts and strife as the main reason why the Christian states were conquered by the Ottomans.

In the late 19th century, as a result of Russia's victory over the Ottoman Empire, the free Christian Balkan states were born. Among them was Bulgaria, which set out on the path of the free nation-state on March 3, 1878, after five hundred years of Ottoman rule. (Stanimirov, 2022)

2. Aspects of the historical development of the Bulgarian diaspora in the Balkans

The geographical space of the Balkans preserves cultural memories of times of turbulent state rise and respectable aesthetic achievements. Bulgaria, for example, in the Middle Ages (7th-14th centuries) included within its borders a number of Balkan areas populated by Bulgarian inhabitants. These areas were subjugated by the Ottoman Empire in the 14th century, but the populations there retained the memory of their ethnic origins. It is significant that in these areas the Bulgarian population created its own cultural heritage and cultural monuments.

The Bulgarian population in the period of the Ottoman Empire continued to live in the territories they had inhabited for centuries. As a result of an unsuccessful uprising against the Ottoman Empire in the 17th century, some of the Bulgarians from the North-Western region moved to the Austrian Empire, to the region of Banat - today Romania (Najdenova, 2012). Another part of the Bulgarian population, also in search of freedom outside the Ottoman Empire, emigrated in the first decades of the 19th century to southern Russia, the region of Bessarabia (today Moldova and Ukraine).

In the 19th century the capital of the Ottoman Empire, Istanbul, became an important educational and cultural centre for the enslaved peoples, including the Bulgarians. The leaders of the Bulgarian reform and cultural movements completed their education in reputable open colleges. In Istanbul, the foundations of a Bulgarian church were laid (the St. Stefan Church), and buildings with a Bulgarian character typical of the period were erected. Newspapers and books were published in the capital to serve the enlightenment of the Bulgarians (Velev, 2020).

From the middle of the 19th century, the cities of Brasov, Galatz, Bucharest in present-day southeastern Romania became the center of Bulgarian political emigration, which realized cultural tasks fundamental for the Bulgarian rise. In 1870, as a result of decades of struggle, the Bulgarians won the right to an independent church. The document issued by the High Gate established the Bulgarian Exarchate, which included those geographical territories in the then Ottoman Empire inhabited by Bulgarians. (Buzhashka, 2017)

In 1878, as a result of Russia's victory in the Russo-Turkish War, a peace treaty was signed in the town of San Stefano, as a result of which the free nation-state of Bulgaria was born. The charter for the establishment of the Bulgarian Exarchate served as the basis for defining the borders of free Bulgaria. Only a few months later, in Berlin, the Great Powers reshaped this decision, significantly reducing the territory of Bulgaria and leaving behind its borders millions of Bulgarians. The following decades are indicative of the complicated fate of these Bulgarians: numerous uprisings, struggles, displacements, etc. An additional, fateful significance for the Bulgarians in the Balkans was the Treaty of Neuilly, according to which new lands settled by Bulgarians were detached from the territory of Bulgaria - the so-called Western suburbs. As a result of these processes, some of the Bulgarians in the Balkans emigrated to free Bulgaria, others remained residents of neighbouring Balkan countries. (Dobrev, 2022a)

The formation of the Bulgarian diaspora is the result of a long historical process. From this point of view, it is accepted in science to divide the Bulgarian diaspora into two large groups: historical and contemporary. The historical diaspora was formed mostly in the Balkans. This includes the Bulgarian communities in today's countries: the Republic of Albania (Golo Brdo, Mala Prespa, Gora), the Hellenic Republic (Aegean Macedonia and White Sea Thrace), the Republic of Kosovo (Gora and Župa), the Republic of Romania (Banat, Wallachia and Northern Dobrudja), the Republic of Northern Macedonia, the Republic of Serbia (Bosilegrad, Tsaribrodsko, Pomoraveto) and the Republic of Turkey (Eastern Thrace), as well as smaller groups in the Republic of Croatia, the Republic of Montenegro and the Republic of Slovenia (Eldarov, 2022).

3. Education in the Bulgarian diaspora in the Balkans as a way to preserve identity

Today, the Bulgarian diaspora in the Balkans participates in the cultural life of their countries of residence - Bulgarian children study in local schools, complete the stages of secondary and higher education. In Romania, Serbia and Albania Bulgarians have a recognised status of national minorities, while other Balkan countries - Greece, North Macedonia, Turkey and Kosovo - do not recognise the Bulgarian community. These situations are a prerequisite for new problems and obstacles for the Bulgarian diaspora related to approaches to preserve and develop Bulgarian identity. The attitude of the central government towards diaspora issues, forms of discrimination and persecution is also not without significance.

In this case, something else should be pointed out. The prevailing notion of the neighbour in the Balkans. On the one hand, the neighbour carries the meaning of a close person. But in the Balkans, precisely because of this disregard for the rights of some of the historically formed ethnic groups, such as the Bulgarians, the image of the neighbour is placed in the content of the category of the Other, regardless of civilizational, values, cultural similarities and intertwining. The educational system does not offer sustainable knowledge on the cultural identity of the neighbour, nor does it look for approaches to study the cultural heritage created by the neighbour on the territory of the respective Balkan country as an example of cultural cohesion. (Dobрева, 2022b).

One of the possible approaches undertaken at the University of Library Studies and Information Technologies (ULSIT) is the research, collection and synthesis of facts and documents related to the life of the Bulgarians in the Balkans. In disciplines such as "History of the Balkans", "Cultural Interactions in the Balkans", along with the emphasis on one's own national history, there is also a focus on the cultural specificity of today's Balkan countries where Bulgarians live. As a result of a research project, a digital map has been produced, which integrates historical facts that are crucial for the Balkan countries, highlighting the most characteristic of their political history and existence. In this way, students acquire knowledge about the civilizational patterns of the Balkans, about cultural convergences and intertwining, about differences, but also about the search for cultural bridges.

The Academic Workshop has been functioning within the University for several years. Here the students' humanities training is complemented by expanding their knowledge and competences in history and literature, especially about the cultural circumstances of the Balkans. The Academic Workshop promotes research on various aspects of the artistic and creative worlds of Southeastern Europe, as an integral part of *the cultural and educational policy of the power executive organizational structures*. (Velev & Nusheva, 2019)

The Centre for the Study of Bulgarians Abroad was established at ULSIT by a decision of the Academic Council. In this line facts and phenomena from the history of the Balkan countries are collected and analyzed. It also collects data on the cultural heritage created over millennia by the representatives of the Bulgarian diaspora, today part of neighbouring territories of Bulgaria. It includes Orthodox churches from the Middle Ages erected by Bulgarian rulers and painted by Bulgarian artists; cultural topoi identified through a variety of materials and literary sources as directly related to the development of Bulgarian culture as part of Christian civilization in the Balkans; building stock from the 19th century period, etc. The very discussion of this variety of cultural monuments - tangible and intangible - turns out to be an occasion to study in detail the culture and history of the Balkan countries, and through lectures and seminars the students discover the common places, interweavings and convergences between the neighbouring nearby cultures. As V. Velev points out, the issue of overcoming the differences between the different communities - ethnic and religious, with the affirmation of the understanding *that the individual ethnicity is the bearer of a different and specific culture of its own kind is relevant for the modern stage. It is also dictated by its religious affiliation, which it defends over time and develops regardless of its place of residence* (Velev, 2016).

Important for the development of the educational system, as the examples of the Bulgarian diaspora show, are the activities developed by Bulgarian cultural societies abroad. One of their results is that in the early 1990s a new normative system was developed in Bulgaria to legitimise contacts with Bulgarians abroad. First of all, the Law on Bulgarians Living Outside Bulgaria was adopted. It established the normative process of contact and communication between the diaspora and official state institutions. At the request of the diaspora, the Bulgarian state assists with textbooks, teaching aids, specific Bulgarian cultural signs, the study of the Bulgarian language, Bulgarian literature, Bulgarian history and Bulgarian geography. Bulgaria may also send relevant specialist teachers to assist.

From the same period (the 1990s), two decrees were developed, aimed at the Bulgarian diaspora. Decree No. 103 covers both groups of Bulgarian communities - the historical and the contemporary. The focus is mainly on the largest historical community - the Bessarabian Bulgarians. According to Decree No. 103, the Bulgarian State admits representatives of the Bulgarian diaspora as students according to certain procedures and conditions. Additionally, and by virtue of bilateral international agreements, Bulgaria sends teachers of the native language, literature, history and geography to Moldova, Ukraine, the Black Sea regions, Tavia, O. Crimea, etc. With the recent update of Decree No. 103, the opportunities for all representatives of Bulgarian communities abroad to apply to Bulgarian universities have been expanded.

Regulation No. 228 has been in force in the Bulgarian education system since 1997. It applies mainly to foreign citizens of Bulgarian origin in the Republic of North Macedonia, who are given opportunities to study in the Republic of Bulgaria in their chosen specialities. The statistics show that the graduates of the Bulgarian diaspora, especially under Decree No. 228, return to the neighbouring countries, i.e. to their country of origin.

On the other hand, through non-formal education, the Bulgarian state stimulates the development of Saturday-Sunday schools, where subjects related to the ancestral homeland are studied. They are organized on the initiative and with the active participation of representatives of the diaspora. Bulgaria's assistance consists mainly in sending up-to-date curricula and syllabuses. They are called Saturday-Sunday schools because the students' education is organized on the days that are not school days in the country of residence - Saturdays and Sundays. In fact, in these schools, the areas of cultural convergence, of contact between the types of identities - tribal (ethnic) and national (of the country of residence) - stand out. The emphasis is on the common, on the unifying principle, rather than on historical divisions and contradictions.

It has become a tradition for the Bulgarian diaspora in the Balkans to maintain their own cultural festivals. As everywhere, and in the examples of the Bulgarian diaspora, these celebrations are essential for the preservation of Bulgarian identity. Among these holidays are Bulgaria's state holidays - 3 March, Liberation Day; 24 May, the Day of the Holy Brothers Cyril and Methodius, of the Bulgarian alphabet, education and culture, and of Slavic literature; 6 September, Unification Day. But along with these days are celebrated, also with great solemnity, and typical for the community holidays. For example, in Adrianople and Lozengrad the Bulgarian Diaspora organizes the Days of Thrace, which bring together both representatives of the Diaspora and Bulgarians from Bulgaria. The Republic of North Macedonia and the Hellenic Republic also hold cultural festivals related to the Bulgarian holiday calendar. Unfortunately, these cultural events often remain closed within the Bulgarian community, mostly due to the political attitude of the successor state.

4. Conclusion

In relation to the historical path of the Bulgarian diaspora, its formation in the Balkans, it is promising to achieve new knowledge about oneself (historical destiny and cultural memory), but - and this is especially important - about the neighbour, about cultural convergences and knowledge about common trends, common civilisation patterns and values through its study, its inclusion in educational paradigms. It is through education that tribal identity is preserved and developed. However, it also gives impetus to the positive development of a sense of national belonging to the country within which the diaspora lives.

In turn, the country of origin has the opportunity to integrate as an integral part of the educational paradigm - both in higher education, but also in individual secondary education lessons - the presentation of the historical and cultural profile of the diaspora. This can support further research into the factors that have contributed to the formation and current existence of Bulgarian communities abroad. Incorporating this knowledge about the Balkans into appropriate educational forms creates the preconditions for building bridges of understanding and active cultural dialogue.

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MEDIA AND AUDIO-VISUAL TECHNOLOGIES FOR TEACHING ARTISTIC CREATIVITY: A COURSE FOR PRESCHOOL AND PRIMARY SCHOOL TEACHERS

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Abstract

The contribution presents a media-archaeological methodological approach to the device of the narrative and audio-vision for teaching the fundamentals of audio-visual culture. The activity involves the creation of short animated cartoons with sound, based on musical subjects. The originality of this approach consists in not relying on automatic technologies for the realization of the product, endowed with producer-programmed intelligence and its inscribed knowledge, but being based on the deconstruction and reworking of traditional techniques to solicit a conscious, non-immersive approach to the construction of visual and sound, and their mediation technology. The course is based on a modular type of methodology: it involves work divided into a series of successive steps, each of which can be modulated by the teacher: the complexity of the tasks will be managed by the teacher, taking into account the specific age (for example, in the experiences (for example, in our experiences with the last preschool classes, we have replaced writing with voice recording). The educational path we outline here can be successfully applied to classes between the last year of kindergarten and the entire primary school. The activity involves group work; from 2015 onwards, it was developed in teaching laboratories of the Primary Education Science degree course at the University of Turin and partly tested in various schools in the territory, teaching courses of between 40 and 50 hours each. This year, we have notably deepened the media-archaeological approach and addressed the dimension of sound.

Keywords: *Audio-visual media, media archeology, teaching, animation, sound.*

1. Conceptual framework

Digital technologies in recent years have undertaken a predominant role in creative processes related to sound and image. Tools for creating sound and multimedia have slowly incorporated a certain amount of implicit knowledge and have developed the ability to replace part of the human creative process; these mechanisms often act in a manner hidden from the users/authors, who are not always aware of the underlying processes. Digital technologies thus change the relationship humans have with the creation of sound and image.

The development of digital technologies designed for the teaching of musical and audiovisual creativity has accompanied this process, even in the primary school. Suffice it to mention important teaching platforms such as MIROR (Addressi, 2020; 2022), or projects such as OPEN SoundS (Canazza et al., 2012): for the music field alone, the taxonomy developed by the LIM (Music Informatics Laboratory of Milan University) counts 65 digital applications dedicated to the primary school (Mandanici et al., 2023). And equally we see the development of teaching multiple strategies dedicated to teaching music and audiovisual through technologies, see e.g., Waldron, Horsey, & Veblen (2020) and William & Webster (2022).

The implementation of educational technologies is usually designed to trigger formative processes by simplifying complex operations through processes that hide some of the complexity by having a certain amount of intelligence inscribed within them. It thus operates within the framework of what we might call the logic of immersion (Grau, 2002). This is a logic that aims to hide the signs of technological mediation, targeting the use of the state-of-the-art technologies. The goal of using technology in these courses is to amaze the users and convey content by simplifying cognitive processes. This process is based on media transparency (Bolter & Grusin, 1999).

In this paper we intend to follow an opposite path: we want to employ obsolete technologies and alienate them, without hiding the signs of technological mediation, starting from a medium-archaeological

perspective. Indeed, studies on media archaeologies (Huhtamo & Parikka, 2011) have unveiled different approaches, parallel and hidden histories, and nonlinear processes in technological evolution, providing a complete and more complex picture of the interaction between technological devices, humans, and social forms. Applying a mediarcheological gaze also implies dwelling on the failures, observing the technological setbacks, analyzing technologies while avoiding to interpret them within the horizon of linear historical progress; deconstructing them, and with them deconstructing the common evolutionist narrative. Our idea is not to employ state-of-the-art media and technologies, but to deconstruct them, exploring obsolete technological processes-with their potentials and limitations-with the aim of highlighting the implicit processes hidden in the current application of technologies and media in pedagogy. The idea is to employ obsolete technologies to avoid concealing the processes usually hidden from the awareness of the author/user. To interpret the technological lag and limitations of technologies in their specific expressive and creative potential and not as limits to creativity. Aim for the development of creative processes that do not follow what is programmed by a developer, but arise from the deconstruction of technologies, media, and media processes.

The didactic experience we are proposing here is based on the re-enactment of obsolete artistic practices realized through digital media. We propose to reproduce creative processes typical of the analog world in the digital universe, exploring the *phygital* realm (see Reilly & Dawson, 2021). In this way, we deconstruct the digital and unleash the educational and creative potential of practices conceived within a different media universe. The distinction between the digital and analog universes has been theorized within the framework of cybernetic theory (Schröter, Ernst & Warnke, 2022); we want to deconstruct this transition and use de-algorithmized procedures, thus analog processes, through the deconstruction of merely digital technologies. We implement obsolete models and processes through digital media, avoiding the exploitation to the state-of-the-art potentialities of new technologies.

We aim at exploring and recontextualizing two now-dated artistic practices and technologies with a didactic purpose: the stop motion technique, from the nineteenth-century tradition, and Foley sound, from the thirties. Through them we want students to discover sound and image – both in their material dimension and in their technological mediation – and to explore these in a different way than they usually do.

2. Method

The methodological line with which we have set up the archaeological media education work revolves around a procedure that has been devised and tested since 2014 in about 50 schools in the area, working mainly with two age groups of students: those 3-6 and those 6-11 (predominantly with primary school students and, secondarily, with kindergarten students) (Denicolai & Parola, 2017). The procedure was designed on the assumption that the concept of ‘computational thinking’ (Wing, 2006; 2008) can also be applied to the activity of building audiovisual products (Denicolai, 2021). In practice, the ultimate aim of the entire process has always been to help the younger generation approach the media, and film and audiovisual language in particular, through two fundamental steps. Firstly, the procedure theoretically draws on traditional pedagogical theories relating to learning by doing derived from Dewey and Constructivism, later taken up by Seymour Papert’s Constructivism. Secondly, and in view of the reference to Papert, we thought of extrapolating the concept of computational thought, algorithm and the idea of the ‘reconstruction’ of an experience – as well as a thought and knowledge. In this sense, the medioarchaeological deconstruction we mentioned above corresponds in media theory to this aspect. Reconstructing knowledge means, in our case, dealing with a subject matter by exploiting the expressive codes of sound and visuals, thus producing audio-visual products – usually short stop-motion animated films – enabling students to dwell on the value of the individual passage and its weight in the overall economy of the media object then obtained. Similarly, the constructionist approach also makes it possible to identify units of meaning – i.e. individual parts of narrative and then of video – which are thus better understood by students, before being assembled into an object and thus having an overall view of it. In the purely cinematic sphere, Ejzenstejn’s (1985/2012) idea of a shot composed of several parts and thus composite seems to adhere to such a conception. It is then up to the brain to put the pieces together, i.e. to provide the observer with an overall view. In this sense, working on smaller parts of an educational content and its audiovisual rendering means applying an algorithmic process of breaking down a complex object (both theoretical and abstract, as well as practical and concrete) into many smaller, simpler parts, so that the process of understanding each of these is easier, before having an overall view again. Ultimately, we think that even the production of an audiovisual object can be used by students – appropriately guided by the teaching staff – to reason on at least three levels. Firstly, on the chosen theme to be represented, thus on a typically narrative and content aspect; secondly, on the discursive logic underlying the production of the object itself: thus, on the necessary steps, including technical ones, to produce an animation video using the stop-motion technique; thirdly, but not lastly, on the fundamental logical and causal relationship

underlying all our actions and activities in the construction of experience. In this sense, the reference to computational thinking and coding as a way of ‘educating’ the machine, i.e. of imparting commands that always have a causal relationship between them, is also perfectly applicable to the production of the visual object. In synthesis, the procedure is organised as follows:

- 1) creation of the story (based on a ‘musical subject’) by the group writing of the story (for children not writing, but narration and voice recording);
- 2) creation of the story (based on a ‘musical subject’) by the group writing of the story (for children not writing, but narration and voice recording);
- 3) re-writing in the form of scenes, both from the point of view of the action, the visual dimension and the sound dimension;
- 4) creation of the storyboard, understood as the process of synthesising the scenes (also includes the design of the soundscape, which is then to be realised);
- 5) construction of sets and props (from a sound point of view, choice and experimentation of materials with which to produce the sounds);
- 6) filming using the stop-motion technique;
- 7) planning and writing of the sound, starting from the sound analysis of the storyboard, and definition of its temporal structure, also in relation to the unfolding of the image;
- 8) recording of the soundtrack by means of foley techniques and live performance;
- 9) editing by means of physical devices of sound textures through real-time performance act;
- 10) audiovisual editing of scenes;
- 11) restitution in the classroom of the work done and the product realised.

Each step listed here is linked to the next and previous ones by the causal relationship. In practice, the participants – i.e., pre-school and primary school students – learn how to make short animation videos using the stop-motion technique based on an actual procedure, which is similar in its logic to that of programming a machine. In this way, we try to stimulate both a critical approach to the specific activity and a greater awareness of the processes that are inherent in the use of technology. Clearly, each step then has internal relationships, again governed by the causal relationship. In this way, we tend to multiply and multi-level a single reasoning approach, the one based on evidence and its consequences. Each step has purely didactic objectives that relate both to the specific topic that is dealt with by means of audio-visual narration and to the transversal skills and soft-skills that participants can develop and apply in carrying out these steps. Furthermore, each step provides for ways of verifying the result obtained: these ways, as a rule, follow the Italian National Indications of the school curriculum and are based on an assessment by objectives achieved.

From the audio perspective, our approach addresses four educational issues. The first is children’s discovery of the acoustic dimension of the landscape. We aim to increase awareness of the acoustic ecosystem, the importance of which has been emphasized by soundscape studies introduced since the 1970s (Schafer, 1977). Sound planning involves reasoning about the soundscape and its nature: how to acoustically depict a landscape, which sounds it contains, which represent it, and which distort it. The second issue that the proposed experience is meant to highlight is to make children aware of the artificiality of the sound dimension in audiovisual productions. Being born in an environment constellated with sound reproduction devices, one perceives the acoustic dimension of audiovisual products immediately, transparent, as if they were part of nature, lacking the electronic mediation (Spaziante, 2009). The acoustic dimension surrounds the child, who draws information from it without being aware of the source from which it comes, hardly noticing it (Dyson, 2009). Working on recording by trying to imitate sounds and their effect by different means involves becoming aware of the artificiality of reproduced sound and its potential to convey content. The third point that our experience wants to raise from the educational point of view is to make people understand the relevance of the sound dimension in the construction of meaning. Indeed, sound conveys meanings, which can be artificially constructed and which we perceive as immediate. Working on sound makes one aware of its relevance in emotional communication, in giving nuance and color to otherwise inanimate objects. Finally, the creation of the sound involves the performative practice, which forces the students to think about how to realize the sounds and organize them over time. It forces them, since they cannot realize everything they would like in real time, to choose what is relevant to the action and what to leave out, and to organize the sound tools, i.e. the physical materials in such a way that they are manageable in a live performance.

3. Discussion

The question of the assessment of the goals achieved is considered starting from the skills assessment forms in use in the Italian first-cycle school (Castoldi, 2016), because we considered it appropriate to allow the teachers involved – also those who intend to use the method autonomously,

i.e., without taking part in research projects – to apply the normal docimological methods also to the audiovisual experience construction procedure. In this way, each teacher has the opportunity to choose which specific goals to achieve, while also offering an overview of the effectiveness of the method indicated. The experimentation of the method concerned in particular the action with the audiovisual language (stop-motion animation) on which we have already tested some evaluation lines relating to the transversal competences and soft-skills of the European Union. In this sense, out of the total number of classes involved, we noticed a general acquisition of skills related to teamwork and the ability to collaborate, as well as a gradual increase in interest in the specific topics covered by each product. For the sound and music part, we intend to proceed by enriching the evaluation scheme with specially identified items, so as to better highlight the possible advantage of using this method also for understanding the dynamics of the soundscape and soundscape and its use in meaning-making processes.

We believe that it is important to emphasise that the construction of the stop-motion animation products is designed according to procedural logic – typical of coding education – with the aim of helping students ‘make and behave like machines’, in order to understand the logic that governs their operation. The ‘doing the machines’ is thus not an imitation of technology, but is ‘taking it apart’; each class normally uses smartphones or tablets to shoot video, exploiting apps such as iMotion (for Apple iOS) or Stop Motion Studio (for Android): but the students are invited to use the technologies without automatic settings – which allows the device to shoot the frame sequences autonomously – but using them in manual mode. In this way, the students take the individual photographs and subsequently edit the material with editing software (again, not exploiting the potential of artificial intelligence). The procedure, therefore, stimulates the students to reason by cause-and-effect relationships even in the realisation of passages where technology could take the place of humans. Likewise, we think it is useful to work in the same way on the soundscape, relying on live recordings and then editing with the previously made video track. In this way, procedurally becomes on two levels: the video is the basis on which the students can imagine a soundscape that is not only a commentary on the image but can in effect dialogue with what is seen. As with video editing, sound editing, using manually managed software, eliminates all machine intervention in favour of a greater awareness of the creative value of the whole process.

4. Conclusions

In this article we have tried to introduce a working methodology based on the use of audio-visual language, asking students in first-cycle schools (3 to 6 years old and 6 to 11 years old) to build animation products using the stop-motion technique, following a procedural logic that is typically used in coding education today. To this activity we are adding a special focus on the sound and musical level, because we intend to formalise the methodology also as a tool to have a greater awareness of how creativity can exploit the syncretic language of the audio-visual. All experimentation and research start from a theoretical basis that refers to media studies and musicology, with a focus on how these theories can also have an important impact on the training of future teachers in the first cycle (kindergarten and Primary School) of the Italian school system.

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NOUVELLES CARTES PORTUGAISES: A GAMIFIED PEDAGOGICAL APPROACH TO PROMOTE PORTUGUESE CULTURAL AND VISUAL HERITAGE

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Abstract

This paper presents a workshop as part of a week-long event promoting Portuguese design culture among Graphic Design students in the French public higher education system. The workshop aimed to achieve three main objectives: promote awareness of 20th-century Portuguese Graphic Designers, artists, and their work; encourage reflection on the historical and current context of communication artifacts; and foster collaborative design strategies. The overarching goal was to design and produce a contemporary card game. The workshop was designed to be adaptable to various cultural contexts, promoting Portuguese and other cultures. It consisted of three main components: a historical and visual presentation, a cultural and political reflection stimulus, and an iteration-based collaborative design activity. The historical and visual presentation delved into the history and visual repertoire of 20th-century Portuguese graphic artists and designers. This included visual details and cultural/historical insights, stimulating group discussion within the contemporary context. The cultural and political reflection stimulus involved presenting the literary work “*Novas Cartas Portuguesas*” to stimulate reflection and challenge existing social representations and visual stereotypes. The collaborative design assignment centered around the creation of a deck of cards. Each participant was assigned a symbol or card value, and by using visual references, they had to reflect and synthesize these elements into a stencil fit for printing. The manual production of stencils facilitated embodied reflection and continuous iteration, with decisions made and discussed in real-time. The participants, comprising 40 students with diverse backgrounds, designed, developed, and printed their graphics on the same deck of physical cards during iterative feedback sessions, allowing for discussions ranging from technical execution to cultural semiotic interpretations. The final deck of cards became a tool for further discussion, with participants using them to explore the meaning of the graphics and develop a narrative for a card game. Other students were invited to play the game during the final exhibition. Qualitative feedback during the results’ presentation indicated that participants understood the assignment and successfully interpreted cultural values into minimal graphics. The interpretations were validated by their peers, demonstrating the effectiveness of the collaborative and iterative process in addressing cultural and social perspectives in Graphic Design. Overall, the workshop achieved its goals of promoting cultural awareness, encouraging reflection, and fostering collaborative design strategies.

Keywords: “*Novas Cartas Portuguesas*”, *graphic design education, cultural heritage, gestalt, gamification.*

1. Introduction

This paper describes a workshop as part of a week-long event promoting Portuguese design culture among Graphic Design students at a French public higher education institution. Three main objectives were defined for this workshop: promote awareness of 20th-century Portuguese Graphic Designers and their work, encourage reflection on the historical and current context of communication artifacts, and foster collaborative design strategies. The main objective was to design and produce a contemporary deck of cards. A graphic product based on a framework designed to help university design students of multiple nationalities and backgrounds find creative answers to the challenge of designing original and meaningful artifacts consistent with the gamified context of the brief.

This exercise, grounded in one country's cultural heritage, was based on experimentation (in terms of mediums and processes) and collaborative, face-to-face practices, promoting an environment of free questioning, discussion, and research, with the brief being open enough for solutions to vary. The aim was to contribute to creating an open exploration environment (albeit intensive, conditioned by a three-day timeframe), in contrast to the academic curriculum these students were following, which was more geared towards learning specific and traditional skills and more conventional working methods. As Papanek (1984) suggested back in the 1970s, the education of designers must adjust to their time. This is a fact then as it is today.

“Education for designers (like nearly all education) is based on learning skills, nourishing talents, understanding the concepts and theories that inform the field, and, finally, acquiring a philosophy. It is unfortunate that our design schools proceed from wrong assumptions. The skills we teach are too often related to processes and working methods of an age that has ended.”

Now is a time of multiculturalism and societal challenges to which graphic design is obligated to contribute positively. Our mission as educators is to provide our students with these experiences, enabling them to be more flexible, critical, and empathetic when stepping into the global work environment.

The practical outcome of this workshop – a deck of cards – was conceived to explore the potential that games can have as educational tools, so not only the aesthetic aspect but also the storytelling context and the game mechanics themselves were considered.

Kapp (2012) underlines the importance of the aesthetics of a game and how it can amplify the player's experience.

“Ignoring aesthetics in the design and creation of a game or the use of gamification techniques reduces the overall experience of the players. The space in which the game is played becomes boring without aesthetics. (...) The aesthetics help the players become caught up in the game experience.” (Kapp, 2012)

Kapp (2012) also identifies storytelling as one of the essential elements and variables of the complex system that is a game: “While not all games have a story narrative behind them, storytelling is an essential part of the gamification of learning and instruction. The element of “story” provides relevance and meaning to the experience.”

The aim of linking the graphic and formal references of the 20th-century Portuguese graphic repertoire with the concepts and challenges of the NCP work was to create opportunities for unique and meaningful game designs in terms of their appearance and rules. Games that could lead to a free exploration of the established cultural and social preconceptions, as well as visually compelling and original. Salen and Zimmerman (2004) suggest something somewhat along these lines by changing the traditional rules and roles of a card-based game:

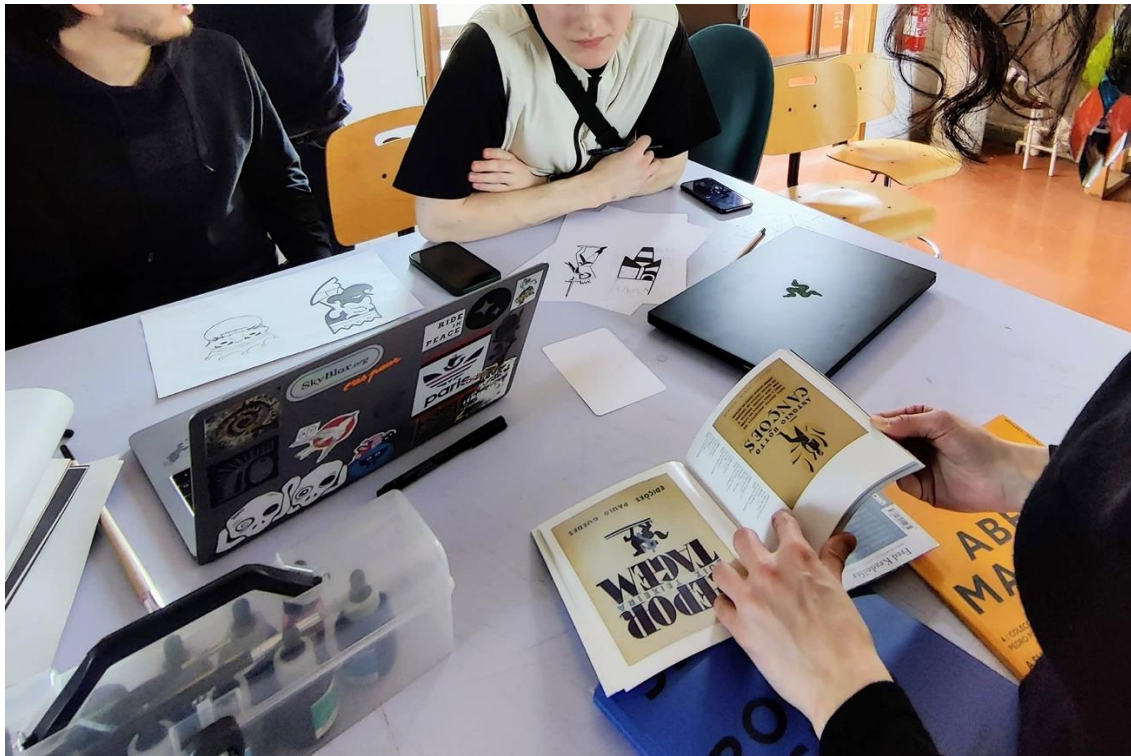
“What if the deck of cards was altered by changing its four suits? Would we still be playing the same game? Perhaps Spades becomes Death, Hearts becomes Love, Clubs becomes War, and Diamonds becomes Sex. The change might entail a graphical alteration to the suits as they appear on the cards or the name by which players refer to the cards. (“I've got an eight of War.”)” (Salen & Zimmerman, 2004)

2. Nouvelles Cartes Portugaises workshop design & objectives

The workshop was designed to be adjusted to several cultural contexts and formal or informal settings, thereby fulfilling the aim of promoting Portuguese culture and intercultural relations. It was organized into three main moments: a presentation of historical and visual references, an incentive for culturally and ethically committed research, and a collaborative design experience based on rapid, analog-based iterations.

The historical and visual presentation focused on the history and visual repertoire of 20th-century Portuguese graphic artists and designers (Figure 1). This presentation included the showcase of several graphic examples by artists and designers and a historical and artistic overview of the development of graphic arts and design in Portugal during the 20th century. The objective was to inform the practical stage of this workshop and encourage a group discussion that could enable a critical analysis of contemporary design within a changing society.

Figure 1. The slide deck presentation of the history and visual repertoire of 20th-century Portuguese graphic artists and designers was complemented with showing and discussion of additional examples from Portuguese graphic design history publications. In the image, participants are appropriating Abel Manta's language into their designs.



Stimulating cultural and political reflection also involved presenting the literary work “*Novas Cartas Portuguesas*” (NCP) to encourage debate and challenge existing social representations and visual stereotypes. Published and banned in the 1970s, NCP is a literary work published jointly by the Portuguese writers Maria Isabel Barreno, Maria Teresa Horta, and Maria Velho da Costa. NCP played an essential role in the fall of the dictatorship and remains crucial to the contemporary political agenda.

The goal was to build a cross-cultural communication platform and collaboration framework towards tackling social and political problems, which were present in the 70s and are progressively reemerging today, aiming at a global and critical worldview. This an approach that the educator and philosopher Paulo Freire (1921–1997) called “critical pedagogy,” explained here by Giroux (2010):

“Critical pedagogy also insists that one of the fundamental tasks of educators is to make sure that the future points the way to a more socially just world, a world in which critique and possibility—in conjunction with the values of reason, freedom, and equality—function to alter the grounds upon which life is lived. That is hardly a prescription for political indoctrination. It offers students new ways to think and act independently.” (Giroux, 2010)

The practical project consisted of a collaborative design activity centered on creating a deck of playing cards in which each participant developed a symbol or card value. To design and play a new card-based game as a group. The workshop audience was diverse, with a robust multicultural profile consisting of bachelor and master students, and it was part of a Portuguese-French intercultural initiative. During the first stage of the workshop, the participants used visual references from the Portuguese graphic heritage presentation to create a stencil for printing. They achieved this by elaborating on the symbolic value of these references and synthesizing the formal elements. Additionally, they developed narrative variations derived from the input of the NCP stories—the manual production of stencils allowed for embodied reflection and continuous iterative decision-making, creating a hands-on approach.

3. Methods and outcomes

The workshop started with a showcase of the work of 20th-century Portuguese graphic designers, which included the presentation of graphic references, the NCP work, and its main theses. The briefing of the entire workshop game-design activity was then presented. The research, ideation, and sketching phases followed.

Working with 40 students from diverse backgrounds (including two Portuguese Erasmus+ students and two Luso descendants), our main objective was to create a deck of 34 playing cards.

Each participant was asked to choose one visual element from a list that included a suit, a card number, or a figure for a card deck. The workshop facilitators would produce and print the pattern on the back. The image of the card element could occupy up to one-quarter of the area of the card and should be reversible. It was essential to consider that each card would result from collaborative design and print processes. Thus, printing areas' overprints and "crossovers" should be planned and nurtured in their process and designs, as emergent graphics could lead to innovative and unpredictable creative solutions (Figure 2). The formal options should be adapted to the stencil technique, which requires a simplified design conscious of the counter forms. The color options were purposefully limited, which, along with the low fidelity of the manual stencil printing technique, fostered faster decisions and quicker iterations during the testing phase (Figure 3).

Figure 2. The use of tracing paper and fast sharpie sketching of initial shapes allowed for planning and promoting the design of collaborative compositions and the study of overprinting designs among participants during review phases.



Figure 3. The imposed limitations to the use of colors and low fidelity manual stencil promoted the research and design of the most efficient shapes in order to convey the intended semiotic meanings. It required a few iterations in the process, but the manual low fidelity allowed for a fast return process.



This was particularly important when individuals were working in a collaborative setting. From day one of the workshop, we implemented iterative feedback sessions covering technical execution to cultural semiotics and storytelling of the final game.

Although the result was a card deck, the initial briefing included a possible game design exercise, using the aesthetics of the cards to enhance the players' experience. The storytelling could ideally provide essential documents about the Portuguese graphic heritage and serve as a medium for reflection on social representations and visual stereotypes.

On the second day, the group refined the sketches and stencil preparation. This included test-printing of colors and color separations and the articulation of individual prints on the same card base.

On the third and final day, the students printed the card deck and rehearsed new card games' goals and mechanics that aligned with the stories and narratives on the cards. As the card deck neared completion, some students started to test the gameplay. However, this printing phase took longer than expected, leading to the decision to have a final gameplay using the rules of a conventional card game familiar to most group members. Other students external to the workshop were invited to play the game during the final exhibition (Figure 4), and an open-ended discussion took place to evaluate the workshop goals as well as the strengths and weaknesses of the process.

Figure 4. One of the clusters of the final focus groups impromptu test-play sessions with the final deck of cards. Participants are exploring the designs the participants made, while discussing their meaning, appropriateness and application in the proposed game.



4. Conclusions

Overall, the workshop promoted Portuguese Graphic Designers and culture, encouraged reflection, and fostered collaborative design strategies. Critical Thinking was encouraged by engaging in discussions on societal issues and challenging existing social representations, inspired by the literary work NCP and fueled by the diversity of the participants' various cultural backgrounds. During the workshop and using a collaborative practice, students were encouraged to think critically about their designs and contributions. The design process was hands-on and iterative, enabled by the stencil technique in use, involving rapid, analog-based experiences and continuous feedback sessions. This resulted in the production of a unique deck of cards.

The exploration of game design as an educational tool added a layer of complexity to the exercise by considering the aesthetic aspect, the storytelling context, and game mechanics. By doing so, the workshop aimed to create engaging and meaningful learning experiences. This aspect, however, had to be adjusted to the tight timeframe of the activity and will be revised in future editions of the workshop.

The workshop ended with an open presentation where other external participants could gameplay. According to the response received during the presentation of the results, the 13 participants that constituted the two-cluster impromptu focus group were able to comprehend the assignment and successfully interpreted cultural values and visual references into minimal but meaningful graphics. When questioned by the facilitators, the interpretations were further validated by several of their colleagues watching the game, demonstrating the effectiveness of the collaborative, hands-on, and iterative process in addressing cultural and social perspectives in graphic design and design education.

There was a clear effort to produce an engaging and thought-provoking game, and the feedback received during the presentation will be used to refine and improve the workshop for other geographical and cultural settings.

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EDUCATIONAL EQUALITY AND PEDAGOGICAL TECHNOLOGICAL TRANSFORMATION OF RURAL SOUTH AFRICAN SECONDARY SCHOOLS

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Abstract

The global COVID-19 pandemic has significantly impacted education systems worldwide, forcing institutions to adapt rapidly to ensure continuity of learning. In the context of South Africa, where educational disparities persist, the pandemic has exposed and exacerbated existing inequalities in access to quality education. This research critically examines the Educational Equality and Pedagogical Technological Transformation of Rural South African Secondary Schools. Recognizing the persistent educational disparities in resource allocation and quality of instruction between urban and rural settings, this study aims to investigate the potential of integrating technological advancements to bridge this gap. The research employs a mixed-methods approach, combining quantitative data collection and qualitative analysis to provide a comprehensive understanding of the challenges and opportunities inherent in education. Quantitative surveys were conducted to assess the current state of educational resources, infrastructure, and academic performance across a representative sample of rural schools. The case study research design was adopted. Concurrently, qualitative methods, such as interviews and focus group discussions, were employed to capture the nuanced experiences and perspectives of educators, students, and community stakeholders. The study investigated the utilization of pedagogical technologies within the sampled 3 rural purposively selected secondary schools, examining 60 teachers as participants on the extent to which digital tools, e-learning platforms, and interactive media were integrated into teaching practices. Data was analyzed manually, graphs and tables were utilized, and themes were drawn. The findings of this study revealed that Special attention needed to be given to the identified barriers to technology adoption, including infrastructural limitations, teacher training, and cultural considerations. Furthermore, the study the findings revealed that the impact of technological interventions on educational outcomes, evaluating factors such as student engagement, academic achievement, and the development of 21st-century skills was a necessary need in rural schools. The study recommended the efficacy of various pedagogical technologies, which would aim to provide evidence-based technological skills for the implementation of sustainable and contextually relevant solutions to enhance educational equality in rural South African schools. The findings hold the potential to inform policy decisions, guide educational practitioners, and contribute to the ongoing discourse surrounding global efforts to achieve inclusive and quality education for all. This study concluded that the Department of Education takes a relook into education by aligning with national educational goals and considering the unique challenges faced by rural communities to contribute to the formulation of policies that promote inclusive and technology-enabled education.

Keywords: *Educational, equality, pedagogy, technology, advancements.*

1. Introduction

Particularly in rural South African secondary schools, educational equality and pedagogical technologies are essential for improving the quality of education. Even with advancements, inequalities in education and resource allocation persist in rural regions due to structural issues (Smith, 2020). These problems should be resolved by combining technology advancement with educational equality. It is critical to modify educational systems for continuity and justice in the COVID-19 epidemic. This study uses a mixed-methods approach to investigate the function of infrastructure, pedagogical technology, and educational resources König, Jäger-Biela, & Glutsch (2020). It highlights obstacles to the implementation of technology, ranging from teacher preparation to infrastructure (Silva, Fernandes, Peres, Lima, & Silva, 2022). Policy choices for inclusive and high-quality education are influenced by the study's findings (Alfredo, Echeverria, Jin, Yan, Swiecki, Gašević, & Martinez-Maldonado, 2024).

2. Literature review

This section studied theoretical and empirical literature to fully comprehend educational equity and the pedagogical technological transformation of rural South African secondary schools.

2.1. Theoretical literature review

In academic debate, the quest for educational equity and pedagogical technology in rural South African secondary schools is a central theme. Firmansyah, Putri, Wicaksono, Putri, Widiyanto, & Palil (2021) draws attention to difficulties that impede equal results, such as inadequate infrastructure and teacher shortages. Advocating for transformational methods and confronting oppressive institutions, critical pedagogy (Silva, Fernandes, Peres, Lima, & Silva, 2022). Sociocultural theory stresses social interactions' function, calling for meaningful involvement (Alfredo, Echeverria, Jin, Yan, Swiecki, Gašević, & Martinez-Maldonado, 2024). According to Sabela (2023), integrating pedagogical technology has the potential for fairness, breaking down obstacles, and promoting individualized instruction. Nonetheless, Shwedeh, Salloum, Aburayya, Fatin, Elbadawi, Al Ghurabli, & Al Dabbagh, (2024) highlights the necessity of infrastructure, teacher preparation, and contextual factors for sustainable practices. Interventions are guided by theoretical frameworks, guaranteeing all students in rural South African secondary schools' fair access to high-quality education.

2.2. Empirical literature

In rural secondary schools in South Africa, empirical research offers important insights on educational equity and pedagogical technology integration. König, Jäger-Biela, & Glutsch (2020) draws attention to resource inequalities and emphasizes focused actions. Infrastructure and training are essential for equal access to technology, according to Gallegos-Rejas, Thomas, Kelly, & Smith, (2023). Contextual elements and community participation are key components of effective pedagogical technology, underline cultural impacts on schooling according to Silva, Fernandes, Peres, Lima, & Silva, 2022). Alfredo, Echeverria, Jin, Yan, Swiecki, Gašević, & Martinez-Maldonado, (2024). Sabela (2023) investigate methods for integrating technology. This empirical research supports inclusive education for all students in rural South African secondary schools by providing information for evidence-based practices and policy choices.

3. Research methodology

Methodological aspects presented in this section involve the research design, population and sampling, data, and analytic techniques.

3.1. Methodological design

Using a mixed-methods approach, the research provides a thorough grasp of the opportunities and problems inherent in education by integrating qualitative analysis with quantitative data collecting. A representative sample of rural schools' academic performance, infrastructure, and educational resources were evaluated using quantitative questionnaires. The research design for the case study was chosen. Concurrently, qualitative approaches, such as interviews and focus group discussions, were deployed to capture the diverse experiences and opinions of educators, students, and community stakeholders.

3.2. Population and sampling

The study examined how pedagogical technologies were used in three rural secondary schools that were purposefully chosen for the sample. It looked at the degree to which digital tools, e-learning platforms, and interactive media were incorporated into teaching practices, with 60 teachers serving as participants.

3.3. Data collection and data analysis

Qualitative techniques, like focus groups and interviews were used to record the complex viewpoints and experiences of teachers, students, and community members. Tables, graphs, and manual data analysis were used. Focus group discussions also promote discussion and offer enlightening data (Ramphabana, 2022). A large sample of instructors participated in quantitative questionnaires to evaluate the patterns and prevalence of participation across socioeconomic backgrounds (Gallegos-Rejas, Thomas, Kelly, & Smith, (2023).

3.4. Data collection procedure

In rural South African secondary schools, data collecting to analyze parental engagement in their children's education was carried out ethically and methodically, taking into account the goals of educational equity and the pedagogical technology revolution. After receiving clearance, a varied group of educators voluntarily participated in the research (Hongoro, Makoae, Alubafi, Ramoroka, Maphosa, Makitla, Maphosho, Nchabeleng, Mohlabane, & Nkosi, 2023). We carefully used qualitative techniques, such as focus groups and interviews, with participants' express permission to minimize interference with their daily lives (Gallegos-Rejas, Thomas, Kelly, & Smith, (2023). Furthermore, participants' anonymous data was gathered with interviews (Ramasamy & Vilakazi, 2022). Coding strategies and triangulation procedures were used to support the validity and reliability of the data that was gathered. With a focus on educational equity and pedagogical technology change in rural secondary schools, this methodical approach seeks to provide instructors with a thorough understanding of their perspectives on parental engagement in South African children's education Hongoro, Makoae, Alubafi, Ramoroka, Maphosa, Makitla, Maphosho, Nchabeleng, Mohlabane, & Nkosi (2023).

3.5. Data treatment and analysis

To investigate educational equity and pedagogical technological change in rural South African secondary schools, data handling and analysis are essential. To guarantee correctness, dependability, and relevance to the study goals, the data were subjected to a methodical processing process once they were collected. Data cleansing was one of the first phases when missing numbers, outliers, and inconsistencies were found and fixed (Sabela, 2023). After that, the data was arranged and coded to make analysis easier. The coding schemes were created to identify important themes and variables on educational equity and the integration of pedagogical technology (Silva, Fernandes, Peres, Lima, & Silva, 2022). Surveys and evaluations were used to collect quantitative data, which was then statistically analyzed to identify trends, correlations, and links between educational results and technology use (Ramasamy & Vilakazi, 2022). Researchers can confirm findings and reach strong conclusions by using a triangulation of data sources and methodologies, which improves the validity and dependability of findings (Alfredo, Echeverria, Jin, Yan, Swiecki, Gašević, & Martinez-Maldonado, 2024). Additionally, the data analysis process was iterative, with researchers going back and adjusting their findings to meet the intricacies present in education and get a deeper knowledge (Sabela, 2023).

4. Findings and discussions

The results show persistent gaps in secondary education that must be addressed to facilitate the successful integration of technology in rural South African secondary schools (Ramphabana, 2022). Communities, parents, teachers, and students must work together on collaborative efforts (Alfredo, Echeverria, Jin, Yan, Swiecki, Gašević, & Martinez-Maldonado, 2024). For pedagogical skills and digital literacy, teacher training programs are essential (Ramasamy & Vilakazi, 2022; Sabela, 2023). These observations guide the development of evidence-based interventions and policy choices that support inclusive, high-quality education in rural secondary schools in South Africa.

4.1. Infrastructure needs to be improved

Figure 1. The infrastructure required for educational fairness in rural schools.

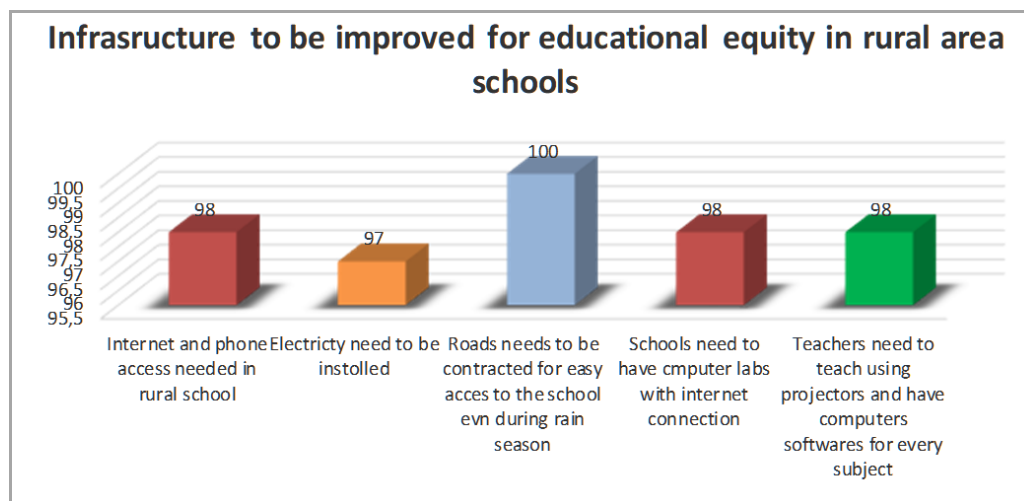
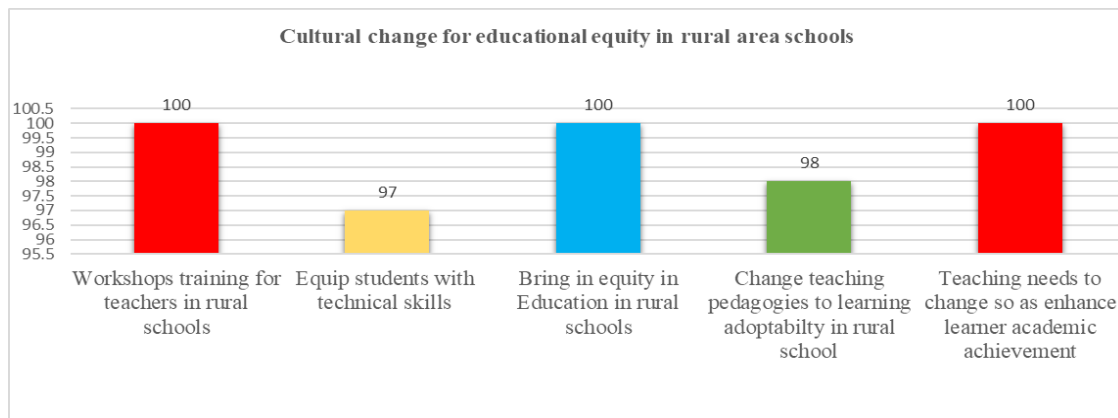


Figure 1 reveals that 98% of participants said that internet and phone access might be required in rural schools, 97% said that electricity installation was necessary, 100% said that a road should be built for convenient access to the school, 98% said that computer labs with internet connections were necessary in schools, and 98% said that teachers should use projectors and have computers for every subject. The results are corroborated by Hongoro, Makoae, Alubafi, Ramoroka, Maphosa, Makitla, Maphosho, Nchabeleng, Mohlabane, & Nkosi (2023) who claimed that inequalities in education in rural South African secondary schools must be addressed to prevent ineffective technology integration.

4.2. Cultural change for educational equity

Figure 2. Cultural shift is necessary for educational fairness in rural schools.



According to Figure 2, 100 % of the participants needed workshop training in technology for teachers in rural schools; 97% said that students needed to be equipped with technical skills to achieve better academic achievements; 100% said that the department of Education needed to implement equitable education in rural schools; 98% said that they needed a change in teaching pedagogies to be implemented in rural schools; and 100% said that teaching needed to change to improve learner academic achievement. The results are corroborated by studies by Ramasamy & Vilakazi (2022) and Sabela (2023), which found that teacher preparation programs are essential for pedagogical skills and digital literacy. However, there is potential for pedagogical technology interventions to solve issues (Silva, Fernandes, Peres, Lima, & Silva, 2022). Furthermore, community engagement may help to enhance teaching and learning of the children teachers meet in the classroom.

5. Conclusion

In rural South African secondary schools, pedagogical technology change and educational equity are goals that require a diversified approach. Even while there are still gaps, integrating technology has the potential to close them and improve student results. Targeted teacher preparation, cultural sensitivity, and community participation show to be essential components in promoting long-lasting transformation. Through the promotion of cooperative endeavours and well-informed policy determinations, interested parties may progress inclusive and high-quality education for every student, regardless of their location or financial status. Embracing these ideals, South Africa may begin on a path towards egalitarian and technologically enabled educational institutions, assuring a brighter future for generations to come.

6. Recommendations

It was recommended that educational policymakers prioritize investments in infrastructure and teacher training to facilitate the effective integration of pedagogical technologies in rural South African secondary schools. Additionally, fostering partnerships between schools, communities, and technology providers may need to enhance access to resources and promote culturally relevant educational experiences. Embracing a holistic approach that addresses socioeconomic disparities and emphasizes community engagement might be essential in achieving sustainable educational equality. Moreover, ongoing research and evaluation of technological interventions could inform evidence-based practices and guide continuous improvement efforts, ensuring that all students have equitable access to quality education in rural areas.

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EDUCATION, DEVELOPMENT AND GLOBAL CITIZENSHIP: A PROPOSAL FOR TRANSFORMATION, AN EXPERIENCE OF (CO)SOCIAL RESPONSIBILITY IN POLYTECHNIC HIGHER EDUCATION

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Abstract

Education, Citizenship and Development are currently inseparable concepts. Educating for global citizenship is inevitably a responsibility to be assumed in the development of educational practices, especially in Higher Education Institutions that train education professionals. According to Óscar Jara (2016), the contemporary scene is a time and space of multiple changes that prompt questioning about the kind of educational processes we want to foster: those that enable adaptation to change(s), while simultaneously allowing the generation of transformative capacities in those who participate, towards the type of society we aspire to. In the context of modern societies that aim to be open and democratic, HEIs must fully embrace these concerns as a civic and social responsibility that characterizes them, based on the reality that surrounds them. They should demonstrate willingness and commitment to finding solutions to identified problems and be concerned about their impact in favor of a more developed, humane, and supportive society. The ESE/IPSantarém has been on a journey of reflection, action, and research in building a course of action that seeks to adopt and consolidate perspectives and practices that are simultaneously reflective, formative, interventionist, and investigative around Education, Development, and Global Citizenship in Higher Education, particularly in Polytechnic institutions. In this process, we identify a cross-cutting investment in developing actions, projects, and partnerships that involve this mission, within a civic and supportive culture that promotes relationships with communities, social responsibility, and awareness for lifelong learning from a global citizenship perspective. Here, we will share the main objectives and proposals under development in this context, the implications for formative and institutional practices, as well as the new challenges and strategies that have been emerging.

Keywords: *Education, development, global citizenship, social responsibility.*

1. The mission of higher education, the role of social responsibility and ED/ECG

This perspective highlights the central role of education systems and all training agents and contexts for social integration and fulfilment and emphasises the centrality of knowledge and the human factor in the face of various vulnerabilities, risks and social fractures in terms of the knowledge acquired in different contexts, the weight of professional and economic logics, the exclusive responsibility of the individual; motivation for learning; or the relationship between levels of schooling, lifelong learning and the reproduction of inequalities. This role seems to correspond to one of the vocations of higher education's mission to overcome the risks of inequality and extreme exclusion by reducing the gap between those who have these opportunities and those who don't (Alves, 2015, 2016): the consolidation of a broad, comprehensive and civic education, suitable for active intervention in professional and social integration contexts, and the possibility of transforming the surrounding conditions. Confronting these challenges is an important contribution to reconfiguring the development of training, profiles and the most appropriate training practices, with Higher Education Institutions (HEIs) playing a crucial role in sharing, analysing and systematising these experiences, models and assumptions (Raposo & others, 2022).

This approach has mobilised us to problematise education, knowledge and lifelong learning itself, given the need to continue questioning the development of the school institution, education systems and learning processes, given the difficulty of integrating social changes (Teixeira, 2021).

Within the framework of modern societies that want to be open and democratic, HEIs must assume their civic and social responsibility, showing themselves to be available and committed to finding solutions to the problems identified, as well as concerned about their impact in favour of a more developed, humane, inclusive and supportive society. Education for Development and Global Citizenship (ED/ECG) presents a way(s) to promote learning processes that allow for collaborative reflection and action on reality, transforming it based on its problems.

Looking at higher education as a space and time in which future professionals are trained - including education professionals - the construction of knowledge that favours the possibilities of developing critical thinking will be a fundamental asset of HEIs (Boni & Walker, 2016). For some, professional learning will be a process that accompanies lifelong learning, involving, in addition to knowledge and skills in a specific field and the ability to reflect on professional contexts, self-knowledge and the ability to define personal and social projects in a given context (Alves, 2015, 2016 cited by Teixeira, 2021). Faced with the challenges of contemporary times, which call for educational processes to be questioned, HEIs themselves are increasingly challenged to reflect on the type of educational practices they develop and the extent to which they contribute to the development of capacities for transformation and change in all those who participate in them (Jara, 2016). The confrontation with this and other challenges in some training profiles, particularly in the field of education, has contributed to the call for a commitment to the development of people and care in the relationship with others. This approach presupposes, encourages and enables training and intervention processes based on a critical reading and social involvement in contexts and problems, prioritising the relationship with people and the values that move them from a perspective of active and global citizenship. In higher education learning contexts and processes, these assumptions have inspired curricular concepts based on promoting autonomous, reflective and investigative learning, while simultaneously fuelling change in the subjects themselves, as subjects who are available for learning and for discovering other capacities or possibilities (Ganpatsingh, 2019; Teixeira, 2021). Jara (2016) states that all forms of education that take on a cultural and political content contain within them a way of thinking and feeling that gives them an intellectual and moral direction at the same time. By proposing an ethical framework for learning processes in schools, both classroom and non-classroom, GCED thus finds a fundamental (and viable) place in HEIs.

In turn, the dynamics of the social responsibility of organisations, particularly HEIs, have become increasingly important. Today, it is a mandatory requirement for a 21st century organisation to take care of the impacts caused by its existence, maximising the positive ones and cancelling out the negative ones as far as possible. In this way, each organisation is called upon to realise its effective commitment to the community it serves (ORSIES, 2018).

Social responsibility emerges as a fundamental pillar in the context of polytechnic higher education, especially when aligned with the quest for transformative and inclusive education. From this perspective, the integration of (co-)social responsibility actions and projects becomes not just an option, but an imperative necessity. This approach, focused on the interconnection between education, development and global citizenship, aims not only to train students with solid academic knowledge, but also to equip them with a critical awareness and sensitivity to contemporary social challenges. Thus, the experience of (co)social responsibility in the context of polytechnic higher education is not restricted to the classroom, but extends beyond the walls of the institution, actively contributing to the construction of a more just, supportive and aware society.

Responsibility for the impact of one's actions and choices can be a driver of learning. Placing sustainability and democracy as the horizon for lifelong learning implies that learning processes, limited, specific, local and contextual (as they always are), are recognised as part of a broad social unit and, therefore, a new societal agenda focused on sustainability and democratisation is a permanent learning agenda that allows society to change (Raposo & Mesquita, 2018).

Strengthening DE/GCE in Higher Education means fully embracing all of its dimensions: Pedagogical - an active learning process; Political - aimed at social transformation, based on permanent critical self-reflexivity; Ethical - based on specific principles and values: solidarity, equity, justice, inclusion; Collaborative - based on sharing experiences and building knowledge together, and desirably so. We see ED/GCE as a training process for this transformative education which, through an in-depth approach to current issues, becomes an instrument for societal change and transformation. Since GCED is in itself a process of transformative education, we believe that it is possible to develop processes that address and deepen the problems of today and their relational complexity, thus placing education as an instrument of global social transformation, contributing to the construction of a world where justice, equity and solidarity are effectively the pillars of society(ies) (Coelho et al., 2020; Raposo et al., 2022).

2. The Transforming schools project and the ED/ECG Learning Centre at ESE-IPSantarém

The Transforming Schools Project - promoted by the Gonçalo da Silveira Foundation and funded by the Camões IP Institute - has been strengthening Development Education as a space for critical reflection and social transformation, based on collaboration with and between HEIs, namely the Higher Education Schools (ESE) of Santarém, Viana do Castelo and Bragança and the Polytechnic Institute of Beja. Through this project, it has been possible to implement processes for the structural and institutional integration of ED/ECG within the higher education institutions involved, making it possible to strengthen their commitment not only in the curricular spaces, but throughout the structure of the ESEs, by: i. strengthening the dynamics of ED/ECG in the ESEs/IPs and their relationship with the territories; ii. creating centres for collaborative work in ED/ECG and iii. promoting opportunities for dissemination, sharing and discussion on ED/ECG. We will try to share the main objectives and proposals under development, the implications for training and institutional practices, as well as the new challenges and strategies that have been emerging.

Currently in its 3rd edition (September 2023 to August 2026), the Project aims to deepen the transformative role of Higher Education through the integration of ED/ECG in the co-construction of knowledge and the involvement of educational communities, proposing to continue to contribute to ESE/IP being part of the construction of a culture of care, solidarity and social justice. Bringing together the complementarities of curricular and institutional integration of ED/ECG and crossing all its potentialities, we assume the centrality of higher education in the integral formation of citizens. This intersection will make it possible to strengthen its commitment to DE in curricular, institutional and community spaces.

The first edition (2018-2020) was based on the need identified by the organising team to introduce Development Education more intentionally in Higher Education Institutions (HEIs), which is why the assumption was made from the outset that schools play an essential role in social transformation, both in the daily life of local territories and for all their potential for transformation, reflection and action at a global level, based on the ethical proposal and principles of action inherent in Development Education/Education for Global Citizenship (ED/ECG).

From the lessons learnt as a result of the collaborative work carried out, it became clear that the project's continuity should go beyond integrating DE into the curricular units of higher education courses and into teaching spaces, as had been envisaged and achieved in the first edition. Considering that social transformation has an implicit political dimension, it also seemed obvious to focus on the institutional integration of DE in higher education beyond teaching spaces, i.e. in a more transversal and structural way. It was in this context that the ED/ECG learning centres emerged in each of the partner HEIs, created in the 2nd edition (2020-2023) and being consolidated in the 3rd (2023-2026).

At ESE-IPSantarém, the ED/ECG Learning Centre includes lecturers from various courses, non-teaching staff and students, and since its creation, it has promoted relations with existing structures at ESE and the Institute. It is housed in the Pedagogical Support Centre and is transversally involved in various actions with the Social Responsibility Office, constituting a collaborative work group that provides answers to the needs of the educational community. It has been possible to create resources and opportunities for disseminating, sharing and discussing ED/ECG with the creation of a physical space for the centre at CAP, integrating mainly bibliographic, documentary and pedagogical resources - methodologies and content. Various actions have been promoted and/or realised in collaboration with some CUs from different courses: CU Social Diversity and Interculturality (Degree in Social Education); CU Global Citizenship (Degree in Multimedia Production in Education). Particularly important has been the collaboration with the Social Education Degree's Internship CU, through which the students themselves have been collaboratively building and implementing intervention projects based on the Centre and the diagnosis of needs that have been identified.

In short, it's a journey of awareness, decision-making and collaborative action, driven by concrete questions that are problematised and lead to processes of training-research-action: What is the role of HEIs in reading and responding to the challenges that society faces on a daily basis, in its complexity and constant change? How do the people who work in HEIs position themselves in the face of the problems of their communities and the world? How can participatory and collaborative processes be included in the training of educational agents?

3. Some results, challenges and concluding remarks

Is it possible, in the organisational context, to find spaces (institutional, curricular and transversal) that promote and validate horizontal relationships and collaboration between peers in identifying problems and proposing solutions?

Is it possible to develop processes that address and deepen the problems of today and their relational complexity, thus placing education as an instrument of global social transformation that

contributes to minimising the problems linked to justice, equity, solidarity that are felt today and to the progressive construction of a better society?

In fact, the conviction and experience of this project point to ED/ECG itself as an instrument of change that affirms itself in the construction of a just, equitable and supportive society, in other words, in social transformation.

In conclusion, we would like to highlight some actions, results and challenges that could give meaning to these issues.

By way of example, we'll share one of the most recent projects, which has been promoted by students developing their internship project in the area of Social Education and who have carried out some of the most recent activities. This was the "Let's Start The Change" project, which set itself the following specific objectives: To contribute to the integration of ESD in an institutional context; to promote information and knowledge of ESD issues and projects; to develop and value the development of global citizenship skills in higher education; and to facilitate global citizenship attitudes and skills.

The activities included:

- Podcast "Let's Talk About", bringing together a set of interviews and themes previously identified with students ("EDCG Concept and Nucleus"; "Entering the labour market"; "Professional experience and practice"; "Transforming Schools"; "The ESES+ Programme and active citizenship"; "Ubuntu"; Valuing the roles of non-teaching staff");
- Workshops with students in collaboration with the UC: "Political Literacy and Citizenship"; "Sustainable Practices"; "Financial Literacy";
- Group dynamics, also in collaboration with the UC: "Day in Nature"; "Active Citizenship"; "Culturality"; "Empathy, respect and dialogue"; "Come and Relax";
- Mural of suggestions and opinions, to involve ESES students and give them a voice.

In terms of results, the National Meetings between Nuclei from the different Higher Education Institutions (HEIs), the extended team meetings or the meetings of each nucleus, have continually allowed the evaluative systematisation of the main learnings:

- The integration of contributions in the students' formative, personal and professional development process and in the preparation for active citizenship.
- The opportunity to adjust training and teaching practices with the students themselves;
- Valuing the impact of transformative actions;
- Awareness of and commitment to the ethical and political dimension of action;
- The confrontation, sharing and questioning of other perspectives and experiences in other contexts and the learning that takes place through relationships.

The challenges identified are diverse, but they continue to be an ingredient for the continuity of the process, with difficulties or constraints that have been with us since the beginning, but which are being reconfigured: resources (time, people and financial); visibility among students and their wider participation; the need for permanent (re)conceptualisation, both because of the complexity of the processes and issues, and because of the inter/transdisciplinarity that requires the participation and involvement of actors from different educational backgrounds or disciplinary areas.

The various actions have given rise to transformative processes and learning (considering the assumptions of the conceptions we've been sharing here about ED/ECG and transformation), of which we would highlight: the first edition of the Project; the National Meetings, the Training of Educational Agents actions; and the appropriation of the Commemoration of the Day of the Santarém School of Education as a day of reflection/training/promotion of ED/ECG.

In this phase of the project (3rd edition), one of the focuses has been to continue to deepen the reflection on the pedagogical intentionality in the learning processes that we intend to propose: a transformative intentionality that allows us to think about any problem in the sense of social transformation. It's about building a democratic school/institution that proposes the transformation of power relations and human coexistence, that generates concrete capacities for intervention (thinking, questioning, creating) and new possibilities; that is geared towards the realisation of a collective utopia and that makes dialogue between knowledges operational.

The challenge that emerges is also to bring the voice and action of the community outside the HEIs into this intentionality and critical, democratic and transformative practice, with greater visibility and a more active role, boosting this extension with the community from an ED/ECG perspective, which leads us to bring the founding questions of our perspective on ED/ECG back into thought and action: how do HEIs relate to the community in a pedagogical, political, ethical and collaborative way?

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FOSTERING GENDER EQUALITY AND INCLUSIVITY AMONG LESOTHO'S YOUTH AND MEN: LESSONS LEARNT AND RECOMMENDATIONS FROM UNICEF EVALUATIONS (2018-2023)

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Abstract

In the pursuit of gender equality and inclusivity, this study undertakes a meta-analysis of the five UNICEF Lesotho CO Office Evaluations conducted between 2018 and 2023 in Lesotho. This analysis centralizes on the incorporation of gender-focused educational strategies aimed at engaging men and male youth and evaluates the effectiveness of these interventions in shifting gender norms. The research methodology entails a comprehensive review of the Evaluations, scrutinizing the integration of gender and inclusivity principles within the program's frameworks and the extent of adherence to UNICEF's gender equality and inclusivity mandates. The aim is to understand how educational content and methods have resonated with and influenced male demographics. The analysis importantly illuminates the complex interplay between gender-focused education and the cultural dynamics of Lesotho, spotlighting the pivotal role of inclusivity. It scrutinizes how inclusivity is either fostered or hindered within the context of Lesotho's traditional gender norms. The study considers how these norms may affect the acceptance and integration of gender equality concepts, especially among male participants. It reflects on the effectiveness of strategies aimed at inclusive education, which not only challenge but also aim to broaden and transform the understanding of gender roles in a culturally sensitive manner. This component of the analysis is critical in developing comprehensive educational programs that are not just gender-sensitive but also truly inclusive, considering the full spectrum of gender identities and expressions, and ensuring that every individual has the opportunity to contribute to and benefit from gender equality initiatives. Key findings from the study indicate that while there is progress, important challenges persist, particularly in fully engaging men and male youth in gender equality, and inclusivity promotion initiatives. The study identifies successful strategies that have led to positive changes in gender ad inclusion perceptions, as well as gaps and biases that need to be addressed. The implications of this research are significant, providing actionable insights for policymakers, educators, and development practitioners seeking to develop gender-inclusive educational programs. By distilling lessons learned and offering evidence-based strategies, the paper contributes to a broader dialogue on effective approaches to gender equality education. It underscores the importance of proactive, reflective practices and the transformative potential of education as a tool for social change, setting the stage for a legacy of gender equality and inclusivity. These findings form the basis for a set of robust recommendations aimed at enhancing the gender sensitivity and inclusivity of UNICEF's future educational programs.

Keywords: *Gender equality, male engagement, inclusivity, program effectiveness, UNICEF, Lesotho.*

1. Introduction

Amidst the grandeur of Lesotho's mountains lies a complex socio-economic reality. Governance gaps borne from episodic political instability have hampered access to vital services and goods, directly impacting the socio-economic stability of the nation (UNICEF, 2023a; UNICEF & Lesotho Red Cross Society, 2023; IMF, 2022). The struggle against poverty, ecological fragility, and limited employment opportunities exacerbates the nation's reliance on international aid, highlighting a critical need for interventions designed with precision to bolster domestic resilience, especially among the most vulnerable groups (The World Bank, 2023a, 2023b; Hemat *et al.*, 2022). Compounding these challenges, the pervasive HIV/AIDS epidemic places additional strain on an already overburdened health system, demanding a cross-sectoral response that integrates nutrition, WASH, healthcare, and education to effectively address the root causes of health disparities (Mairos Ferreira *et al.*, 2023; Schwitters *et al.*, 2022).

Gender inequality in Lesotho is a multifaceted issue that transcends the simple dichotomy of male and female disparities (The World Bank, 2023a). Historical context and socio-economic structures have colluded to entrench a patriarchal system that systemically disadvantages women and girls (Mairós Ferreira & Muthengi, 2023a, 2023b; Paramaiah *et al.*, 2020). Nonetheless, a holistic perspective on gender inequality recognizes that the patriarchal dividend for men is also a patriarchal burden, whereby traditional roles inadvertently limit male expression and contribute to harmful masculinities. Addressing this requires an inclusive approach that also analyzes how men and boys, particularly those with disabilities, are affected by and can contribute to gendered power dynamics. Societal norms that dictate the archetype of the able-bodied male as the provider exacerbate the marginalization of disabled men, who are often excluded from both the discourse on gender equity and from opportunities for economic and social participation. Gender equity as a concept must transcend the distribution of resources and opportunities, advancing towards a transformative change in the institutional structures and belief systems that underlie gender relations.

In alignment with the overarching goal of gender equality and inclusivity, this paper presents a brief exploration of five UNICEF Lesotho Country Office Evaluations conducted from 2019 to 2023. The research critically examines the male role within these frameworks, seeking to redefine entrenched gender norms and highlighting the significant potential of men as catalysts for familial and societal change. This inquiry promotes a robust initiative towards capacity building and consciousness-raising among family members, particularly focusing on the transformative influence of men. It endeavors to pioneer a new era of child development in Lesotho characterized by equity and inclusivity.

2. Methodology

The meta-analysis presented here draws from a series of Evaluations by the UNICEF Lesotho Country Office, spanning 2019 to 2023. It examines the integration of gender and inclusivity principles within UNICEF Lesotho's program frameworks, assessing compliance with UNICEF's mandates for gender equality and inclusivity. The objective is to discern the impact of educational content and methodologies on male audiences, gauging how effectively these interventions have engaged and influenced male perspectives and behaviors toward gender norms and inclusivity. An iterative coding process was central to this effort, dynamically shaping the data collection and ensuring that findings resonated authentically with participants' experiences, thereby cementing the research's conclusions in the reality of Lesotho's societal context. Methodological rigor was fortified through a comprehensive triangulation strategy, which served to validate the research findings. This approach involved the corroboration of data points across various Evaluations, irrespective of their specific focus areas, to form a coherent narrative. The combination of different methodological strengths from each Evaluation through both methodological and data triangulation bolstered the internal validity of the study. This meticulous approach ensured a balanced and thorough representation of gender dynamics as portrayed in the Evaluations, providing a credible and trustworthy analysis that contributes substantively to our understanding of gender integration in programmatic initiatives.

3. Findings and discussion

In the pursuit of gender equality, equity, and inclusivity, the Evaluations conducted by the UNICEF Lesotho Country Office from 2019 to 2023 highlight a critical opportunity: the active role of men and male youth can be significantly enhanced to drive these efforts forward. The comprehensive evaluation of the UNICEF Lesotho Country Programme (2019-2023) demonstrates commitment to integrating gender equality, equity, and inclusivity within various developmental frameworks [*e.g.*, "The Country Programme (...) includes inclusion- and equity-integrated support for improving the access and quality of early childhood care and development, as well as primary/secondary education, out-of-school children, and adolescents" (Bester, 2022, p. 32)]. Notably, it underscores the decade approach (division in decade 1 and decade 2) as pivotal, recognizing the formative years of children and youth as critical junctures for intervention. The Evaluation Report points out that, while achievements have been validated, there remains considerable scope to bolster the gender, equity, and inclusion dimensions, especially within the strategic development plans.

"The evaluation found that the Country Programme is aligned with UNICEF's Gender Action Plan (2018–2021) and NSDP II priorities to address gender inequality. Examples of UNICEF interventions addressing gender inequality include support to the Ministry of Education and Training to strengthen the gender-responsiveness of national education sector plans and policies; capacity strengthening of law enforcement officials to identify and respond to cases of gender-based violence; and the Joint UN programme 2gether 4 SRHR (sexual and reproductive health rights) empowering adolescent girls and

young women. The Country Office, however, lacks an overarching gender strategy, and so interventions addressing gender inequality lack coherence. The evaluation identified the need for gender technical capacity in the Country Office" (Bester, 2022, p. x).

Although men are undoubtedly involved across various programmatic areas, the other The evaluative discourse suggests that efforts must pivot toward a more deeply integrated approach that amplifies the potential of gender, equity, and inclusion strategies to permeate and influence the decade framework's entire spectrum. This need for a deeper, more integrative approach that fully mobilizes their potential as catalysts for change is also corroborated in the other Evaluations (iQvia, 2023; Binci *et al.*, 2022; Cream Wright, 2019). This is not just a matter of participation; it is a transformative process where men and boys evolve into ambassadors of gender equity, embodying the values of inclusivity in their communities. The transformative role of males is consistently observed as a common element in the Evaluations, particularly regarding their participation in discussions and training on gender issues. From the teachers in the classroom to the young leaders in the community, the presence of male figures engaging in gender discourse is essential.

"We as Basotho we still have a cultural belief where we believe ladies or mothers are the only ones to take care of their babies. But we broke that cultural barrier through forming forums. Some men still want to do that. It's also their responsibility to take care of their families (...) Immediately when these ladies heard that we were discussing about how men should take care of their families, the women were happy about that. They said, 'at least now bo ntate (males) will go to facilities and test; we will not go alone there'" (iQvia, 2023, p. 57)

Yet, despite this acknowledgment, the Evaluations concurrently underscore the necessity of addressing the barriers that prevent men and male youth from fully contributing to gender equality efforts (iQvia, 2023; Bester, 2022; Binci *et al.*, 2022; Cream Wright, 2019). Cultural expectations, traditional roles, and the lack of clear avenues for involvement are consistently mentioned as impediments to achieving true inclusivity. The challenge, therefore, lies in dismantling these barriers to forge a more equitable path forward. Specific strategies, as reported in the Evaluations, have led to positive changes, suggesting a more significant investment in these approaches could be beneficial. For instance, in the Evaluation of the Lesotho Child Grants Programme (Binci *et al.*, 2022), male engagement was particularly effective when programs were closely aligned with local customs, showing that gender initiatives resonate best when they are culturally attuned. Moreover, navigating the complex dynamics of family participation in Lesotho's public health sphere, the Endline Evaluation of the Integrated HIV & AIDS-Nutrition Programme in Lesotho (iQvia, 2023) reflects on how men's involvement in maternal and child health initiatives has yielded positive changes. Nevertheless, it is evident that there remains untapped potential in the male youth demographic. The data suggests that adolescent boys, in particular, are at a pivotal developmental stage where interventions could significantly influence their perception of gender roles. However, these interventions must be designed with an acute awareness of the socio-cultural landscape they aim to change [*e.g.*, Lesotho Evaluation of Lesotho Country Programme 2019–2023 (Bester, 2022)].

Across all Evaluations, another critical element is abundantly clear: the active participation of men and male youth in gender initiatives is not merely beneficial but essential for the holistic development of gender equality, equity, and inclusivity. The Final Report of the Lesotho CFS Evaluation (Cream Wright, 2019), for instance, illustrates that when men are provided with the opportunity and the tools to engage with gender initiatives, they can become influential allies in promoting gender equality. The report's qualitative data speak to a shift in attitude among male participants, showcasing a growing awareness and willingness to challenge and change deeply rooted gender norms. Furthermore, the Endline Evaluation of the Integrated HIV & AIDS-Nutrition Programme in Lesotho (iQvia, 2023) brings to light the delicate interplay between existing cultural norms and the acceptance of new gender paradigms. The journey toward full gender equality and inclusivity is complex and multifaceted. Male and male youth engagement vary across the board, with certain Evaluations pointing to more effective methods of inclusion than others.

"The evaluation found that the Country Programme is aligned with UNICEF's GAP (2018–2021) and interventions under the Country Programme are among the priority interventions of NSDP II to address gender inequality. [...] However, UNICEF's work in addressing gender inequality tends to be projectized and lacks coherence" (Bester, 2022, p. 38).

In sum, the Evaluations collectively emphasize that to move the needle on gender equality, equity, and inclusivity, we must actively cultivate the roles of men and male youth as advocates and practitioners of these values. This requires a concerted effort across all sectors, to build programs that are, entirely, gender-sensitive and inclusive.

4. Conclusion and recommendations

In concluding the meta-analysis of the Evaluations conducted by the UNICEF Lesotho Country Office from 2019 to 2023, a unifying thread emerges: the empowerment of men and male youth is crucial and holds substantial untapped potential to bolster gender equality, equity, and inclusivity. The Evaluations illuminate a compelling narrative; they highlight the necessity for a strategic realignment of existing initiatives to better incorporate and amplify the roles of men and boys in gender-based programs. The transformative influence they can wield, as documented in the Evaluations, is manifest in their growing willingness to redefine traditional gender norms and partake actively in the cultivation of an inclusive society. Yet, the journey remains intricate, interlaced with cultural nuances and systemic barriers that demand thoughtful, context-sensitive approaches. The Evaluations underscore a collective call to action: to harness the insights gleaned, to translate them into decisive, culturally resonant strategies that will indelibly mark Lesotho's commitment to fostering a community where inclusivity is not an aspiration but a lived reality. Moving forward, the recommendations drawn from these comprehensive Evaluations are clear. There is an imperative to develop robust, evidence-based strategies that integrate men and male youth as central figures in gender initiatives. These strategies should encompass educational, health, and community sectors, creating inclusive platforms that not only educate but engage males in gender discourse and action. Building upon successful programmatic interventions, such as those highlighted in the Lesotho Child Grants Programme, future initiatives must ensure the sustainability of engagement practices that encourage male agency and leadership in promoting gender equality. Consistency in approach and methodology across all programs will be vital to this endeavor. By fostering a culture where men and boys are empowered as equal stakeholders in gender justice, Lesotho can carve a path toward a future defined by equity and inclusivity for all its citizens.

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SHAPING THE TEACHER'S ROLE: NAVIGATING DIVERSE RESPONSES TO DIGITAL TRANSFORMATION IN AUSTRIAN MIDDLE SCHOOLS

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Abstract

In recent years, digital collaboration and communication have significantly impacted the educational sector in Austria. This study focuses on how teachers integrate digital tools with traditional teaching, affecting lesson preparation, classroom dynamics, and communication. Interviews with ten Austrian middle-school teachers revealed a positive attitude towards digitalization, emphasizing the need for well-equipped infrastructure and continuous professional development. The findings suggest that the benefits of digitalization in education outweigh the risks, advocating for ongoing teacher training in digital competencies.

Keywords: *Digital transformation, middle school education, teacher adaptation, educational technology, Austrian schools.*

1. Introduction

For over two years, the COVID-19 pandemic has dramatically altered our daily lives, impacting sectors globally, including education. The crisis necessitated rapid and significant shifts to digital platforms in various domains. Schools and universities transitioned to remote learning, revealing both deficiencies and potential in digital education (Eickelmann, 2018; Goudz & Erdogan, 2021).

The move towards digitalization in education, already underway since the early 2000s, accelerated during the pandemic. This shift highlighted the expanding role of digital media in teaching, emphasizing the need for adaptation among educators (Brandhofer, 2012; Heimlich, 2007). While much focus has been on students' learning outcomes and evolving learning structures, the experiences and adaptations of teachers have often been overlooked.

This paper aims to provide an in-depth analysis of how middle school teachers in Austria have adapted to this digital transformation. It explores the balance between traditional teaching methods and a broad spectrum of digital tools, examining the impact on lesson preparation, teaching methods, and communication with students and parents. The study employs qualitative research methods to investigate the opportunities and challenges teachers face due to digital media integration, aiming to answer the question: "What are the opportunities and risks associated with the use of digital media for middle school teachers in Austria?"

2. Theoretical background

The advent of digital media, encompassing advanced technologies like computers, laptops, and smartphones, has catalyzed a transformative shift in educational methodologies. This shift is evident in Austria's "School 4.0" initiative, which integrates digital literacy into school curricula, focusing on both infrastructure enhancement and digital competency among teachers and students. The program underscores the importance of teachers' proficiency in digital tools for effective education delivery, a need highlighted by the mismatch between teachers' perceived and actual digital skills in studies like TALIS 2018 (Brandhofer, 2017; Huber et al., 2020; Manovich, 2002; Winter et al., 2019).

Austria's educational strategy includes significant investments in teacher training for digital competence, as evidenced by the 8-Point Plan and partnerships with institutions like the Virtual Pedagogical University. These initiatives are underpinned by theoretical models such as TPACK (Mishra & Koehler, 2006) and DigCompEdu, which provide frameworks for understanding the necessary digital competencies for teachers in the evolving educational landscape.

The rise of digital tools has introduced innovative teaching methods, notably the Flipped Classroom, which aligns with modern pedagogical approaches by fostering interactive, student-centered learning. Cooperative and collaborative learning methods, enhanced by digital tools, are gaining traction, promoting greater student interaction and engagement. This shift necessitates a strong focus on teacher motivation for adopting digital tools effectively, as outlined in the Will-Skill-Tool-Model (Brandhofer & Großböck, 2014; Knezek et al., 2000; Konrad & Traub, 1999).

The educational landscape has seen a shift toward digital platforms like Moodle and Google Classroom, enhancing the dynamic and accessibility of educational experiences. With this digital integration comes the increased importance of data protection and internet safety, making it essential for teachers to be well-versed in these areas to maintain a secure digital learning environment (Grogorick & Robra-Bissantz, 2021; Iftakhar, 2016; Köppl-Turyna & Lorenz, 2020).

3. Methodology

The study at hand utilized qualitative empirical social research through expert interviews with teachers from various Austrian middle schools. These teachers were selected for their expertise in the field of digitalization in education.

A structured interview guide, consisting of ten main and several follow-up questions, was developed based on theoretical considerations and prior research. Ten teachers, considered experts in digitalization, were interviewed. The questions focused on school infrastructure, digital competence development among teachers, and the impact of digitalization on lesson preparation and teaching methods.

The sample included teachers from both urban and rural schools across Austria's western federal states, offering a broad perspective of the digitalization in education across different environments. Interviews were recorded, transcribed, and analyzed using Mayring's structured content analysis method, focusing on categorizing and assessing content based on in-depth interviews (Mayring, 1994, 2015).

To ensure the anonymity of participants and representativeness of the study, demographic data was omitted unless necessary. The findings provide insights into the digitalization process in Austrian middle schools, reflecting the experiences and perspectives of the interviewed teachers.

4. Results

The results of the study show a significant transformation in Austrian middle schools due to digitalization. Teachers are increasingly using multimedia tools to enhance lessons, making them more interactive and engaging. For instance, one teacher used digital simulations in a science class to demonstrate complex concepts.

The infrastructure in schools has improved, with better access to technical devices and updated software. During the pandemic, teachers heavily relied on digital platforms like Microsoft Teams for remote teaching, and apps like SchoolFox replaced traditional communication methods, enabling more efficient interaction with parents.

In terms of facilities, schools reported having at least one computer room, and some are equipped with interactive whiteboards (Smartboards). However, adapting to these technologies was challenging for some teachers, as illustrated by a teacher who struggled with the lack of training on Smartboard usage.

The Ministry of Education's 8-Point Plan, which provides digital learning devices like tablets, was generally well-received. Teachers acknowledged its benefits but also mentioned delays in device distribution, which hindered the integration of digital tools in some schools.

The shift to digital textbooks has been a significant change. One teacher noted how eBooks not only lightened students' physical loads but also offered interactive content, enhancing learning experiences. Despite these advancements, teachers emphasized maintaining traditional teaching methods. For instance, in a math class, while digital tools were used for illustrative purposes, basic calculations were still done manually to strengthen students' arithmetic skills.

Digital education's integration varies across subjects. In language classes, tools like Quizlet for vocabulary learning have become popular. In contrast, the use of digital media in physical education was more limited, with some teachers using it for recording sports performances for analysis.

Overall, the study indicates a positive trend towards digitalization in Austrian middle schools, with a balanced approach between embracing new technologies and retaining essential traditional teaching methodologies.

5. Discussion and reflection of results

Digital media, as per the experts, plays a crucial role in our society, evident in private, educational, and professional realms. It's increasingly important to be aware of both the opportunities and risks associated with digital progress.

The technical infrastructure in Austrian schools has greatly improved, enabling the effective use of digital media in teaching. The majority of teachers have embraced digitalization as a tool for teaching and learning. The device initiative by the Ministry has been particularly influential, providing students with personal devices for use both in and outside the classroom. This advancement has opened up new perspectives, preparation methods, teaching methods, and learning formats. Distance learning, hybrid teaching, and blended learning have become integral parts of school life. Communication between students, teachers, and parents has also been enhanced through apps and platforms like SchoolFox or WebUntis. Classrooms are now well-equipped with teacher computers, laptops connected to projectors, and interactive whiteboards, making teaching more dynamic and engaging. The digital approach, when properly implemented, offers numerous opportunities for both teachers and students, assuming both parties are open to it.

Despite the enthusiasm for digital media in education, it's acknowledged that there's a flip side. Some teachers are reluctant to adopt digital tools, either due to the initial increased workload or satisfaction with existing methods. The delayed delivery of Windows Tablets under the Ministry's initiative caused frustration and impeded planned digital integrations. Inadequate maintenance and support for digital infrastructure can also pose significant challenges. The ambivalence toward digital media is particularly evident among teachers who are either technologically inexperienced or nearing retirement.

6. Conclusion

The study's findings align with previous research, such as Drossel et al. (2019), which highlighted the negative impact of unreflective use of digital media on teaching quality. Contrary to Winter et al. (2019) in the OECD TALIS study, our experts believe that teachers are quite competent in handling digitalization and can identify areas needing further training. This study found that teachers generally view their and their colleagues' attitudes towards digital opportunities and the need for ongoing training more positively than depicted in many studies.

In conclusion, while digital media in education brings numerous benefits and opportunities, its effective and meaningful integration requires careful consideration, adequate training, and support. The successful implementation of digital tools not only enhances teaching and learning experiences but also prepares students for a digitally-driven future.

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COMPARATIVE ANALYSIS OF ROBOTICS AND VIRTUAL REALITY IN THE ENHANCEMENT OF SOCIAL SKILLS IN AUTISTIC STUDENTS

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Abstract

Information and Communication Technologies (ICT) have become one of the fundamental tools for improving the learning of students with special educational needs. The flexibility to adapt to the needs of these students makes them a fundamental element in the classroom. In recent years robotics and virtual reality (VR) are increasingly present in educational environments. These are the ITCs best suited to the visual learning characteristics expressed by students with autism. Therefore, the aim of the research is to analyze in which areas robotics and VR have produced improvements. To this end, we have worked with 8 students with autism aged 6-12 years in 11 sessions with VR and 11 with the NAO robot in the period from April to June 2023. To evaluate the improvements of these children, the Denver questionnaire was used, which is composed of 6 dimensions. Data were collected by the investigators and tutors. The informed consent form filled out by the participants' families explained the objectives of the research and the activities to be carried out. The results indicate that subject 6 is the one with the highest percentage of improvement after the application of VR. Reaching 37.50% in expressive communication. In robotics, subject 1 with 29.63% in adult social skills and subject 6 with 37.50% in expressive communication are the most outstanding. When comparing VR and robotics, subject 2 has experienced improvements ranging from 2-4% in the areas of imitation, joint attention, and expressive communication. As future lines of work, the possibility of including automatic algorithms that can measure in real time the improvements in learning developed by autistic students are proposed. This article was supported by the Programa Estatal de I+D+i Orientado a los Retos de la Sociedad del Ministerio de Ciencia e Innovación Español. PID2020-112611RB-I00/AEI/10.13039/501100011033 and the Agencia Estatal de la Investigación.

Keywords: *Robotics, autism, virtual reality, joint attention behaviour, expressive communication.*

1. Introduction

In school classrooms there is an increasing number of students with learning difficulties related to the area of communication and social interaction. Students with Autism Spectrum Disorder (ASD) are increasingly present in schools, being 0.6% of the world population presenting this disability (Salari et al., 2022). The increased detection of this disorder may be influenced by two factors according to Durkin et al. (2017): firstly, the awareness of families that causes them to try to carry out a work plan to help their children outside the classroom. Secondly, the use of more accurate and less biased diagnostic tools that allow determining the level of autism of children.

Autism spectrum disorder (ASD) can be defined as a developmental disorder that presents difficulties in two areas of development: social and communicative interaction and repetitive patterns of behaviors interests or activities (APA, 2013). Difficulties in the areas of communication and social interaction cause autistic students to have difficulties in expressing themselves verbally and nonverbally in combination with the absence of the ability to identify body language in different social situations (Telisheva et al., 2022). Likewise, these students, depending on the social context, have difficulties in identifying, recognizing, and expressing emotions (Lorenzo & Lorenzo-Lledó, 2024), which causes them to have many problems in assigning a mental state to themselves as well as to others (Premack & Woodruff, 1978). Regarding repetitive behavior patterns, this is a consequence of the fact that autistic students have a detail-focused processing (Happé & Frith, 2006) and therefore have great difficulty in controlling stimuli in real environments (Reeve et al., 2007).

Based on the characteristics of students with autism, there is a need for tools that allow the creation of simple social situations where the control of stimuli can provoke predictable responses in the environment (Robins & Dautenhahn, 2014). Both robotics and virtual reality (VR) are tools that serve this purpose. The great advantage of robotics is that it allows in real environments the development of social interaction activities with the robot acting as a support element (Robins & Dautenhahn, 2014). In addition, robots allow the user the infinite repetition of the activity, which is one of its ways of learning (Lorenzo & Lorenzo-Lledó, 2024). Likewise, the robot can adapt its behaviors in real time to the participant's emotions (Fuentes-Alvarez et al., 2023). As for VR, the main advantage is the possibility to perform the activities in safe environments without suffering the negative effects of errors in a real environment (Moon & Ke, 2021). Moreover, the realism of the environments that are designed favors the transfer of acquired skills to real environments (Moon & Ke, 2023).

2. Objectives

Based on the above analysis, the objective of the research is to determine in which areas robotics and virtual reality have produced improvements in autistic students. The following research questions have been established to develop the stated objective.

- Which tools obtain better scores in the different areas of the Denver questionnaire?
- In which areas have the highest increases occurred with the use of robotics?
- In what areas have the highest increases occurred with the use of virtual reality?
- Which subjects achieved the highest scores with the two technological tools?

3. Method

A pre-experimental design has been chosen where there is a single group in which pretest and posttest measures are taken (Albarracín-Villamizar et al., 2020). In addition, a quantitative approach has been designed to obtain through descriptive statistics which have been the improvements in the scores of the subjects (McCusker & Gunaydin, 2014).

3.1. Participants

Eight participants diagnosed with autism from a regular school were selected. The age of the participants ranged from 6-12 years old. The 37.5% were diagnosed with level 1 autism while the rest were diagnosed with level 3 autism. 62.5% had a level of curricular competence of first grade of primary school and the rest had a level of curricular competence of 3-4 years of kindergarten. In addition, 75% had oral communication and only 25% attended a regular classroom. Finally, 87.5% had a level 3 support level.

3.2. Instrument

For the development of the robotics activities, we worked with the NAO robot. This robot has 25 degrees of freedom and could establish a certain degree of verbal and non-verbal communication (Puglisi et al., 2022). In addition, its microphone and sensor system allow it to collect information about the environment. To work with VR, the Oculus Quest 2 glasses were used, which according to Lorenzo et al. (2023) have a resolution of 1832x1890 and a liquid crystal display. In addition, it is integrated into a system that allows the user's point of view and the associated audio to be updated. Furthermore, a field notebook has been used to record the behaviors performed by the participants in their interaction with robotics and VR.

3.3. Design

The eleven sessions that took place in VR covered a variety of areas. For example, the first session worked on classroom rules. While from session 2 to 6 the user focuses on the area of emotions, identifying them, associating them, analysing the causes that produce them. For session 7, symbolic play is worked on with the elaboration of the Macedonian. Sessions 8 and 9 continue with the work on emotions with the colour monster. Finally, in session 10, the executive function is worked on by preparing the school bag and in session 11, another activity on emotions such as the thermometer of emotions. For the development of robotics, the same activities are implemented in real environments but with some variations with relaxation activities, the bingo game, and the association of a pictogram with an animal.

3.4. Procedure

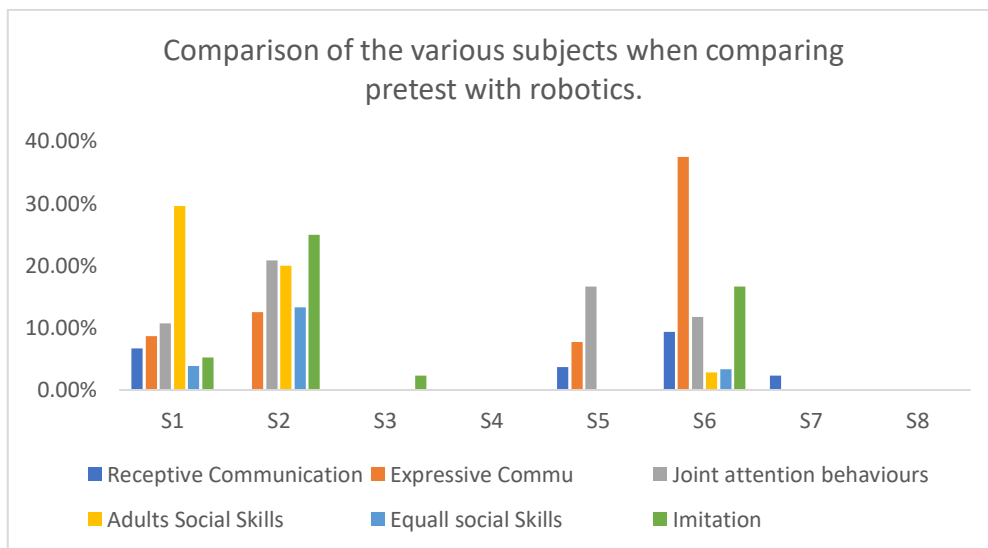
In the development of the intervention, an initial meeting was held where the researchers met to obtain a first list of schools, which would be made up of those with specific units. After contacting the selected schools, a meeting was arranged with them to explain the project and to familiarize them with the

technological tools. Subsequently, another meeting was held with the families to obtain the authorizations, the format of which followed the criteria established by the UA ethics committee (Exp UA 2022 05 01). In addition, we explained to them what the activities consisted of. The children's teachers and the researchers were present during the intervention. Eleven sessions lasting 15 minutes were developed and implemented for both robotics and VR.

4. Results

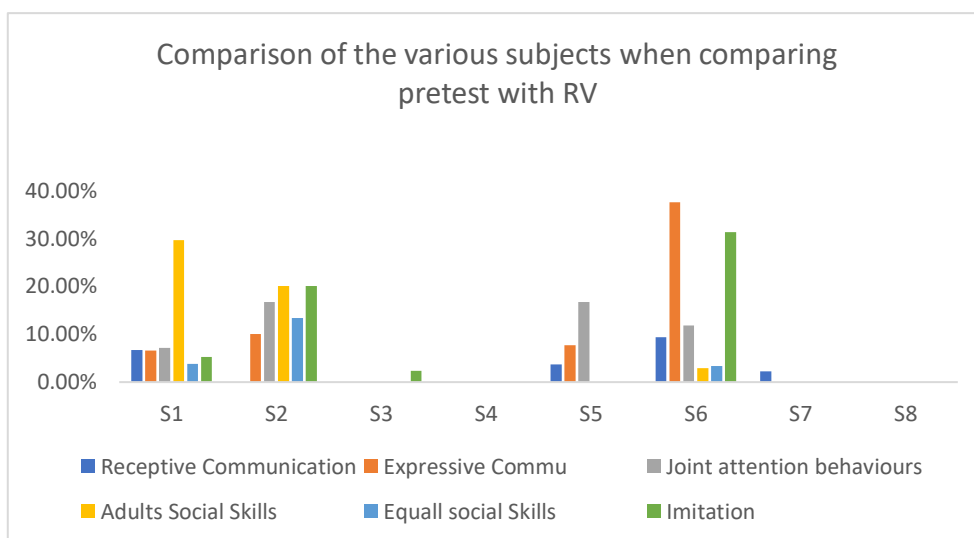
The analysis of Figure 1 shows how subject 6 is the one with the highest scores with respect to the pretest after the application of robotics. Expressive communication stands out with 37.50% and imitation with 16.67%. It reached an average percentage increase of 13.58%. Despite not reaching the highest values, subject 2 has the highest average percentage with 15.28%. In this sense, the areas with the highest mean increases are expressive communication with 8.30% and joint attention behaviors with 7.50%.

Figure 1. Comparison of the various subjects with comparing pretest with robotics.



With reference to the analysis in figure 2, also with the VR, subject 6 is the one who obtains the highest score increases. It also has the highest average percentage increase with 16.03%. Subject 2 has the second highest mean score with 13.33%. In this sense, the area of expressive communication with 7.71% average growth and imitation with 7.35% acquire the best scores with VR.

Figure 2. Comparison of the various subjects with comparing pretest with VR.



5. Discussions

With respect to the first research question, robotics is the tool that obtains the highest scores. This is a consequence of the fact that the robot can be used in real environments as an element of support and explanation of how to act in a social environment (Lorenzo et al., 2024). In contrast to VR where three-dimensional real environments are worked on without contact with the real world (Lorenzo et al., 2023).

Regarding the second research question, robotics provokes higher improvements in joint attention behaviors because the NAO robot has rotating mechanical parts, its body parts present different colors (Cabibihan et al., 2013). Moreover, the improvement in expressive communication may be a consequence of the robots displaying basic emotional expressions through simple activities (Robins et al., 2009). This leads to a better understanding of emotions and their subsequent manifestation.

In the third research question, VR favors expressive communication due to the characteristics of realism and anthropomorphic behaviors presented by the avatars (Garau et al., 2005). In this way it is easier to understand emotions and therefore there is a better expression of verbal and non-verbal information. In this sense, the improvement in imitation may be a consequence of the ability presented by VR to repeat activities as many times as the user desires (Moon & Ke, 2021).

In the fourth research question, both subject 2 and subject 6 have in common that they possess high IQ and oral communication development, which are the conditioning factors in the high cognitive loads generated by VR and robotics activities (Moon & Ke, 2021).

6. Conclusions

Throughout the study, it has been possible to see the improvements that both virtual reality and robotics have generated in the different areas of communication and social interaction. Therefore, the following conclusions can be drawn from the research questions.

- Robotics is the tool that leads to the greatest increase in communication and social interaction for autistic students.
- Robotics has led to the highest increases in the areas of expressive communication and joint attention behaviors.
- Virtual reality has led to the highest increases in expressive communication and imitation.
- Subject 2 in robotics and subject 6 in VR had the highest mean increases.

In this way, it can be concluded that activities have been developed with technological tools that will allow their future application by teachers in the classroom. Despite this, future lines of research include the possibility of adding more activities that are applicable to different contexts. Furthermore, a follow-up plan should be included at the end of the interventions.

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NAVIGATING THE PROVISION OF SUPPORT TO LEARNERS WITH SPECIAL NEEDS IN RURAL MAINSTREAM SCHOOLS: TEACHERS' CHALLENGES

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Abstract

Implementing support to learners experiencing barriers to learning in South African schools, has largely been presented with challenges which increasingly make it difficult for teachers to navigate their provision of support. Thus, the pragmatic realities show that there is a need to identify and combat such challenges. This study investigated challenges experienced by teachers in their attempt to support learners with special needs. The study is underpinned by the social constructivism research paradigm. The study used the transformative learning theory as its theoretical framework. The phenomenological qualitative research approach was employed to explore teachers' challenges in providing support to learners with special needs in mainstream rural schools. Data were collected using focus group interviews, with 36 purposively selected teachers in all 6 schools. The collected data was thematically analysed and interpreted using Braun & Clarke methods. The study discovered the following as major challenges hindering the provision of support to learners with special needs: a lack of teacher competency in managing the diverse learning needs of learners; an inability to improvise amidst the challenge of limited resources; as well as a lack of consistent and thorough training in attending to complex and severe learning disabilities. The study thereby recommended resource allocation, teacher professional development training in aspects relating to supporting learner special needs, strengthening of School-Based Support Team and initiation of collaborative networks, to be in place for the alleviation of the support challenges experienced by teachers.

Keywords: *Challenges, mainstream schools, special needs, support, teachers.*

1. Introduction and background

The Salamanca Statement and Framework for Action on Special Needs Education, and the Education White Paper 6 (2015) view supporting learners' learning needs as a pivotal initiation which should promote equality in the educational setting. Both documents deem it mandatory for all learners to be supported academically regardless of their physical conditions, intellectual capacities, social standards, emotional positions, linguistic capabilities, or other conditions (UNESCO, 1994). Clear measures of support and intervention have been laid out by the Education White Paper 6 (2015), aimed at ensuring that all learners experiencing barriers to learning are educationally supported to the level of the demands of their experienced learning difficulties. Thus, the provision of support to learners with special needs is said to occur at different levels such as the initial screening guided by the learner profile; identification and assessment of barriers to learning; and supporting the identified learning needs, which is guided by the Support Needs Assessment Form 1 and 2 (Department of Education, 2014). The context of the SIAS Policy document takes into account the need for teachers to be proficient in their ability to possess a conceptual understanding and practical demands of providing support to learners with special needs. However, due to lack of support in rural schools, teachers are therefore charged with the responsibility of increasing their knowledge on aspects of support needs (Mawila, 2023).

The provision of support to learners with special needs in rural mainstream schools is challenged with frustrations and complaints from teachers, often because of the overpopulated classrooms, which makes it almost impossible to support all learners' learning needs (West & Meier, 2020; Tshangana, Nomtshongwana & Buka, 2023). On the other hand, a shortage of equipment, teaching aids, and well-suited infrastructure often poses a significant hindrance to teachers in the rural mainstream schooling system (Modikoa Pillay & Shipalana, 2023). In addition, large class sizes have been identified as a hindrance to supporting inclusive education practices (Seliane & Kgothule, 2022). Among other

contributing factors, mismanagement of disruptive behaviour is often reported as a result of overcrowding (Gagnon, Sylvester, & Marsh, 2021).

Challenges around teachers include limited access to information and training in dealing with learners with special needs (Engelbrecht, 2020). Teachers tend to demonstrate a sense of learned helplessness, which in turn, reduces conducive learning environment, further limiting levels of possible support towards learners with special education needs (Adewumi et al., 2019). This tends to position learners as referred cases to special schools, or categorised as progressed, all due to their learning needs being unidentified and thereby unsupported (George, 2019). In some cases, they are left to repeat a grade, tempering with learners' self-esteem, causing victimisation, and eventually dropping out of school. According to Traya and Lopez (2023) teachers tend to feel threatened by the demands and difficulties that lie with teaching in mainstream education settings, where they tend to doubt their ability to support learners' learning needs accordingly. Moreover, Nseibo, Vergunst, McKenzie, Kelly, Karisa, and Brian Watermeyer (2022) demonstrated such to occur because of a lack of teacher support, training, and preparation.

In mainstream rural settings, learners come from unsupported homes, where parental involvement is absent (Muthukrishna & Engelbrecht, 2018). Furthermore, learners from low-income raking homes tend to perform poorly in their academic performance, as those raised by their grandparents tend to severely lack academic progress due to the lack of support at home (Owens, 2018). Moreover, some parents in rural settings seldom engage themselves in the educational affairs of their children and completely leave it to the school to carry the entire burden (Stelmach, 2020). In addition, lack of parental support makes it unbearable for teachers to function (Munje & Mncube, 2018). Despite inclusive education policies embracing values of equality and diversity (Education White Paper 6, 2015). Learners with special education needs, and those who come from impoverished households tend to be viewed by both teachers and other learners as different (Owens, 2018). Where teachers are unable to comprehend their attitudes as being discriminatory and contradictory towards the right to access education, which are negative (Muthukrishna & Pedra Engelbrecht, 2018).

2. Theoretical framework

The current study is premised on transformational learning theory by Jack Mezirow (1978). The theory focuses on changes that happens after learning (Hay, 2021). Transformative learning theory emphasise the need for effective changes in individuals' frames of reference (Fleming, 2022). In this study the transformative learning theory is used to help teachers to navigate on support services in rural schools. This may suggest that through the use of the theory teachers' perspectives will be transformed so they can navigate support services to learners who experience barriers to learning. Rodríguez and Barth (2020) argue that the transformative learning theory explores how people evolve their understanding and worldview through critical reflection. This means that teachers are supposed to reflect on their challenges in supporting learners so they can improve their teaching practices. Uddin (2019) also argues that teachers are the agents of change as they aim to make inclusive education meaningful by using suitable teaching pedagogies. This suggest that teachers can improve on the support they render to learners with special needs if their needs are attended to.

3. Methodology

The study is embedded in the social constructivist paradigm. Through the use and application of this paradigm, subjective knowledge and understanding of teachers' perspectives were investigated regarding support within mainstream schools of Mafikeng (Wahyuni, 2012). A qualitative approach which is an in-depth and subjective study that investigates people and events in their natural settings Creswell (2014). The study made use of phenomenological design to describe, interpret and make sense of the experiences of respondents about the phenomenon (Creswell, 2014). 36 teachers were purposively sampled from the 6 schools... his research study made use of focus group interviews, to obtain information that would answer the research questions (Qu & Dumay, 2011). The collected data were thematically analyzed using the six steps of Braun and Clarke (2019). The study is approved under the ethical number (N W U - 0 0 1 9 0 - 19 - A 2).

4. Data presentation and discussion

The study has accumulated rich data from over 36 research participants in all 6 schools visited in the rural settings of Mafikeng, in the North West Province, South Africa. However, only a few responses are presented as a result of the restricted number of pages for the article. Focus group interview data

shows a lack of teacher competency in catering to the diverse learning needs of learners; limited resources; as well as a lack of thorough teacher training in the development of skills and expertise, around the provision of support to learners with special needs. The results for the study are discussed under the following headings, namely, learner support needs; nature of support administered; and lack of training and resources.

4.1. Learner support needs

Table 1. Sampled responses on learner support needs.

Research Question: What learning needs do you encounter among learners in your Classroom?
Teacher 1, School A: "They can't read and if they can't read then they can't answer the questions in the examination."
Teacher 2, School B: "They can't cope in class, we have also noticed that they tend to have a low concentration span and unable to pay attention for a longer period of time."
Teacher 4, School E: "There are few who have visual problems and they can't see, in that regard, they tend to all want to sit at the front row. They often come from abusive families, in that way if the learners already has barriers to learning it worsens the situation."
Teacher 4, School D: "Cognitive needs, for example processing new information and thinking Independently."
Teacher 3, School F: "Other learners do not have parental support, as means of assistance or internet provision to complete projects, and to some extent it is because other learners are in situations of child-headed families, where now they assume the responsibilities of caring for the younger ones."

The displayed shows how teachers are confronted with the complexities of learning barriers which they lacked the basic skills to support. Furthermore, it showed that they have not been exposed to any formal training, or preparation to be in the position of administering care and support to the learning needs of learners with special education needs. All of this alludes to the ineffectiveness of the District Based Support Team (DBST) in matters relating to support services rendered to schools. Teachers are concerned about the existing lack of the required resources needed to include, accommodate, and support the diverse learning needs of learners.

The posed findings resonate with that of (Engelbrecht, 2020) on issues pertaining to the helplessness there is in inclusive education practices due lack of pedagogical knowledge and teacher training thereof in dealing with learners with special needs.

Based on the above responses, factors related to the low socio-economic status of the learners and issues around them being in child-headed households contribute to teachers not knowing whether learners in question have barriers to learning, or if such barriers to learning are rather perpetuated by factors themselves. Furthermore, learners are reported to be lacking in their reading and writing abilities, where quite a substantial number have been observed to show signs of low concentration span. It is therefore reported that such learners tend to fall victim to bullying, "They are often ridiculed in class as a result of their barriers to learning or struggle", said teacher 5, of school D.

4.2. Nature of support administered

Table 2. Sampled responses on nature of support administered.

Research Question: In what ways do you include (administer care and support) learners with special education needs in your classroom?
Teacher 3, School A: "Not having the skills to administer care and support to learners with special learning needs, I find myself helpless."
Teacher 2, School B: "I am not trained to perform the skills of a special needs education teacher and I am not have not being trained for that."
Teacher 4, School E: "We report special needs cases to the department of education, but often it does not solve the problem."
Teacher 5, School C: "For those who cannot see properly during examinations we prepare A3 question papers for them to see."
Teacher 4, School D: "It is difficult to include them with limited resources, we often want to include them, but the absence of the resources becomes the problem."

Teachers attested to the fact that their support methods may have not been as successful and effective as anticipated. However, some maintained to have observed their methods yielding better results, while on the other hand, other teachers reported to have had no other methods to utilise. It was rather interesting to observe teachers' resilience despite their functioning in isolation, without prior training or preparation, and limited resources. Even with the intervention strategies laid out, teachers

admitted that their strategies may have not always been effective to successfully support the existing learning needs in their schools.

This reveals how teachers are confronted with extreme difficulties while attempting to supporting learners learning needs. Where in spite of the guidelines and policies formulated, clear practical direction to affect such directives are not adequately relayed. Although teachers are to assume a role of an interventionalist in their classrooms as asserted by (Buli-Holmberg & Jeyaprathaban, 2016). It still remains that teacher are to be thoroughly trained and supported on how to actualise the already existing Support policy documents that should guide the process of support in their classrooms.

4.3. Lack of training and resources

Table 3. Sampled responses on Lack of training and resources.

<p>Research Question: What learning needs do you encounter among learners in your Classroom?</p> <p>Teacher 2, School B: "Teachers need a comprehensive training with regard to inclusive education."</p> <p>Teacher 5, School C: "There is a need for a thorough training sessions from the department of education, instead of just dumping us with the responsibilities and not teaching us on how to deal with it."</p> <p>Teacher 4, School D: "I need to be taught how to care and support learners' learning needs, especially those with learning disabilities. As a teacher I am not capable of knowing one hundred per cent if learners have barriers to learning or not."</p>

Lack of training and the unavailability of resources posed a threat. The fact that 30 teacher participants reported to have not received training of any kind on how to support learners with special education needs, depicts the strain under which both teachers and learners are functioning. The above results are in harmony with those of Hoppey (2016) as well as Nseibo et al. (2022), whom discovered a prevalence of inadequate teacher preparation and training.

5. Recommendations

Resource allocation necessary for support provision in schools should be prioritized. Furthermore, School-Based Support Teams (SBSTs) should be given quarterly comprehensive training and equipped on the high demands and complexities of handling the educational needs of learners with special education needs. Moreover, teachers would need to undergo practical training where related special education methodologies and pedagogies are initiated per school in accordance with the educational needs experienced. Lastly, the essence of collaboration between different structures, systems and role-players in schools would need to be realised and strengthened for support to be affected.

6. Conclusion

From the results of the study, it is evident that teachers in rural mainstream schools of Mafikeng want to support learners with special needs. However, it is also evident that teachers are burdened and left to function in isolation, making it greatly difficult to navigate their way in fully supporting learners' learning needs. A major concern is that teachers have not been trained to navigate the demands that comes with supporting complex learning needs within inclusive education practices. The implications, therefore, show this to have considerably hindered teachers from meeting the inclusive education demands. The overall predicament ultimately places the learners in a disadvantaged position, due to lack of educational support. So long as responsible structures and stakeholders at the higher level of the education system do not engage collaboratively in resolving the existing challenges, with practical and realistic solutions, the expectation of teachers to produce the anticipated outcomes from what was never initially invested in will continue.

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TRAITORS, REALITY SHOW TURNED INSTRUCTIONAL STRATEGY

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Abstract

The Traitors (US) is a popular reality game show on Peacock. This show has over a million views per episode. The purpose is to not getting voted off or ‘murdered’ by a traitor. The group is split up between Faithfuls and Traitors, except no one knows who is what. The Faithful need to find and vote the Traitors off between they get murdered. If there is a Traitor(s) along the Faithfuls at the end the show then the Traitors will be receiving the whole prize. The concept of this show could be an engaging and effective instructional strategy. It requires all students to be actively engaged in the content along with knowledgeable of the content they are learning. It will challenge students strategic thinking regardless whether they are a Faithful or Traitor.

Keywords: Instructional strategy, gameshow, strategic thinking, reality television, prizes.

1. Introduction

Teachers are constantly tasked with teaching the content in a engaging and effective way. Often times, teachers struggle to hold a student’s attention span. This creates a need for innovative instruction. It can be difficult to constantly think of new ideas to hold student’s attention and teach for mastery. The solution to that is to look at reality television shows. Reality television has become a huge part of society and some form of show is played on almost network and streaming platform. Teachers can take some of those concepts are apply it to an instructional strategy.

Before creating an instructional strategy, teachers need to have an understanding and data to show students’ academic knowledge. This knowledge helps the teacher create the appropriate instructional strategy (McLeod, Fisher, & Hoover, 2003). Knowing student’s interests, strengths, and weaknesses are critical part of the creation process. Teachers can implement an engaging instructional strategy but not targeting the appropriate content level could result in students not learning the content. Vice versa, the instructional strategy could be at the appropriate content level but it is engaging, resulting in the lack of mastery.

Traitors (US) is currently a popular reality television show. By implementing these concepts in an instructional strategy is will help create engage students in the content. This paper will explore the various methods for implementing Traitors for different content situations.

2. Instructional strategies

Instructional strategies are at the forefront on K-12 education. Teachers have a list or bag of instructional strategies they use to teach the content. Gropper (1974) explains an instructional strategy refers to prescriptive rules for designing instructional events that results in learning experiences. These learning experiences are used to enact behaviors to create mastery of the content. Teacher need to implement the instructional strategies that will advance students to a higher level of mastery (McLeod, Fisher, & Hoover, 2003). It is imperative that instructional strategy selected helps students learn and master the content being taught.

Traditionally teachers select an instructional strategy when they have the standard(s), central focus, learning objectives, and desired behaviors (Bannan, Dabbagh, & Walcutt, 2020). Ultimately, the teacher knows what material students need to know, at what level they need to learn, and how the students will learn the material. The instructional strategy can differ based on whether the teacher wants students to work in group, pairs, whole class, or individual. Those are all important for how a student will learn the content for select an appropriate instructional strategy.

Instructional strategies are used for a planned block of instruction, learning strategies are used to improve knowledge, skills, and experience. Instructional and learning strategies mirror each other (Bannan, Dabbagh, & Walcutt, 2020). The teacher will need to consider how they will teach the content and how students will learn. One can't happen without the other. Strategies for meaningful learning include collaborative, conversational, authentic, reflective, goal-directed, and active (Bannan, Dabbagh, & Walcutt, 2020).

Finnan (2009) found students experience success when they are actively engaged in their learning. This results in implementing active instructional strategies. Active learning includes activities which require students to do things and think about the things they are doing. The elements of active learning include thinking critically, collaborating, giving and receiving feedback, and reflecting upon the learning experience (Bonwell & Elson, 1991). Therefore, instructional strategies with active engagement increase content knowledge and mastery.

3. Traitors

Reality television is a common household show in the 21st century. Collins English Dictionary (2024) defines reality television as a type of programming which show how people behave in everyday life, or in situations. These shows can be cited back to as early as the 1940s with the show, Candid Camera (Rosenfeld, 2024). Throughout the years there has been a wide amount of various reality television shows, featuring games shows, living situations, survival dating, in the life of, etc. Reality television shows are growing exponentially each year. In January 2024, the reality television show, The Traitors (US) took the nation by storm.

The reality program began with the Dutch show De Verraders in 2021. De Verraders is Dutch for 'The Traitors'. The popularity of the Dutch show resulted in the The Traitors UK, following the year of its founders' debut. Following the success of the UK version The Traitors US began in 2023. The Traitors (US) is streaming on Peacock. Season two of The Traitors (US) began streaming in 2024. The show became wildly popular. The first week the show charted on the Nielsen streaming charts with 384 million views (Power, 2024).

The Traitors includes a cast of 20 members. Each cast member is a Traitor or Faithful. There are about 1-3 active Traitors on the game at all times. The goal of a Traitor is to remain undetected from the Faithfuls. While the Faithfuls goal is to eliminate the Traitors. There are round tables throughout the show allowing the whole cast to banish a someone. The Traitors are also allowed to collaborate to 'murder' a Faithful each night. If a Traitor makes it to the end of the show then they will win all the prize money. However, if all the Traitors are eliminated then the Faithfuls will split the prize.

3.1. Traitors as an instructional strategy

The Traitors is a popular reality show that shows little connection to the K12 classroom. However, the design of the game show can be applied to the classroom as an engaging and effective instructional strategy. As an instructional strategy, the teacher selects the Traitors before the class begins so the students know they are Traitors before they walk into class. The remainder of the class will be Faithfuls. During class, the Traitors have the goal is to not get caught giving the wrong information. However, they can also give correct information to throw the Faithfuls off of their trail. At the end of the class, the whole class will vote on who the traitors are. If the majority is correct then the Faithfuls will receive a prize, even if one Traitor makes it through the vote then that Traitor will receive the whole prize or it will be split among the other traitors. This instructional strategy can be implemented a few different ways. Below I will explore a few different implementation options.

3.2. Implementation for learning new content

When teaching new content, you can implement the Traitors instructional strategy by offering a flipped learning option for the Traitors. The students selected as Traitors will be required to learn the content before class. These students will need to be self-motivated and independent learners. Without creating more work for the Teacher, assign the Traitors videos of the instruction through Teacher tube, Khan Academy, etc. Students will learn the basic concepts of the new content. During the lesson, the Traitors are still learning amongst the Faithfuls however, they can distinguish what is and is not correct at a basic level. In order for this method to be effective, the lesson has to have multiple opportunities for students to work together and practice the content. The Faithfuls are tasked with learning the new content but also recognizing false information.

3.3. Implementation for reviewing content

When reviewing content, the Traitors need to be selected before the class begins but not too far in advance or you run the possibility of students telling each other. Reviewing content can be done in a whole group or small groups. If your classroom is reviewing the content as a whole group then you will need 4 students selected as Traitors for a class of 30 students. Questions will need to be interactive, providing students with an opportunity to collaborate together to use the content knowledge. There will need to be situations for students to work together with continuous different students. All Faithfuls will need the opportunity to work with all Traitors at least once. For whole group, all students will vote on the Traitors. The number of Traitors should be shared at the beginning of class. If the class successfully votes all the Traitors, then they will receive a prize. However, if a Traitor remains then they receive the whole prize or split the prize among the remaining Traitors.

If your classroom is reviewing content in small groups then you will need to select a Traitor for each group. The groups need to consist of at least 4 students, it is suggested to have an odd number for voting purposes. The group work needs to consist of students working together to practice and use the content. For small group, the group members will vote on the Traitor. Each group that successfully votes a Traitor will receive a prize and if every group successfully votes a Traitor then the whole class will receive a prize.

3.4. Implementation for a unit

This instructional strategy could be used for a unit or learning segment. This implementation would closely mirror the reality show. There are three students selected as Traitors, however they cannot know who the other Traitors are. At the end of the class period the whole class will vote on the Traitor (like a banishment). If a Traitor is banished then that student will become a Faithful. The Teacher will then select a new Traitor to be added to the group of Traitors, resulting in three Traitors every class. The prize system will work differently for the unit. If a Traitor is banished that class period then the Faithfuls will receive the prize. Each Traitor that makes it through the class period will receive a prize. The final day of the unit the class will need to vote on all three Traitors. If they get it correct then the class will receive the ultimate prize, if they not they the Traitors will receive it.

3.5. Prizes

Prizes are the essential part for this instructional strategy. Prizes are a high motivation for students. It increases extrinsic motivation and enhances learning (Sternberg & Baalsrud-Hauge, 2015). Earning a prize for something is considered extrinsic motivation. Students learning essentially depends on motivation. Motivation is defined as the act or process of motivating; the condition of being motivating; a motivating force, stimulus, or influence; incentive; drive; something (such as a need or desire) that causes a person or student to act (Merriam-Webster, 1997).

The prize students are aiming to receive needs to be motivational for both a Faithful and Traitor. By having an appealing prize, it motivates the Faithfuls to seek out the Traitors and it motivates the Traitors to keep the secret that they are a Traitor throughout the class. This could be candy, food, extra points, test exemption, etc. In order to make the prize appealing the Teacher must know what will motivates the students and ultimately their interests.

3.6. Benefits

This instructional strategy relies on the mastery of the content. Traitors can not successfully be a Traitor without knowing what is correct and incorrect. Reservedly, the Faithfuls can not successfully select the Traitor without knowing the correct and incorrect content knowledge. This will require students to fully understand the content in order to recognize the misinformation given. By students examining the possibility of errors they are using problem-solving techniques, reflective upon their work, provide justification among their arguments and can communicate ideas (Borasi, 1994). This instructional strategy is providing opportunities for students to think critically about the content. Students need to be continuously suspicious of other students answers and think about their own knowledge to confidently select misinformation.

4. Conclusion

Traitors can be implemented in various ways, new content, reviewing, and throughout a whole unit. Students have to be vigilant of other students. They need to be confident in their knowledge and be able to decipher the incorrect content to select the Traitor. This requires students to be constantly reflective upon their own learning. In addition, Traitors need to be able mastery the content in order to

share misinformation. They will have to logically distinguish the difference between correct and incorrect information constantly throughout the lesson or unit to be a successful Traitor.

The next steps are to conduct case studies on various implementations. These studies will show the successful implementation, the motivational prizes, and the level mastery of student success.

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DEVELOPMENT OF INTERCULTURAL LITERACY IN HIGHER EDUCATIONAL INSTITUTIONS: CHALLENGES AND POSSIBILITIES

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Abstract

The world has always been interconnected, and now even more so. Our actions, attitudes and opinions have a profound impact on others, as do cultural differences that affect each of our perceptions, behaviours, work and learning styles etc. At the same time, we need more tolerance and empathy to understand and accept others, especially those who behave, think and act differently in the teaching/learning process. In this context, the need for intercultural literacy is increasingly relevant. In addition, since intercultural education is a continuous, permanent process that is not always harmonious, self-directed learning skills are very relevant. The analysis of the theoretical and practical discourse once again confirmed the importance of intercultural literacy and self-directed learning competencies - as 21st century competencies - in order to become active citizens who will pursue social justice in communities and around the world (Boutte, 1999). The presentation will be based on a survey and analysis of the experience of the Šiauliai State Higher Education Institution in developing those competencies for our domestic and international students. Analysis of empirical data showed how intercultural literacy and self-directed learning competencies could be developed in formal and non-formal education, what are the positive factors, as well as challenges and problems here, how self-directed learning skills support the development of intercultural competences. The main methodological concepts are based on social constructivism and reconstructivism, which enable critical interpretation of "formed" educational phenomena and understanding them in a sociocultural context. A phenomenological approach favours a dialogue between learner and teacher, which requires a lot of effort and preparation required from the teacher. Humanistic psychology and pedagogy, where education in a democratic community is characterized by "cooperation, participation in the management of educational institutions, social integration, social responsibility and independent learners learning to enjoy themselves freedom, independence and life can take hold. The main conclusions, which were done, are the following:

- Theoretical and empirical analysis of the discourse allows us to distinguish some positive factors that could be the basis for more effective development of intercultural literacy.
- On the other hand, the development of intercultural literacy is not a harmonious process. This means that it is necessary to continue this in all possible ways, places, aspects and levels, because it is, clear that in a successful situation there are certain challenges and problems.

Keywords: *Intercultural literacy, self-directed learning competencies, higher education, intercultural and multicultural communication, management of teaching/learning process.*

1. Introduction

The world has always been interconnected, and now even more so. Our actions, attitudes and opinions have a profound impact on others, as do cultural differences that affect each of our perceptions, behaviours, work and learning styles etc. At the same time, we need more tolerance and empathy to understand and accept others, especially those who behave, think and act differently in the teaching/learning process. In this context, the need for intercultural literacy is increasingly relevant. In addition, since intercultural education is a continuous, permanent process that is not always harmonious, self-directed learning skills are very relevant.

The analysis of the theoretical and practical discourse once again confirmed the importance of intercultural literacy and self-directed learning competencies - as 21st century competencies - in order to become active citizens who will pursue social justice in communities and around the world (Boutte, 1999, Banks, 2009, Banks & Russell, 2003).

Comparative analysis of theoretical discourse (Jandt, 2013, Pruskus, 2012, Baraldsnes, 2012, Starkey et al., 2010, *The Handbook of Intercultural ...*, 2014, *Multicultural & Global Literacy ...*, 2017) enabled to identify the main aims and objectives of intercultural literacy development. The most important aims and objectives here are understanding of your own and other cultures, avoidance of cultural prejudices about your own and other cultures, valuation of cultural diversity, openness to cultural differences, otherness, even openness to changes, seeking compromises in a culturally diverse environment and so on. No less relevant is also understanding that our own culture has influence on our understanding of our as well as of another culture. That every person's culture has influence on his/her perception, behaviour, thinking, communication, even teaching, learning, working and living in general. That's why the best methods of intercultural literacy development are those which are based on person's experience, which enable to learn through participation, practice, communication and all other activities that involve as many as possible senses.

For those reasons very important in intercultural literacy became development of skills, especially such as communication, interaction, work, co-work with people from different cultures, ability to see the everyday things and events from new corner, to adapt in changing environment, society, to make new decision.

The main methodological concepts are based on:

- Social constructivism and reconstructivism, which enable critical interpretation of "formed" educational phenomena and understanding them in a sociocultural context. (Berger, Luckmann, 1999; Duoblienė, 2006)
- A phenomenological approach favours a dialogue between learner and teacher, which requires a lot of effort and preparation required from the teacher. (Mickūnas & Stewart, 1994.)
- Humanistic psychology and pedagogy, where education in a democratic community is characterized by "cooperation, participation in the management of educational institutions, social integration, social responsibility and independent learners learning to enjoy themselves freedom, independence and life can take hold. (Maslow, 1943; Rodgers, 1996)

2. Objectives

Šiaulių valstybinė kolegija / Higher Education Institution were great experience in development of intercultural and multicultural competencies and literacy of national and international students. That experience already was presented in the conferences and publications (Pocevičienė, 2023). The main goal of this research was to know how students themselves evaluate those activities and based on analysis of empirical data to identify:

- How intercultural literacy could be developed in formal and non-formal higher education,
- What are the positive factors as well as challenges and problems could be identified in development of intercultural literacy.

3. Methods

With the goal to identify the opportunities of intercultural literacy development in higher educational institutions the survey was done. The quantitative and qualitative analysis based on of the experience of Šiaulių valstybinė kolegija / Higher Education Institution in developing of intercultural literacy of national students has been completed.

4. Design

In the survey, 78 national students from different study programmes were participated. Majority of them already had experience of participation in majority of the activities suggested in the survey. Because of this circumstance, their answers should not be seen as based on cognitive knowledge, but as the result of experiential learning and reflection. Of course, for deeper understanding the positive factors that could influence the quality of intercultural literacy as well as to identify the challenges and problems it would be necessary to repeat the survey with the bigger amount of respondents.

5. Discussion

Students were presented with the main intercultural literacy education activities carried out at the institution with a brief description of them. A detailed description of these activities was decided against for several reasons. First of all, this is because most of the students who participated in the research had

the experience of participating in these activities themselves. Another important reason was to try to reduce as much as possible the opportunity for students, when answering questions and evaluating activities, to rely on their cognitive knowledge about what activities are possible and when they are useful. As mentioned earlier, the aim was for the students to answer the questions and evaluate the activities based on their experience and not just their knowledge. The following activities were submitted for student evaluation:

- **Study results in a study programme**, especially social or/and personal study results (for example, “[...] communicating in writing and orally in [...] foreign languages in an unfamiliar, changing, interdisciplinary environment”)
- **Study subjects (compulsory or/and optional) where English is the language of instruction**
- **Introduction with the new cultures by studying foreign languages** (in Šiaulių valstybinė kolegija / Higher Education Institution in all study programmes one, and in social sciences, business and management at least two foreign languages are compulsory)
- **Study subjects that are directly related with international and intercultural communication** (for example, *International Marketing or International and Intercultural Communication*)
- **Topics in the study subjects**
- **Visiting professors from foreign higher educational institutions** (according to Erasmus+ programme, programme of Ministry of Education, Science and Sports in Lithuania or the programmes of municipalities)
- **Involving international students to the extra-curriculum activities in higher educational institution** (for example, conferences, participating in seminars, round-table discussions, presentations of home culture, home university, city etc.)
- **Introduction with the new cultures.**
- **Meetings with other students** who have intercultural experience
- **Joint activities of national and international students in the higher educational institution**
- **Participating in different exchange programmes** (for example, Erasmus +, BIP, etc.)
- **Participating of HEI in European University Alliances etc.**

Opinion of the respondents about different activities is presented in the Table 1.

Table 1. Opinion of the Respondents about Activities for Development Intercultural Literacy.

Activities for Development Intercultural Literacy	Percentages
Involvement of intercultural literacy into study results	80,8
Compulsory study subjects where English is the language of instruction	69,2
Optional study subjects where English is the language of instruction	89,8
Introduction with a new cultures by studying foreign languages	89,8
Topics related with interculturality in the study subjects	92,3
Visiting professors from foreign higher educational institutions	96,2
Involving international students to the extra-curriculum activities in higher educational institution	89,8
introduction with new cultures in different extra-curriculum activities	69,2
Meetings with other students who have intercultural experience	65,4
Joint activities of national and international students in the higher educational institution or outside	78,2
Participating in different exchange programmes (for example, Erasmus +, BIP, etc.)	65,4
Participating of HEI in European University Alliances	76,9

The analysis of empirical data allows us to say that the vast majority of students positively evaluate all the activities carried out. On the other hand, a deeper analysis shows that those activities in which students have more personal experience (for example, *introduction with a new cultures by studying foreign languages* or *visiting professors from foreign higher educational institutions* or *Involving international students to the extra-curriculum activities in higher educational institution*) or those activities that pose less challenges to them are evaluated more positively than those in which they have less experience or believe that participating in them would pose additional challenges or require additional efforts.

Analysis of empirical data showed that intercultural literacy is also much related with self-directed learning competencies (Kazlauskienė et al., 2015, Kazlauskienė et al., 2010, Pocevičienė, 2014, 2019) that also could be developed in formal and non-formal education. In addition, that the most positive factors for intercultural literacy development are practice, participating and gathering own experience as well as in formal and informal activities.

As the other activities are already more or less analysed in before, more attention should be paid to initiative of European Universities alliances to one of which belong and Šiaulių valstybinė kolegija / Higher Education Institution. (NEOLAiA, 2023) The European Universities initiative is an ambitious EU

initiative aimed at establishing alliances between higher institutions from all across Europe, for the benefit of their students, staff and society. (The European Universities alliances in action, 2023).

By developing long-term structural, strategic, and sustainable cooperation between the higher education institutions in the European Universities alliances, the initiative aims to improve the international competitiveness of higher education institutions in Europe promote European values and identity that is very important aspect of intercultural literacy. (The European Universities alliances in action, 2023).

The initiative has the potential to bring greater benefits to higher education institutions than any previous cooperation projects because through these alliances students can not only get a degree by combining studies in several European countries, but also very qualitatively develop their intercultural literacy.

The main challenges and problems in intercultural literacy development are mostly related with lack of the experience, as well as with some characteristics of students, such as avoidance of unknown, uncertainty, as well as lack of self-directed learning skills that also support the development of intercultural competences.

6. Conclusions

- There is a wide spectrum of formal and informal activities for intercultural literacy development in HEI, but the most successful are those where students are able participate themselves.
- The most valuable would be those activities that are permanent, especially relevant in this case are and in future even more will be the European Universities alliances, which provides not only more opportunities, but also whole and global context of values for development of different types competencies also of intercultural literacy
- Theoretical and empirical analysis of the discourse allows us to distinguish some positive factors that could be the basis for more effective development of intercultural literacy such as personal experience, openness to diversity and changes as well as reflection and other skills and competencies in general related with self-directed learning competencies.
- On the other hand, the development of intercultural literacy is not a harmonious process. This means that it is necessary to continue this in all possible ways, places, aspects and levels, because it is, clear that in a successful situation there are certain challenges and problems.

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INCLUSIVE POLICIES AND PRACTICES IN THE FIELD OF CONTINUING VOCATIONAL EDUCATION AND TRAINING

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Abstract

This paper aims to present various and good Bulgarian and international inclusive policies and practices in the field of continuing vocational education and training. Due to the financial crisis, EU policy has focused on investing in high-quality vocational education and training to promote smart, sustainable and inclusive growth and tackle high levels of youth unemployment, focusing in particular on promoting work-based learning place, ensuring quality, improving access to vocational education and training, strengthening key skills and professional development of teachers in the field of vocational education and training. The future of vocational education and training (VET) after 2020 will be based on a vision of VET policy promoting inclusion and equal opportunities and contributing to sustainability, social justice and prosperity for all. VET programs should be inclusive and accessible to vulnerable groups, such as people with disabilities, people without skills or qualifications, people from minorities, people with a migrant background and people who have fewer opportunities because of their socio-economic background or area, in which they live. Targeted measures and flexible forms of learning can help prevent early leaving education and training and support the transition from school to work. This paper argues that the new society based on knowledge and digital technologies has the potential to provide access for all citizens to the advantages and benefits it creates. By utilizing methods of bibliographic research, analysis, and synthesis to explore publications on inclusive policies and practices in continuing vocational education and training, and drawing upon the findings, recommendations were developed to expand inclusive opportunities within this field. 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 № KII-06-H80/1, funded by National science fund of Bulgaria.

Keywords: *Inclusive education, continuing education, vocational education and training, policies and practices.*

1. Introduction

Continuing Vocational Education and Training (VET) plays a key role in developing the skills and competencies of the workforce in today's world. However, to be effective, it must be accessible to all, including the differently abled, minorities and other vulnerable groups. In this context, inclusive policies and practices are central to ensuring equal access and equal opportunities for all actors.

2. Overview

In the 21st century, people are becoming increasingly aware of the ideas of humanism that underpin modern society. These ideas imply discovering and realizing the potential of each person, including the one with special needs. Creating equal opportunities and an accessible education environment, as well as successful integration into the social environment, is of paramount importance to these citizens (Eftimova, 2018).

One of the greatest problems of the 21st Century not only in our country, but also around the world, regardless of the strategies adopted and long-term policies is the accessibility and the inclusion. Legislative and regulatory changes as well as changes in public attitudes are very slow. Apart from legislative changes, it is important to work on a daily basis in a real environment to achieve sustainable results. As an element of the introduction of a new paradigm for humans, reconsideration at all levels is

required. One of them is education, the quality of education and the opportunities it provides for all. (Eftimova, 2020)

"Inclusive education" is a process of ensuring that all learners with special needs have equal opportunities to receive an effective and quality education. This is possible by applying new interactive additional aids in the learning process.

Inclusive education aims to make the educational process more accessible to persons diagnosed with physical, mental or emotional disorders. Persons who dropped out prematurely from the educational system, as well as the unemployed, can also be considered unaffected in the problematic of the research question. One of the key problems is that the standard training process is significantly more difficult and incomprehensible for the above individuals. This is where the role of inclusive education comes in, helping to adapt the learning content to be easier for learners to grasp.

Unfortunately, in most cases it is taught in the same way. How are those learners who are struggling and trying to catch up on their own expected to continue? For them, the standard training process is much more complicated and extremely difficult. These trainees do not lack desire, they make an extraordinary effort, but they do not always succeed. Inclusive education gives all learners a chance to know, to be able to, and to be educated.

In recent years, inclusive education has been considered for the stages of primary and secondary education, but the topic is poorly represented when we talk about the field of higher education, as well as continuing professional education.

3. Continuing vocational education and training (CVET) – flexible, inclusive and accessible

One of the significant issues for the development of education is the approaches to overcoming the crisis phenomena as a result of the processes of globalization (Buzhashka et al., 2019) Inclusive policies and practices in Continuing Vocational Education and Training (CVET) include various strategies and measures to ensure the accessibility, support and successful participation of all learners. These policies may include adaptive learning, personalized approaches, support for learners with different needs, financial support for access and other tools to promote inclusion. Compared to formal education, VET assumes more flexible forms in terms of the forms of training, adaptation of the learning content and the application of more interactive forms to support the educational process.

3.1. Key factors for accessible and quality CVET

According to the European Agency for Special Needs and Inclusive Education the key factors are the follow:

- **Legal framework.** At the national and international level, a robust legal framework governing inclusive education within secondary and upper-secondary education domains is firmly established, ensuring that schools receive comprehensive support mechanisms. This support encompasses various provisions such as additional funding, optimized staff-to-learner ratios, dedicated support personnel, interdisciplinary teams, customized educational materials, and resources aimed at facilitating the adoption of learner-centered pedagogical approaches. Moreover, resources are allocated to enhance organizational adaptability, enabling institutions to effectively accommodate diverse trainee's populations. Furthermore, a legal framework is in place that empowers vocational education and training (VET) institutions to offer apprenticeships at varying levels, each with tailored curricula leading to distinct qualification levels. Policy flexibility is emphasized, granting VET institutions the autonomy to offer diverse VET programs, implement varied curricula, and confer different qualifications, all tailored to the specific needs of individual learners.
- **Leadership.** The leadership demonstrated by the director of the educational institution is not only effective but also characterized by its distributive nature, garnering appreciation and respect from all stakeholders involved.
- **Motivation and commitment.** The principal, teaching staff, and all other members of the staff exhibit exceptional levels of motivation, diligence, dedication, and a willingness to openly express their enthusiasm. Within the educational institution, there pervades an authentic atmosphere characterized by a profound sense of commitment, care, and inclusivity, coupled with a resolutely positive attitude that fosters equal opportunities for all. The collective team ethos within the institution is grounded in a steadfast belief in the abilities of the learners, embracing a mindset that perceives opportunities rather than challenges.

- **High qualifications.** When it comes to delivering affordable and high-quality training, the pivotal components encompass educators, support staff, and auxiliary personnel who are highly skilled and proficient. These individuals possess a spectrum of qualifications, ranging from official university degrees to professional certifications, or they may bring extensive practical expertise gained through long-term immersion in the relevant field.
- **Further training and educational opportunities.** Comprehensive in-service or further training opportunities are extended to all educational and support staff, aimed at upholding and enhancing the quality of education provided. Educational staff are furnished with ample support mechanisms to ensure the consistent implementation and preservation of a learner-centered approach, thereby fostering an environment conducive to personalized and effective learning experiences for all students.
- **Partnership, co-operation and networking structures.** Comprehensive partnerships are forged, uniting all stakeholders and services, with meticulous attention to formalizing and coordinating these alliances. This entails the establishment of robust cooperation frameworks with local enterprises, facilitating practical training opportunities and potential employment post-graduation. Moreover, fostering collaboration between vocational education and training (VET) institutions and the trainees is prioritized, underpinned by a foundation of robust, formalized cooperation and ongoing dialogue, ensuring that they are regarded as equal partners in the educational journey.
- **Multi-disciplinarity.** Comprehensive multi-disciplinary teams are formed, comprising all professionals engaged in vocational education and training (VET), each with clearly defined roles and responsibilities. These teams operate under a collaborative framework, fostering a cohesive teamwork approach and demonstrating a high level of cooperation with other relevant services.
- **Suitable ratios/small classes.** Thanks to small class size of the groups, an optimal lecturer-learner ratio is maintained, ensuring that each trainee receives personalized attention and support. Additionally, coordinated at the school level, there are appropriate support staff-learner ratios, enabling the provision of a comprehensive range of support services tailored to the diverse needs of the learners.
- **Assessment.** Before embarking on their vocational education and training (VET) journey, learners engage in comprehensive assessment schemes. This proactive approach ensures the meticulous selection of the most suitable VET programs, aligning closely with the individual abilities, preferences, and aspirations of the learners.
- **Learner-centred approaches.** Embracing a learner-centered approach, pedagogical methods, materials, curricula, assessment techniques, and objectives are all tailored to meet the unique needs of each individual. This approach places a primary emphasis on harnessing the capabilities of the learners, ensuring that educational practices are finely tuned to maximize their potential for growth and success.
- **Individual plans.** Tailored individual education, learning, training, and transition plans are meticulously crafted and put into action, paving the way for the creation and execution of personalized curricula designed to meet the unique needs and goals of each participant.
- **Pathways.** Various avenues exist for learners to enhance their qualifications or grades, transition to alternative programs, explore different career paths, and attain academic and/or professional certifications. These options afford learners the flexibility and autonomy to pursue diverse educational and career trajectories that align with their evolving aspirations and goals.
- **Flexibility.** The vocational education and training (VET) settings exhibit a high degree of flexibility, with structures and durations of VET programs being readily adaptable to meet the evolving needs of learners. This flexibility may manifest in various forms, such as extending the duration of courses or providing longer internships within preparatory classes. Additionally, VET courses themselves are designed with flexibility in mind, allowing learners the opportunity to commence their educational journey at a lower-level program and seamlessly progress to higher-level programs, whether before or after graduation.
- **Certificates.** Certificates and portfolios are meticulously maintained to track learners' skills, achievements, and the support they necessitate within the workplace. These records serve as invaluable repositories of information, facilitating ongoing assessment, guidance, and tailored assistance to optimize learners' performance and success in their professional endeavors.
- **Quality assurance.** Stakeholders exhibit unwavering commitment to quality assurance and improvement strategies within the vocational education and training (VET) sector. Programs are meticulously implemented and certified to elevate VET standards, with a dedicated focus on continuously enhancing learners' readiness for the dynamic demands of the labor market.

Through these concerted efforts, stakeholders strive to ensure the sustained relevance, effectiveness, and excellence of VET offerings, thereby facilitating the seamless transition of learners into successful and fulfilling careers.

- **Dropout reduction strategy.** The education institutions undertake the development and implementation of effective educational measures aimed at preventing or mitigating dropout rates while concurrently exploring innovative educational alternatives tailored to re-engage disengaged learners. Through these proactive strategies, the educational institution endeavors to create a supportive and inclusive learning environment conducive to the sustained academic and personal development of all learners.
- **Matching.** The educational institution demonstrates proficiency in aligning with the skills demanded by the labor market while also effectively addressing the skills possessed by learners. Teachers and trainers exhibit adaptability in modifying their pedagogical approaches to meet the evolving needs of employers. Additionally, vocational education and training (VET) programs undergo regular and comprehensive reviews, both internally and externally, to ensure their alignment with current and anticipated skills requirements. Through these systematic evaluations and adjustments, the institution remains agile and responsive, equipping learners with the relevant competencies needed to thrive in today's dynamic workforce landscape.
- **Support in transition.** Career counselors or officers play a pivotal role in informing and guiding learners about potential employment opportunities. They facilitate and actively support learners in establishing contacts with employers, providing invaluable assistance in job-seeking endeavors. Additionally, these professionals offer comprehensive support throughout the job application and recruitment process, ensuring that learners are equipped with the necessary resources and guidance to pursue rewarding career paths effectively.
- **Availability of staff and resources.** Staff members, including job coaches, career counselors, and mentors, are consistently accessible throughout the transition into the workforce and throughout the duration of employment. Permanent availability of resources and support services ensures continuous assistance and guidance for individuals navigating the complexities of employment. Formal job coaching programs, comprehensive career guidance services, and ongoing support initiatives, including after-care provisions and employer preparation, remain readily accessible to facilitate smooth transitions and sustained success in the workplace.
- **Follow-up.** Highly skilled and proficient staff members offer continuous follow-up support activities tailored to the specific requirements of both employers and young graduates, ensuring the retention of learners' employment within companies for as long as necessary. This ongoing support is designed to address evolving needs and challenges, fostering a conducive environment for professional growth and long-term career sustainability among graduates.

3.2. Recommendations for future actions

Coordinated actions and strategies are needed to increase the effectiveness of inclusive policies and practices in Continuing Vocational Education and Training (VET). What are our recommendations?

- Improving information support and guidelines for inclusive practices.
- Integration of inclusive methods and technologies in the educational process.
- Increasing financial support for learners from vulnerable groups.
- Development of training programs for the training of trainers.
- Creation of measures and mechanisms for continuous qualification of trainers and other supporting staff, through active application of various methods of inclusion, accessibility and flexibility.
- Development of tools and guidelines to be applied in the training of the target groups
- Creation of a platform for sharing good practices for the implementation of inclusive education in all degrees and forms of formal and informal education

4. Conclusion

Inclusive policies and practices are crucial to ensure equal access to continuing vocational education and training for all participants in the educational process. By actively implementing these policies and practices, we can create an educational environment that is not only equitable but also inclusive. Such an environment provides opportunities for the development of skills and opportunities for each learner, regardless of their social or cultural context, physical or mental potential, or other factors. As a result, each participant in the educational process can reach their full potential and participate fully in society, which ultimately contributes to the development and progress of the entire society.

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ANALYSIS OF LONG-TERM LEARNING THROUGH GAMIFICATION IN ENGINEERING COURSES

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Abstract

Gamification is an educational strategy to improve the teaching and learning process, based mainly on increasing student motivation. This study describes a teaching innovation project carried out during the academic years 2022/23 and 2023/24 with engineering students from the University of Jaén (Spain). During the first year, a series of gamified activities (quizzes and presentations) were conducted on a selection of topics from different subjects. This allowed analyzing an improvement in students' motivation and self-perception regarding the use of games in class. Subsequently, during the second year, monitoring of the assimilation of units worked on in a gamified way in the previous year was investigated among different groups of students. Specifically, the analysis of results accomplished in the Materials Science and Materials Technology subjects is described, which show a small trend of improvement compared to the control groups that worked on the same units with a classic methodology. However, the extraction of definitive conclusions is conditioned by numerous factors such as the small size of the statistical sample or the different teachers participating in the activity.

Keywords: Gamification, engineering, students, materials, learning.

1. Introduction

Gamification has received much attention as a powerful tool for promoting student active learning. The idea of fun is described in a general way as a trigger for increasing motivation and the natural competitiveness among students. Thus, the educational community increasingly uses this strategy to train students to learn by playing. It is a tool capable of arousing the student's interest, transforming a routine activity into a dynamic and stimulating one (Kapp, 2014). Specifically, among the benefits described, it stands out that the study is more proactive and that the effectiveness of learning is optimized, mainly in the field of Educational Sciences, Human and Social Sciences, Information Technologies or with the learning of a second language. However, gamification works described in the field of engineering not directly related to information technologies are in the minority (Parra-Santos et al., 2018).

In the case of engineering studies, the use of gamification has also been described as a source of benefits, although there are aspects to be known in more depth such as the influence of the teacher's own role or the evaluation of the improvement in long-term retention of concepts (Leung & Pluskwik, 2018; Júnior et al., 2019).

Concerning this last aspect, the influence of gamification on long-term learning is a complex and nuanced issue. Some studies have found that gamification can lead to improved practical assignment scores and overall performance (Domínguez et al., 2013). Gamification has a positive impact on long-term learning, particularly in terms of motivation, engagement, and learning outcomes (Zainuddin et al., 2020; Nurtanto et al., 2021; Montenegro-Rueda et al., 2023). It can lead to improved student behavior and performance, and can be particularly effective in higher education (Barata et al., 2017). On the contrary, other studies have reported a decrease in motivation, satisfaction, and academic performance over time (Hanus & Fox, 2015). Despite the potential for gamification to engage and motivate students, there is insufficient evidence to support its long-term benefits in educational contexts (Dicheva et al., 2015).

Therefore, while gamification may have short-term benefits, its long-term impact on learning is still uncertain. In fact, the effectiveness of gamification can vary among different student groups, with some students benefiting more than others (Barata et al., 2017) so it is important to consider individual differences in its implementation to enhance long-term learning. Ongoing research continues to explore how gamification can be optimized to maximize its benefits for long-term learning.

2. Objectives

This study describes the first observations and analysis made about long-term learning within the framework of a teaching innovation Project on the Introduction of Gamification in engineering courses at the University of Jaén (Andalusia, Spain). The main objective of this research has been the determination of differences between the long-term retention of content related to the study of metallic alloys by Mechanical Engineering students. Part of these students received instruction with gamification activities while the rest followed traditional learning.

3. Methodology

3.1. Participants

Specifically, the study involves students in Materials Science and Materials Technology courses taught during the academic years 2022/23 and 2023/24, respectively, in the 2nd and 3rd year of the Bachelor Degree in Mechanical Engineering. A sample of 50 students have participated in the proposed activities during the first academic year. However, only 25 of these students have continued to participate in the proposed activity in the second year for the evaluation of long-term learning. The participants were approximately 80% male and 20% female, with an average age between 21 and 22 years.

3.2. Activities

Among all activities proposed in the teaching innovation Project, a game-based pedagogical activity was provided via mobile phones to the 2nd-year students in the academic year 2022/23 to analyze their knowledge in the subject *Strengthening mechanisms of metallic alloys*. In essence, the students must solve a problem posed by solving multiple-choice questions related to the subject, becoming the student protagonist of the narrative. When the student fails a question, there is a time penalty before the trial. All students must respond correctly to all questions to unlock a code and solve the original problem posed. The first three students completing the game were rewarded with a bonus in their marks (final grades) to create a competitive environment and affect their motivation. This game was designed using the Genially platform and consisted of ten questions and closed-response options (Table 1).

Table 1. Questions included in the game related to the study of metallic alloys strengthening.

	Question
Q1	How does the dislocations movement affect the mechanical strength of an alloy?
Q2	How does the grain size of an alloy influence its mechanical strength?
Q3	How does the size of the added alloy atom and its concentration affect the degree of hardening in a metallic alloy?
Q4	How are the properties of an alloy generally compared to those of the pure, unalloyed metal?
Q5	What alloys can be subjected to precipitation hardening?
Q6	What is achieved with a maturation time after quenching?
Q7	How does the yield strength of a plastically deformed alloy evolve?
Q8	Why does the strength increase when plastically deforming a metal?
Q9	What processes allow the mechanical properties of a plastically deformed metal to be restored?
Q10	What does the critical strain indicate for plastically deformed metals?

Before taking the game, the students independently prepared a series of educational videos on this topic in groups of 5-6 members, supervised by the teacher. A control group of students learned the topic in a conventional, non-gamified way.

Students who moved on to the 3rd academic year (2023/24) were re-evaluated on the gamified topics by using the same game / questionnaire. The comparison of the results obtained with those of the group of students with conventional education allows conclusions to be drawn about the capacity for content retention and long-term learning developed by an educational strategy based on gamification.

4. Results and discussion

There is general agreement that gamification increases student motivation and, therefore, can constitute an educational strategy with potential for promoting long-term learning outcomes by increasing engagement. In particular, this study proposed monitoring different groups of Mechanical Engineering students with the objective of evaluating the retention of contents related to the study of metallic alloys in two different academic courses. In the first year, gamified learning environments promoted the active participation and interaction of 50 students. Through repeated practice, feedback loops, and reinforcement mechanisms, it is hypothesized that these learners solidified their understanding of concepts and retained information for longer periods. The evaluation scheduled during the second year showed, however, that only 25 students participated voluntarily in monitoring the activity. This suggests that in the long run motivation can decline. Furthermore, the influence of a novelty effect and extrinsic rewards on motivation is identified, which can lead to greater motivation in the short term, followed by a decrease with further exposure to gamification. Therefore, long-term exposure to gamification as well as the novelty effect should be better explored (Ratinho & Martins, 2023).

Taking into account the small sample of participating students, Table 2 shows the results obtained in the proposed contest. 8 of the participants belong to the group that played the same game the previous year, after making the presentations on the topic. On the contrary, the group with the remaining 17 participants received conventional teaching on the topic. A preliminary observation of the results allows us to detect more difficult questions such as, for example, questions Q5, Q7 and Q8, highlighting the influence of the design of game elements, their alignment with learning objectives and their integration into the curriculum or training program.

The mean scores and standard deviation in each group were: 7.4 ± 1.8 and 6.6 ± 1.8 for students with gamified and conventional learning, respectively. From these results, it could be concluded that the gamification strategy led to a small improvement in the retention of the content taught. However, given the small size of the sample of students evaluated, it is difficult to draw conclusions or significant differences between both groups. In fact, according to Smiderle et al., 2020, gamification affects users in distinct ways based on their personality traits and specific characteristics.

Besides, there is still very limited literature in the field of effect of gamification on long-term learning. Results seem to be predominantly positive in terms of motivation and engagement but only a few studies confirm clear interconnections with learning outcomes. They can suggest a lack of solid correlations between gamification, motivation and cognitive processes (Azzouz & Gutierrez-Colón Plana, 2020). In this sense, according to the experiment by Dominguez et al., 2013, students who completed the gamified experience got better scores in practical assignments and in overall score, but their findings also suggest that these students performed poorly on written assignments and participated less on class activities, although their initial motivation was higher.

Hanus & Fox, 2015, have described a more negative conclusion. Their results found that students in a gamified course showed less motivation, satisfaction and empowerment over time than those in a non-gamified class. The effect of course type on students' final exam scores was mediated by students' levels of intrinsic motivation, with students in the gamified course showing less motivation and lower final exam scores than the non-gamified class.

In view of these results and previous experiences in the specialized bibliography, future studies should focus on the influence of students' individual traits (e.g., gaming experience, openness to competition and cooperation) on gamification strategies.

Table 2. Quiz answer summary. Right and wrong answers in green and yellow colour, respectively.

STUDENTS WITH GAMIFIED LEARNING ACTIVITIES										
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	GRADE
										8
										9
										5
										8
										10
										5
										7
										7
									Mean	7,4
STUDENTS IN CONTROL GROUP WITH CONVENTIONAL LEARNING										
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	GRADE
										8
										8
										8
										7
										7
										4
										4
										9
										7
										6
										8
										6
										5
										9
										8
										4
										4
									Mean	6,6

5. Conclusions

In conclusion, the study sheds light on the complex dynamics surrounding the implementation of gamification in educational contexts, particularly within the realm of Mechanical Engineering education. While initial findings suggest a potential for gamification to enhance student engagement and retention of content, nuanced challenges emerge upon further investigation. The observed decline in voluntary participation over time and the variable impact on motivation underscore the need for a deeper understanding of the long-term effects of gamification. Despite some indications of improved retention with gamified approaches, the small sample size limits the conclusiveness of our findings. Moreover, contrasting studies highlight the diverse effects of gamification on different facets of student performance and motivation. Moving forward, future research endeavors should prioritize exploring individual student

traits and preferences to tailor gamification strategies effectively. By addressing these complexities, educators can harness the full potential of gamification to create engaging and effective learning environments in Mechanical Engineering and beyond.

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EXPLORING PRESCHOOL TEACHERS' PERSPECTIVES ON THE INTEGRATION OF TECHNOLOGY-ENHANCED LEARNING IN BASIC SCIENCE

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Abstract

The rapid advancement of technology has led to an increased prevalence of digital devices in the lives of young children, who now view these tools as indispensable and valuable components of their everyday routines. Integrating technology-enhanced learning has emerged as a pivotal theme in early childhood education, reshaping the pedagogical approaches in preschool education. Preschool education is a critical stage for fostering foundational knowledge and a curiosity for scientific concepts. The role of technology in facilitating this educational journey has gained prominence in recent years. Therefore, this study explores preschool teachers' perspectives on integrating technology into basic science instruction for young children. This aims to examine preschool teachers' attitudes towards integrating technology in Basic science education and investigate the perceived benefits of technology integration in Basic science education from the perspective of preschool teachers. The study employed a survey approach. The survey used a 4-point Likert scale to elicit information from 63 preschool teachers. Responses from the data collected were analyzed using descriptive statistics, t-tests, and Pearson correlations. The study findings reveal a positive attitude of preschool teachers towards integrating technology-enhanced learning into basic science. The mean score shows the preschool teacher found technology to be a valuable tool for enhancing the learning experience in basic science ($\bar{x} = 3.65$), technology in basic science lessons at preschool can make learning more engaging for young children ($\bar{x} = 3.67$), integrating technology into Basic science education is essential for preparing preschoolers for the digital age ($\bar{x} = 3.46$), and the preschool teacher perceives technology as a valuable resource for adapting my teaching methods to the individual needs of preschool students ($\bar{x} = 3.52$). Furthermore, the findings show a strong positive and statistically significant correlation ($r = .608, p = .00$) between teachers' attitudes and perceived benefits of technology integration in preschool science. Conclusively, the study shows that preschool teachers hold a positive attitude toward integrating technology-enhanced learning into preschool Basic science education and recognize its benefits for student learning outcomes. Based on the result, the study recommends prioritizing professional development for teachers to improve their technological skills and pedagogical approaches and allocating resources for educational technology tools.

Keywords: *Preschool teachers, technology-enhanced, basic science, preschool children.*

1. Introduction

The integration of technology has become paramount at all levels of education including early childhood education. Preschool settings play a crucial role in laying the foundation for a child's academic and cognitive development, and the utilization of technology in this critical stage has garnered increasing attention. Recent literature underscores the transformational impact of technology in early childhood education (Nurdiantami & Agil, 2020). The 21st century has witnessed a paradigm shift in the way children engage with and perceive technology. With the prevalent presence of digital devices in daily life, young children now view technology as an integral and indispensable aspect of their learning environment (Graafland, 2018).

The impetus for integrating technology into preschool education is not solely driven by its ubiquity but also by its potential to enhance learning experiences. Technology offers interactive and engaging platforms that can cater to diverse learning styles, promoting active participation and knowledge retention among young learners (Raja & Nagasubramani, 2018). Furthermore, technology integration aligns with the evolving nature of literacy, encompassing not only traditional skills but also digital literacy crucial for navigating the modern world (Vodă et al., 2022).

In the realm of science education, early exposure to technology can provide preschoolers with a dynamic and interactive approach to understanding fundamental scientific concepts. Science education at the preschool level lays the groundwork for a lifelong curiosity and appreciation for scientific inquiry (Ramanathan et al., 2022). Therefore, understanding the perspectives of preschool teachers becomes imperative in navigating the integration of technology-enhanced learning into basic science education. Despite the potential benefits, challenges and concerns surround the integration of technology in early childhood education. Issues such as screen time, age-appropriate content, and teacher preparedness necessitate careful examination (Graafland, 2018). Preschool teachers, being key facilitators of early learning, are central to this discourse. Their attitudes, current technology use, and perceived benefits in integrating technology into basic science education necessitate exploration. To this end, this study addresses three research questions and one hypothesis: (1) What are the attitudes of preschool teachers towards the integration of technology in basic science education? (2) To what extent is technology currently used in preschool science classrooms? (3) What do preschool teachers perceive as the key benefits of technology integration in basic science education? and (4) Ho: Positive attitudes among preschool teachers toward integrating technology in basic science correlate with a perception of increased benefits.

2. Theoretical framework

The study is underpinned by Rogers' Diffusion of Innovations (DoI) theory to understand teachers' adoption and integration of technology-enhanced learning (Rogers, 1983). In applying the DoI theory to the study, several key components are considered. Firstly, the study explores preschool teachers' attitude towards technology integration and perceived benefits of integrating technology in the context of basic science in preschool education. This exploration aligns with Rogers' framework, which identifies these attributes as crucial determinants of innovation adoption. The study also delves into the categorization of preschool teachers into adopter categories. The adopter categories are defined as "the classifications of members of a social system on the basis of innovativeness" (Rogers, 2003, p. 22). The adopter categories include innovators, early adopters, early majority, late majority, and laggards. Individuals belonging to each adopter category exhibit similar innovation characteristics: an individual's innovativeness is determined by how early they adopt new ideas in comparison with other members of a system (Sahin, 2006).

First are the Innovators, characterized by their adventurous nature and eagerness to experiment. New ideas were welcomed by innovators. In the context of technology integration, these are the trailblazing teachers who boldly explore technological tools in their teaching practices. Following them are the Early Adopters, opinion leaders respected within their social system. These leaders play a crucial role in mobilizing resources that carry innovation forward, from initiation to implementation (Light, 1998). These individuals play a crucial role in influencing their peers, advocating for, and successfully integrating technology into teaching practices. As we move to the Early Majority, a pragmatic group that adopts innovations after careful observation. The early majority adopt innovation before their peers do; they are in the second half of the process. The Late Majority adopts innovations when they become a norm or necessity, and investigating their concerns and motivations reveals potential barriers and strategies for wider acceptance. Finally, the Laggards resist change due to fear of technology or a preference for traditional methods. Understanding why some teachers resist integrating technology-enhanced learning uncovers deep-seated concerns that need addressing for comprehensive adoption (Rogers, 2003).

Relevant to this study, the DoI Theory offers a structured framework for understanding the stages of adoption among teachers regarding technology-enhanced learning integration. Widely applied in educational technology research, particularly by Rogers (2003), this theory remains pertinent in understanding the dynamics of technology-enhanced learning adoption in educational contexts. Through this theoretical lens, this study aims to unravel the intricacies of technology integration, providing nuanced insights into the attitude of teachers and their perceived benefits of embracing innovative technology in their pedagogical practices.

3. Method

This study employed a survey approach. This approach comprehensively explores preschool teachers' perspectives on integrating technology-enhanced learning into basic science. The participants include 63 preschool teachers from diverse educational settings for the study. A simple random sampling was utilized to ensure representation across different demographics, such as gender, years of teaching experience, and qualifications. The survey consisted of 18 items, prompting preschool teachers to express their agreement or disagreement on a four-point Likert-type scale to attitude and perceived benefit of integrating technology-enhanced learning in basic science. The scale ranged from 1, indicating 'Strongly disagree,' to 4, representing 'Strongly agree.' Six items focused on attitudes toward technology integration in basic science, another six addressed perceived benefits, and the remaining six items explored the current use of technology in preschool science classrooms, with the scale ranging from 1 'Never' to 4 'Always'.

4. Result and discussion

The demographic composition of the participants reveals that 6.3% were male, while 93.7% were female. In terms of age distribution, 24.4% fell within the 25-34 age range, 31.1% were between 35-44 years old, 7.8% were aged 45-54, and 6.7% were in the 55-64 age bracket. Regarding teaching experience, 4.4% had less than a year of experience, 35.6% had 1-5 years, 7.8% had 11-15 years, 7.8% had 16-20 years, and 6.7% had more than 20 years. In terms of qualifications, 7.8% held a National Certificate in Education (NCE), 54.4% had a Bachelor of Education (B.Ed.), 3.3% had a master's degree, and 4.4% possessed a Postgraduate Diploma in Education.

The outcomes of Likert-type statements regarding preschool teachers' attitudes, current technology usage, and perceived benefits in integrating technology-enhanced learning in basic science, are presented in Tables 1, 2, and 3. The calculation of the mean score results in a value of between 3.10 to 3.67. Scores exceeding the minimum of 2.5 points indicate positive attitudes, usage, and benefits.

Table 1. Preschool teachers' attitude towards integrating technology-enhanced learning in basic science.

S/N		Frequency and Percentage				Mean	Std. Deviation
		SD	D	A	SA		
1	Technology is a valuable tool for enhancing the learning experience in basic science (AT1).	-	-	22 (34.9%)	41 (65.1%)	3.65	.481
2	I believe that using technology in preschool science lessons can make learning more engaging for young children (AT2).	-	-	21 (33.3%)	42 (66.7%)	3.67	.475
3	I believe integrating technology into basic science education is essential for preparing preschoolers for the digital age (AT3).	-	-	34 (54%)	29 (46%)	3.46	.502
4	I am open to experimenting with new technology tools and resources in my preschool science curriculum (AT4).	-	9 (14.3%)	39 (61.9%)	15 (23.8%)	3.10	.615
5	I am enthusiastic about the potential of technology to enhance the quality of preschool science education (AT5).	-	3 (4.8%)	46 (73%)	14 (22.2%)	3.17	.493
6	I perceive technology as a valuable resource for adapting my teaching methods to the individual needs of preschool students (AT6).	-	-	30 (47.6%)	33 (52.4%)	3.52	.503

Table 1 reveals the preschool teachers' attitude towards adoption of technology. The mean score shows the preschool teachers' found technology to be a valuable tool for enhancing the learning experience in basic science ($\bar{x} = 3.65$), technology in basic science lessons at preschool can make learning more engaging for young children ($\bar{x} = 3.67$), integrating technology into Basic science education is essential for preparing preschoolers for the digital age ($\bar{x} = 3.46$), open to experimenting with new technology tools and resources in my preschool science curriculum ($\bar{x} = 3.10$), enthusiastic about the potential of technology to enhance the quality of preschool science education ($\bar{x} = 3.17$), and perceives technology as a valuable resource for adapting my teaching methods to the individual needs of preschool students ($\bar{x} = 3.52$). Based on this, preschool teachers are positive about using technology to enhance basic science learning. It supports the findings of Ramadan et al. (2019) and Tiede et al. (2022) that teachers show a positive attitude towards technology adoption in the classroom.

Table 2. Preschool teachers' current use of technology in basic science.

S/N		Frequency and Percentage				Mean	Std. Deviation
		Never	Rarely	Sometimes	Always		
1	How often do you use technology, such as computers, mobile phone, or tablets, as a teaching tool in your preschool science lessons?	3 (4.8%)	4 (6.3%)	23 (36.5%)	33 (52.3%)	3.56	1.028
2	How frequently do you incorporate educational apps designed for science learning into your preschool classroom activities?	3 (4.8%)	13 (20.6%)	25 (39.7%)	22 (34.9%)	3.11	.969
3	How often do you utilize digital resources, such as multimedia presentations or videos, to support science lessons in your preschool classroom?	4 (6.3%)	12 (19.0%)	25 (39.7%)	22 (34.9%)	3.16	1.081
4	How frequently do you incorporate technology tools for teaching science with preschool children?	4 (6.3%)	10 (15.9%)	24 (38.1%)	25 (39.7%)	3.11	.900
5	How frequently do you use technology to customize science instruction to meet the individual needs of preschool children?	3 (4.8%)	16 (25.4%)	25 (39.7%)	19 (30.2%)	3.17	.493
6	How often do you integrate technology tools to promote scientific inquiry and exploration among preschool children?	7 (11.1%)	21 (33.3%)	11 (17.5%)	24 (38.1%)	3.52	.503

Table 2 presents the preschool teachers' current use of technology in preschool science classroom. The mean score shows the preschool teachers' use you uses computers, mobile phone, or tablets as a teaching tool in your preschool science lessons ($\bar{x} = 3.56$), frequently incorporate educational apps designed for science learning into your preschool classroom activities ($\bar{x} = 3.11$), often utilize digital resources, such as multimedia presentations or videos, to support science lessons in your preschool classroom ($\bar{x} = 3.16$), frequently incorporate technology tools for teaching science with preschool children ($\bar{x} = 3.11$), frequently use technology to customize science instruction to meet the individual needs of preschool children ($\bar{x} = 3.17$), and often integrate technology tools to promote scientific inquiry and exploration among preschool children ($\bar{x} = 3.52$). This study implies that preschool teachers currently utilize technology in preschool science classrooms. It corroborates the findings of Konca and Tantekin Erden (2021) that teachers demonstrated utilization of technology in the classroom.

Table 3. Preschool teachers perceived benefits of technology integration in basic science.

S/N		Frequency and Percentage				Mean	Std. Deviation
		SD	D	A	SA		
1	Technology integration enhances preschool students' engagement and interest in basic science concepts.	-	-	39 (61.9%)	24 (38.1%)	3.38	.490
2	Integrating technology in basic science education fosters a sense of curiosity and exploration among preschool students.	-	-	38 (60.3%)	25 (39.7%)	3.40	.493
3	Technology allows for individualized learning experiences, catering to different learning styles and abilities among preschoolers.	-	-	27 (42.9%)	36 (57.1%)	3.57	.499
4	The use of technology in preschool science education helps prepare children for future technological advancements and digital literacy.	4 (6.3%)	-	24 (38.1%)	35 (55.6%)	3.43	.797
5	Preschoolers' exposure to technology in science education promotes a positive attitude toward science as they grow.	-	4 (6.3%)	31 (49.2%)	28 (44.4%)	3.38	.607
6	Technology allows preschool teachers to stay updated with current scientific discoveries and teaching methods.	-	-	31 (49.2%)	32 (50.8%)	3.51	.504

Table 3 shows the preschool teachers perceived benefits of technology integration in basic science. The mean score shows technology integration enhances preschool students' engagement and interest in basic science concepts ($\bar{x} = 3.38$), fosters a sense of curiosity and exploration among preschool students ($\bar{x} = 3.40$), allows for individualized learning experiences, catering to different learning styles and abilities among preschoolers ($\bar{x} = 3.57$), helps prepare children for future technological advancements and digital literacy ($\bar{x} = 3.43$), exposure to technology in science education promotes a positive attitude toward science as they grow ($\bar{x} = 3.38$), and allows preschool teachers to stay updated with current scientific discoveries and teaching methods ($\bar{x} = 3.51$). The study implies that preschool teachers perceive technology-enhanced learning as beneficial to science classrooms. It supports the findings that teachers perceive technology-enhanced learning to benefit their classroom.

Table 4. Positive attitudes among preschool teachers toward integrating technology in basic science correlate with a perceived benefits.

Correlations			
		Grouped Attitude	Grouped Perceived Benefit
Grouped Attitude	Pearson Correlation	1	.608**
	Sig. (2-tailed)		.000
	N	63	63
Grouped Perceived Benefit	Pearson Correlation	.608**	1
	Sig. (2-tailed)	.000	
	N	63	63

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4 illustrates the correlation between preschool teachers' attitudes toward integrating technology in basic science and the perceived benefits of technology integration. The findings show a strong positive and statistically significant correlation ($r = .608$, $p = .00$) between teachers' attitudes and perceived

benefits of technology integration in preschool science. This indicates a significant correlation between preschool teachers' attitudes toward technology-enhanced learning and their perceptions of the benefits of technology-enhanced learning in the science classroom.

5. Conclusion and recommendation

Overall, the study shows that preschool teachers hold a positive attitude toward the integration of technology-enhanced learning into preschool basic science education and recognize the benefits it will have for their students' learning outcomes. Taking into account the results of the study, it is recommended that teachers prioritize professional development to improve their technological skills and pedagogical approaches in order to improve student outcomes. Also, allocating resources for educational technology tools and utilizing them should be done.

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EXAMINING PRE-SERVICE TEACHERS' USE OF CODING AND ROBOTICS DURING MICRO-LESSONS IN THE TEACHING OF CONSTRUCTION IN TECHNOLOGY THROUGH PROBLEM-BASED LEARNING

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Abstract

Due to the technological advances of the Fourth Industrial Revolution (4IR), the South African education system revised its existing curricula to include robotics and coding. Such a development demands teachers to re-evaluate their pedagogical approaches to accommodate innovative technologies. However, using recent technology, such as robotics, in classroom activities adds complexity to teachers when engaging learners, as some students are not familiar with this teaching strategy and have limited knowledge of robotics technology. Additionally, meaningful robotics integration requires engaging students in small group activities. Still, interpersonal dynamics come into play, which can influence robotics task outcomes as the equipment is unavailable due to the high cost of robotics kits. Hence, there is a need to develop pre-service teachers professionally. The study explored pre-service technology teachers' integration of robotics technologies when teaching grade 9 structured construction topics. The Technological Acceptance Model (TAM) was used as the theoretical framework to interpret the data and ultimately frame the study findings. Following a qualitative research design, seven final year pre-service teachers enrolled for the Technology Methodology and Practicum module were purposefully selected to participate in the study, of which five participants were enrolled for the Bachelor of Education Degree and two participants for the Post Graduate Certificate in Education at a South African university. Firstly, the participants were developed on integrating robotics and coding when teaching Grade 9 technology structured construction concepts. The participants then planned and taught micro lessons. For data collection, each participant was observed whilst teaching micro lessons and then interviewed to determine their experiences of the development they received and their planning and teaching whilst integrating robotics and coding. Lesson observations and interviews were recorded in video and audio, respectively. Using Atlas Ti to manage the data, analysis followed a thematic approach, allowing for the identification of common themes and patterns in teachers' practices and experiences. Findings indicate that pre-service teachers acquired effective collaboration and engagement skills with learners, teamwork, and hands-on skills. The teachers acknowledged during interviews that the process not only equipped them in terms of creativity progress and pedagogical practices but also helped them to deepen their subject matter knowledge. As such, this study has implications for policy and implementation since it underscores the importance of developing pre-service and in-service teachers before implementing an innovation in any curriculum.

Keywords: *Coding, Fourth Industrial Revolution, pedagogical strategies, technology, robotics.*

1. Introduction and background

In recent years, educational institutions have increasingly adopted the Fourth Industrial Revolution (4IR) technologies, such as robotics and coding, to enhance the teaching and learning experience by fostering interdisciplinary learning and acquiring problem-solving skills as students apply critical thinking skills (Ehushi & Uribe, 2017). Robotics and coding have emerged as widely adopted in many institutions of higher learning to offer a robust framework for online learning. Understanding how students use and navigate digital platforms such as robotics being integrated during teaching and learning is essential for improving their learning experience as the educational paradigm continues to shift in favour of these tools (Makhubalo, 2023). Robotics technologies are further integrated into many universities to prepare students for the future world, as most jobs nowadays require employees with a technological background. Students being exposed to this technology are further opening opportunities to

engage in learning experiences that can fascinate their interest as they become more innovative, acquiring practical skills as they engage in hands-on activities and practical activities (Leoste et al., 2021).

Integrating robotics technology has become crucial for providing a flexible and interactive learning environment (Makhubalo, 2023). However, the success of these systems depends significantly on the effectiveness of the training provided to users (Sullivan & Bers, 2018). Understanding the perceptions and experiences of pre-service teachers during the micro lesson with the use of robotics is essential for improving the training process and ultimately enhancing their learning experiences and acquiring the competencies and skills demanded in the 4IR era. Hence, most universities embrace robotics and coding as they provide students with varying technological skills. This was also attested by Sullivan and Bers (2018), who mentioned that robotics empowers students and lecturers with the necessary skills for enhancing educational experiences.

Universities are essential in helping students get ready for various situations by trying to give them a well-rounded education that extends beyond specialized job training. According to Scott et al. (2019), universities empower students with knowledge and skills that are useful in the workplace and ensure that they have a technological background, which is regarded as one of the essential skills the employee must attain. Considering that robotics is a recent technology, most students showed interest in it as they became highly engaged towards the robotics activities within their STEM discipline; they learnt how to apply skills and integrate them into their academics to deepen their (Eguchi, 2017). Additionally, Anwar et al. (2019) mentioned that robotics improves students' engagement and interest in the subject as they acquire sufficient and new knowledge and academic performance in a range of STEM subjects and provide impactful learning experiences. Furthermore, Zhong and Xia (2020) emphasized that robotics integration needs careful preparation and deliberate intervention techniques to guarantee that students have a successful and fulfilling educational experience.

Student experiences and attitudes toward educational robotics are crucial for honing their skills within their STEM subjects' areas. Based on their attitudes and experience, a broad spectrum of affective behaviours, including commitment, acceptance, preference, and appreciation, are included in their experience and attitude (Kucuk & Sisman, 2020). According to the authors, it was observed that most of the students have more interest in robotics technologies, and many of them have fun, especially when creating robotic artefacts or solving robotics problems. Van der Merwe (2018) made the case that before pre-service teachers can become certified teachers, they should be given opportunities to grow as academic students and taught how to be creative and have effective teaching skills. Van der Merwe (2018) research further highlighted areas in which pre-service teachers need to grow to become qualified educators and acquire competencies skills. In the study conducted by Makhubalo (2023), it was observed that robotics and coding resulted in students learning through a hands-on approach and skills that enable them to physically interact with concepts and witness how theoretical knowledge is applied in real-world situations. It cultivates an innovative mindset and expands one's perspective. Because of this imperative, the study sought to explore pre-service technology teachers' integration of robotics technologies when teaching grade 9 structured construction topics.

2. Theoretical framework

This study was underpinned by the Technological Acceptance Model (TAM) theory by Davis (1989) to seek to comprehend and forecast users' adoption and acceptance of new technologies. Marangunić and Granić (2015) revealed that TAM explores how users accept and use technology based on the following two factors: the perceived ease of use and perceived usefulness. Nguyen et al. (2020) allude that the perceived ease of use is the level to which a person believes that using a specific technology will be effortless. In the context of this study, TAM assisted the researcher in identifying, after undergoing, students' experiences and attitudes on the acceptance of the use of robotics and coding in the teaching of construction within grade 9 Technology subjects. Another factor that TAM investigates is perceived usefulness. According to Portz et al. (2019), perceived usefulness refers to the level of a person's belief that using a particular technology is going to improve their job performance.

3. Methodology

This study adopted a qualitative case study research design to seek to comprehend the meanings, viewpoints, and experiences of pre-service teachers (Creswell & Creswell, 2017). This design allows the researcher to explore pre-service experiences while engaging with robotics technology to solve technology construction tasks during their micro lessons. According to Creswell and Creswell (2017), qualitative research methods are suitable for investigating, interpreting, and describing scenarios and obtaining a general (as opposed to precise) concept from the subjects. Through this research design, the

researcher could explore the use of robotics by pre-service teachers and fully understand the participants' attitudes and perceptions during their micro lesson observation and semi-structured interviews.

3.1. Selection of participants

This study adopted purposive sampling to select seven pre-service teachers majoring in technology as their methodology major within the faculty of education. Etikan et al. (2016) mentioned that purposive sampling is a deliberate choice of a participant due to the qualities the participant possesses. Seven participants were selected for this study. These participants include both male and female students. Criteria for selection will include that the student must be registered with the University of Johannesburg in the faculty of education, must be in a final year or must be enrolled for a post-graduate certificate in education (PGCE) majoring in technology as their major. Pre-service teachers must have undergone robotics and coding training to ensure that they have a baseline understanding of this technology and can operate it.

3.2 Data collection and analysis

Data was collected through semi-structured interviews and observation during micro-lessons. According to Longhurst (2003), a semi-structured interview is a conversation in which the interviewer asks questions of the other party to get information from them. Conversational, semi-structured interviews enable participants to delve into topics they deem pertinent to themselves (Longhurst, 2003). Each interview took approximately 20-30 minutes. Interviews were audio recorded with permission from the student and then transcribed using Microsoft Teams application software. Seven pre-service teachers were observed using OSMO cameras as they had micro lessons with robotics technology. The researcher taped every session, which lasted 20 to 30 minutes for each student. After the observation, the researcher uploaded the videos to Google Drive for cloud storage. The researchers accessed these videos and watched them multiple times to assess the efficacy and caliber of students' engagement. After that, they were uploaded to Microsoft Stream to be transcribed.

4. Findings

Pre-services stated that they had an excellent experience integrating robotics technologies during their micro lessons. What worked to their advantage was that they could engage in hands-on skills activities, which enabled them to be involved in practical experiences rather than theory. Through this experiment, they utilized robots to construct and build blocks, which permitted them to create a robotics learning artefact after completing the task. It is evident that robotics technologies enable pre-service teachers with hands-on skills as they become more creative and acquire innovation skills when solving robotics activities such as building house blocks. As pre-service were sharing their experience, they expressed their happiness and excitement about their robotics experiment. Some outlined that this technology empowered them to explore more competencies skills while teaching as they enhanced computational thinking, critical thinking, innovation, and creativity skills in their teaching instructions.

In addition to the experiment, some pre-service teachers mentioned that during their micro lessons, they could relate concepts of construction topics in reality as a result of robotics. While they were teaching, it was easier for them to apply theory concepts into practice. Participant T1 shared his thoughts regarding his experience.

T1: *Utilizing robotics and coding was a great innovation in my classroom presentation, and made learning interesting as it grasped the attention of students since they linked knowledge they have learnt in the class while solving robotics tasks. Students were excited to learn, they absorbed the task information effectively. This integration allowed hands-on activities, which benefits psychomotor students because mostly these types of students are not accommodated, as teachers are active and students are passive. Thus, student engagement was fostered.*

The response indicates that robotics technologies permit pre-service teachers to contribute by proposing innovative solutions and engaging in hands-on activities while focusing and paying attention to the task. The findings also found that integrating robotics technologies into the classroom provides a dynamic and engaging learning experience. It imparts valuable skills that are relevant to the fourth industrial revolution, encourages creativity and innovation, and prepares students for a future world driven by technology. Some pre-service teachers pointed out that robotics empowered students as they engage in learning activities; they become motivated and willing to explore and solve complex activities in a technology subject. The following response from Participant T2 is evident to this:

T2: *What I observed during the micro lessons was that students were motivated to exceed expectations when completing tasks. They demonstrated a willingness to learn new tools and apply their experience to create new tasks within their methodologies. They did another task as some were able to build electrical circuits without being instructed by me.*

Due to the experience with robotics technologies, some pre-service teachers view this technology as an effective tool for teaching. They mentioned that students could have a better understanding of content as robotics deepened students' understanding of subject content. In addition, they indicated that robotics is effective in enhancing meaningful explanations of technology and scientific concepts. From other pre-service teachers' responses, robotics allowed students to be committed to their activities by actively and effectively participating in achieving the task goal and making the robotics task successful.

Pre-service teachers' utilization of this technology in their micro lessons allowed them to engage their lessons in cooperative learning, where students were highly engaged and committed towards the task. As a result of limited robotics technologies, they were encouraged to use cooperative learning as they had to share the resources and engage in groups. Some pre-service teachers attested that this learning strategy was highly effective as students put more effort into the project's success, allowing them to support each other by sharing innovative ideas and engaging in hands-on contributions while connecting those robotics technologies to build their projects. To attest to the statement above, Pre-service Teacher 4 had the following to say.

T4: *Students were putting ideas together and discussing solutions as a group while building those blocks. The first thing they did in their groups was to collaborate, share ideas, discuss, and agree on one thing while building their blocks.*

Some pre-service teachers mentioned the complexity of this technology in teaching technology subjects, which is linked to troubleshooting and operation skills. They revealed that although they managed to use these robotics effectively in their micro lessons teaching, they experienced some challenges as they had limited knowledge of robotics. This challenge delayed them to complete their task and lesson in time as they spent much time trying to troubleshoot. Pre-service Teacher 5 participant made the following explanation:

T5: *I found it difficult as sometimes the robot could not work and that was the biggest challenge I experienced.*

Unfamiliarity with robotic equipment due to a lack of exposure has a considerable detrimental impact on the pre-service ability to learn with robots. In some instances, pre-service teachers indicated that one challenge they encounter is a lack of exposure to these technologies. They outlined that the universities buy limited robotics resources as they are costly. Furthermore, lecturers who have a solid background in robotics and coding. As a result, pre-service teachers being prepared for this innovation must be prepared to receive training in robotics and coding, and apply it in the classroom. These pre-service teachers pointed out that the lack of robotics resources at universities contributes to students' failure to develop knowledge and skills in robotics and coding, hampering them from using them in their learning and highlighting that the lack of availability of robotics learning tools further sets learners back in acquiring the relevant knowledge and skill. This came from Participant T6's response.

T6: *I think these robots are not enough for us to use, sometimes it takes time for us to have training sessions as the queue may be long. If universities can buy enough robots I think it will be better for all of us.*

5. Discussions

Pre-service teachers have indicated that their robotics experience was effective as it enhanced students' self-directed learning and allowed them to explore their skills to solve complex problems within technology tasks. These findings concur with Lee et al. (2016), who attested that students engaging in groups using robotics technology provide them with more opportunities to explore and create new tasks. As they solve technology problems, they become motivated by their achievements and the knowledge and skills they gain. As a result, they are eager to learn more about robotics technology and apply it to scientific and technology tasks. As students engaged in this kind of learning, Makhubalo (2023) highlighted that robotics technology plays a significant part as it permits students to be highly engaged in their learning tasks while solving problems. This supported Keith et al. (2019), who found that students who participated in learning activities using technology tools discovered new opportunities to explore and create projects. They are encouraged by their achievements and the knowledge and skills they acquire.

6. Conclusion

This study examined pre-service teachers' use of coding and robotics during micro-lessons in teaching construction in technology through problem-based learning. The findings revealed that pre-service teachers' experience with robotics technologies was effective as they could deepen subject knowledge among students while teaching. They could integrate theoretical concepts of technology subject into reality while solving robotics problems. These findings further showed that students were highly engaged throughout the lesson and could share responsibilities while solving tasks. As they engaged in their learning activities, pre-service teachers enhanced hands-on skills among students as they were building and designing blocks. As a result, students developed competencies such as creativity, critical thinking, innovation, and problem-solving skills. These findings have implications for professional and competency development to enhance pre-teachers' knowledge and skills in teaching in digital or virtual environments where robotics technology is being used as a tool to enhance learning.

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A CONCEPTUAL MODEL FOR EVALUATING THE EFFECTIVENESS AND QUALITY OF INCLUSIVE EDUCATION, TRAINING AND LIFELONG LEARNING

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Abstract

The new information society implies a revolutionary change in the features and possibilities of the educational system. There is a need for learning, the characteristics of which will be activity, productivity, and awareness. This determines qualitative changes both in the attitude towards students and in the educational content and its priorities, the design and technology of education, the educational environment and the role of the teacher in it. The new educational paradigm, the result of the development of education in the conditions of the information society, in the pedagogical aspect is personally oriented and respects the rights of the person and in particular the child, in the didactic aspect it is oriented towards key competences in which transversal skills and metacognition have a dominant role, in a psychological aspect develops thinking and its qualities. This publication aims to present a scientific research project whose main goal is to create a new theoretical model for researching the effectiveness of lifelong learning (LLL) strategies by studying, analysing and evaluating the Lifelong Learning process globally and in Bulgaria in particular, especially when it comes to inclusive education. Testing of the theoretical model through a sociological survey and focus group research will be organized to propose a pilot model for assessing the effectiveness and maturity of the LLL. The methodology applied in the study includes searching and analysing factual information, study of models and 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 № KII-06-H80/1, funded by National science fund of Bulgaria.

Keywords: *Inclusive education, lifelong learning, effectiveness and quality, vocational education and training.*

1. Introduction

A new approach to the problems of qualification, education and training is required, dictated by the scale of education and training of the economic and social changes taking place in Europe. An adequate response to the rapid development of the knowledge-based economy and demographic pressure is needed. The main goal is to improve the competitiveness of the workforce and, accordingly, the competitiveness of the national economy by increasing people's adaptability to economic and social changes, promoting equality and participation in all forms of professional and personal development. New technologies enable the creation of a virtual educational environment and the implementation of new approaches to interactive communication. The project advocates the thesis that the partnership between the business world and the various degrees and sectors of education, training and scientific research will help to more precisely direct efforts towards the formation of appropriate knowledge, skills and competences that the labour market requires, and to stimulate innovation and entrepreneurship in all forms of learning.

The new information society implies a revolutionary change in the features and possibilities of the educational system. There is a need for learning, the characteristics of which will be activity, productivity, and awareness. This determines qualitative changes both in the attitude towards students and in the educational content and its priorities, the design and technology of education, the educational environment and the role of the teacher in it.

The new educational paradigm, the result of the development of education in the conditions of the information society, in the pedagogical aspect is personally oriented and respects the rights of the person

and in particular the child, in the didactic aspect it is oriented towards key competences in which transversal skills and metacognition have a dominant role, in a psychological aspect develops thinking and its qualities.

Changing the educational paradigm changes the entire system of education. Formal education is unable to satisfy people's needs for permanent qualification and retraining. In a knowledge society, there is no such thing as "completed education". A network of educational activities appears that are not regulated by laws, rules and regulations, but are regulated by the interests and needs of the participants in them, take place inside or outside educational institutions and end with the achievement of a very specific goal. This type of educational activities fills the content of the concept of non-formal education. There is also knowledge that one acquires daily and independently, outside of any system of organized teaching. This system of education is called non-formal education, informal education, independent learning (Vasileva et al., 2019).

2. Relevance of the topic / about the project

The opportunities for acquiring knowledge in the information society are growing rapidly, and this puts individual countries and the member states of the European Union the task of solving the problem of validating the knowledge acquired through various forms, by finding compliance with the levels in the European Qualifications Framework and those developed on it base national frameworks.

The educated person today lives in the global world and must be prepared for it. He must learn to live in a world whose symbol is globalization, with its political, economic and social consequences. As a result of this reality, the educated person is faced with new and unknown challenges – of intensifying international and national competition, of the struggle between the global and the local, of preserving one's own culture and respecting the culture of other nations. The world is turning into a global village, and man into a citizen of the world in terms of thinking, worldview and information. In this aspect, the problem of globalization of education systems does not mean uniformity, or at least uniformity in everything, globalization in education systems means standardization. The European Union demonstrated a clear understanding of the need to apply the competence approach in teaching and learning.

The main recommendation is an orientation from learning to learning outcomes. This conceptual change is a consequence of the development of modern society, which is characterized by the rapidity of changes, as well as the unpredictability of these changes. In this dynamic and complex world, the requirements for young people are aimed at forming creative skills, developing critical thinking, adaptability skills based on competences in various fields. The new image of the personality to satisfy the needs of today's and future society requires fundamental changes in curricula and programs.

Fostering lifelong learning is key to the success or failure of innovative companies. Successful investments in education and training programs encourage partnerships between different companies, and the role of the state as a regulator of this type of partnerships is still strong and thus limits the natural business interests of the partners. It is important to identify the various factors that drive lifelong learning in individual companies, and these generally remain only partially understood. The focus of lifelong learning needs to be on increasing the profitability and competitiveness of the business (Yankova et al., 2017). The cognitive skills of the population are a key element in knowledge-based economies, which is why the European Union emphasizes the development of a skilled workforce. Unlike commonly applied forms of assessment, which are very general and measurable at a certain point in time, individual cognitive skills have a differentiated nature and respond with varied manifestation according to the demands of the labor market, which is precisely why modern knowledge-based economies highly reward the acquisition of cognitive skills.

Lifelong learning should improve the career development of workers, increase flexibility and strengthen the competitive position of the enterprise. Best practices and stronger policies must be used responsibly to sustain and strengthen value creation. The impact that investments in human resources have on the productivity and growth of enterprises is the main focus. It should be borne in mind that employees and organizational capacity for continuous learning remain largely invisible and cannot be fully accounted for in enterprise balance sheets. A strong incentive to increase the provision of increasingly complex services, knowledge and innovation is the use of best practices in the field of human resources. High performance work and training systems cover employment protection actions. An organizational environment of employee trust is created, which strengthens their commitment to the respective enterprise. Confidence in new forms of LLL is growing and this is fueling interest in creating new learning content. The bottom line is that social networks are giving way to resourceful new forms of e-LLL (Vasileva et al., 2020).

The best way to establish the effectiveness of training is by collecting data based on measurements. Sometimes it is not how the learning takes place, but what is taught that matters for effectiveness. Therefore, the following factors should be looked at and measured: lack of incentives to implement training,

implementation of an incentive system, unclear job functions, explanation of job functions, inadequacy of feedback, offering adequate feedback, lack of access to and reliability of the resources needed to perform the task: providing access to reliable resources, lack of knowledge, low physical and mental capacity. Highly effective organizations continuously evaluate their activities to determine performance and competency gaps and their alignment with corporate and/or departmental goals.

The Business Maturity in LLL is designed specifically for business organizations or units within such organizations that focus on lifelong learning, continuing education and professional development, as well as corporate training departments or degree programs. The overall score will help the business determine its overall maturity, and the scores for each area will help the business identify which ones need the most attention and work to move to the next stage of maturity.

In the society of knowledge, the economy does not develop on the basis of mechanical technique, but on the basis of knowledge, research, innovation in thinking and production. Technology and information, which are the intellectual product of knowledge, are the basis of profit. In a society where education is a key resource, it is necessary to change the educational paradigm, as well as the very concept of an educated person. There is a need for learning, the characteristics of which will be activity, productivity, awareness. The new educational paradigm, reflected to the greatest extent in Lifelong Learning (LLL), in the pedagogical aspect is person-oriented and respects the rights of the individual, in the didactic aspect it is oriented towards key competences in which transversal skills and metacognition have a dominant role, in a psychological aspect, it develops thinking and its qualities. The goal, sub-goals and tasks of the current project will explore the knowledge achieved in this area, as well as the measurable and achieved impact on the subjects, objects and environment in LLL, which will contribute to improving the interaction and feedback between business, the non-governmental sector and government institutions in the field of LLL.

3. Project objectives and hypotheses

The main goal of the project is to create a new theoretical model for studying the effectiveness of lifelong learning, by studying, analyzing and evaluating the lifelong learning process globally and in Bulgaria in particular, through the sociological research and focus group research. Through reviews and analyzes of LLL globally, indicators laid down in various documents regarding the achievement of LLL effectiveness will be examined. Special attention will be paid to research in the field of innovative educational practices and European cultural and educational policies, and especially to existing models for the assessment, certification and validation of LLL. These models will be explored in terms of evaluating and measuring their effectiveness in relation to society, the individual and economic conditions. In order to fulfill the set goals, the project will rely on the current trends in the management of the information and communication infrastructure and organizational culture of lifelong learning and in the approaches of learning and transmission of knowledge between generations. As an essential part of achieving the goal of the project is the research of positive models of LLL that offer prediction of the effectiveness of their implementation based on profitable innovative tools for impact.

Our hypothesis is that the existing models for evaluating the effectiveness and maturity of the LLL reflect social and political tasks and do not sufficiently take into account the individual needs of the trainees, as well as do not motivate units and enterprises to use innovative development tools and indicators. Therefore, we expect that in the implementation of the project goal, this hypothesis will be investigated, and as a result of the fulfillment of our goal, the shortcomings of the evaluation of efficiency and maturity at the moment will be overcome and models will be created that can be applied with ease and predict specific results necessary for the anticipatory development of LLL in relation to societal and individual expectations and needs. In order to fulfill the set goals, the project will rely on the current trends in the approaches to the management of the information and communication infrastructure and the organizational culture of lifelong learning and in the approaches to learning and transmission of knowledge between generations. During the implementation of the project, the following principles will be followed: Study of models and good practices in the researched area; Research and analysis of lifelong learning strategies and policies; Study of the organizational processes at the LLL; Research and study of strategies and policies of the companies investing in LLL; Study of the need for business strategies of companies with the subject of activity of LLL; Analysis and research of national and globalization processes from the point of view of human rights and personality. Study of the conditions for creating a theoretical model that would contribute to the improvement of the main building factors of the cultural-educational areas of the social sciences and civic education.; Confirmation of a new vision for an interactive educational environment in the field of lifelong learning; Creation of a basis for the development of national frameworks in accordance with the levels in the European qualification framework for a way out of the problem with the validation of

knowledge acquired through different forms; Increase interest, awareness and access of potential users to an interactive educational environment for lifelong learning.

4. Methods, research equipment and techniques

The main research approach for the implementation of the research project implies the application of the principles of the Unified Methodology for Conducting Functional Analysis in the State Administration (EMPFADA). In the course of the research, it is precisely adapted and includes the following methods: on the principles and methods of construction and modeling, a reference model will be developed for the organization and functions of lifelong learning systems, and the proposed concepts, policies will be formulated, proven and defended and strategies for sustainable development of the lifelong learning system, based on the use of good practices and positive experience of EU member states and world leaders in the sector; the research techniques used include analysis of the legal framework, review of documents and structuring of statistical and other information, interviews, surveys, observations, expert assessments, etc. Empirical sociological research is planned as a reliable and secure source for complete and up-to-date social information about social reality. Empirical methods and approaches used will be based on the professional experience, organizational-management qualification and scientific-research competence of the members of the project team with a view to successfully proving the originally formulated scientific hypothesis. The system analysis will allow revealing the state of the information and communication environment in the field of lifelong learning, thereby identifying the key factors determining the development of the information and communication culture of all participants in the organizational-management and production-consumer processes. The functional approach will assist in determining the interrelationships, interdependencies between the individual structural elements of the lifelong learning, culture and education systems in Bulgaria and their impact on socio-economic, cultural and social development.

5. Lifelong learning business maturity stages

Conditionally, 4 stages can be distinguished, which always precede the reaching of full maturity of companies specializing in lifelong learning, continuing education and/or professional development. This maturity is reached by fully mastering these 4 stages:

- **Stage 1: Static:**

Leadership: lacks clear vision or accountability, focus on individual processes.

Strategy: Poorly articulated, unclear goals and metrics.

Capacity: Lack of resources, unclearly defined processes.

Portfolio: "We've always done it this way", the offers are informative.

Marketing: Invalidated understanding of market, competition or audience, limited, haphazard communication channels, no specific metrics.

- **Stage 2: Reactive**

Leadership: Poorly presented vision, accountability for current performance, no clarity on how it can be sustained or improved.

Strategy: Exists, but not differentiated, not widely shared, and not tracked and measured

Capacity: Resources meet current needs but are insufficient for growth. Processes are implied but poorly documented.

Portfolio: Efforts have been made to assess training needs but these are minor, offers are somewhat performance-based, there are rudiments of impact assessment reflected beyond the documentary requirements.

Marketing: Immature on the market. Offers submitted via a specific communication channel and their results are not tracked.

- **Stage 3: Proactive**

Leadership: The vision is driven by a cross-functional team, a shared understanding of sustaining and developing achievements.

Strategy: Widely segmented and served differentiated, has traceability through metrics

Capacity: Resource meets current and evolving needs, key processes are documented, there is investment in staff and volunteer development.

Portfolio: Has a good knowledge of learning needs, of lifelong learning theory, but insufficient practical experience of applying the knowledge assessed to work, reflected beyond the documentary requirements.

Marketing: Periodic efforts to assess the market and competition, efforts to develop segments and priorities aligned with the audience, use of multiple communication channels with appropriate measurement and opportunity to improve results. The beginnings of branding of lifelong learning.

- **Stage 4: Innovative**

Leadership: Shared vision from top management, clear accountability and responsibility, through next and interim plans, a culture of continuous learning.

Strategy: Provides a clear positioning that is shared and taken across the organization, continuously actively trackable metrics.

Capacity: Resources meet current needs and support innovation, processes are well defined and consistently used, and there is significant investment in staff and volunteer development.

Portfolio: Clear understanding of training needs as well as practical, excluded application of theory, effective alignment with training needs and strategies in delivery, assessment to assess focus on change.

Marketing: Validate understanding of market and competition, implementation of segmented priority offering, strategic use of multiple communication channels, presence of a strong brand for lifelong learning.

The assessment of the achieved level based on the description of these 4 stages serves to create a business model for lifelong learning. At each stage, maturity is measured against the characteristics and performance in 5 areas that have been found to be critical to the success of the learning and the educational companies themselves.

Achievements in the five key areas are:

- *Leadership:* How clear is the business's vision for training and education? How is the achievement of a shared and sustainable vision measured over time? Is there a culture of learning in the organization and its audience?
- *Strategy:* How clear is the formulated strategy? Has it been communicated to the entire organization? Are there clear metrics established and trackable to align the organization to the strategy according to the recorded data?
- *Capacity:* Does the organization have sufficient capacity in terms of human resources and technology to achieve an effective vision and strategy?
- *Portfolio:* Are the content, methodology and terms well aligned. Are training needs well researched? Is there an assessment of the effectiveness of the training across levels and over time?
- *Marketing:* Is there a valid understanding of the overall market and competitive environment? Are you consistently using appropriate marketing methodologies and monitoring whether it is effective? The four profiles on your side offer an overall picture of the business at each stage of maturity and a description of the degree of manifestation in the five areas. In reality, most businesses perform better in some areas and worse in others. Part of the business model is an evaluation methodology that the firm can use to analyze performance in each of the five areas.

6. Conclusion

The business model can be used by market-oriented training firms to assess their performance in the five areas that are key to overall performance and success. The Maturity Assessment Model is designed specifically for business organizations or units within such organizations that focus on lifelong learning, continuing education and professional development, as well as corporate learning departments or degree programs. The assessment will provide a score for each of the five areas as well as an overall rating. The overall score will help the business determine its overall maturity, and the scores for each area will help the business identify which ones need the most attention and work to move to the next stage of maturity.

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EXPLORING THE SUPPORT NEEDS OF TEACHERS IN INCLUSIVE SCHOOLS

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Abstract

Supporting teachers in inclusive schools is of paramount importance in the South African education system as it helps to enhance education for sustainable development. Supporting teachers also benefits them to get exposure to inclusive pedagogies. Even though teachers have undergone pre-service training, and some also received in-service training, it is apparent that teachers do not receive adequate support to teach in inclusive classrooms. Framed within the Transformative Learning Theory as the theoretical framework, this study sought to explore the support needs of teachers in inclusive schools. By utilising transformative learning theory, the identified support needs may aid in transforming the teachers' frame of reference regarding their teaching practices so that they can transform through the realization of their support needs. The study is entrenched within the qualitative research approach and use the interpretivist paradigm. Interpretivism is preferred because it allows the teachers to construct their own reality of their support needs in inclusive schools. 12 participants from two (2) full-service schools in the Ngaka Modiri Molema District were purposively sampled. Data was generated through semi-structured interviews. Analysis of data was done through Braun's six-step of thematic data analysis method. The findings propose that the teachers in inclusive schools require in-service training and workshops that are continuous. The teaching and learning resources for the benefit of both teachers and learners were also highlighted as the support needs of teachers in inclusive schools. In addition, collaboration with parents and district officials was highlighted as another support needs for teachers working in inclusive education settings. It is recommended that the school management teams, SBST and DBST ensure that teachers are trained continuously on various learner barriers and offer practical skills for completing the SNA1 referral form. Furthermore, it is recommended that SMT and SBST should encourage parents to be involved in the learners' learning.

Keywords: *Inclusive schools, instructional pedagogies, support needs, support services, teachers.*

1. Introduction and background

Globally, inclusive education (IE) was initiated as a result of the worldwide conference on Special Education that was held in Salamanca in 1994. The Salamanca conference proposed that all educational systems worldwide should be inclusive of varied learner diversity (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1994). Like other countries, South Africa is a signatory of the Salamanca statement and framework on special needs education (Engelbrecht, Nel, Smit & Van De Venter, 2016). Inclusive education should provide equal educational opportunities for all learners, regardless of their inabilities, abilities, backgrounds, gender, sexual orientation, and religion. Inclusive education policies regard a teacher as the key and primary stakeholder in implementing inclusion (Adewumi & Mosito, 2019; Ayaya, Makoelle & Van der Merwe, 2020; Chow, 2023).

In South Africa, the Education White Paper 6 on special needs education (Department of Education [DoE], 2001) was specifically promulgated to guide the implementation of an inclusive education system. It was in this inclusive policy that the South African Education system was divided into three categories of schools namely, ordinary or mainstream schools, Full-Service Schools (FSS), and Special Schools as Resource Centres (SSRCs) as a strategy of ensuring inclusion in schools (DoE, 2001). This means teachers should embrace inclusive practices in their instructional pedagogy. According to UNESCO (1994), inclusive schools should offer quality education for all learners, including learners with disabilities thereby enhancing education for sustainable development. However, for teachers to fully embrace inclusive education practices, their support needs should be prioritised.

International and national inclusive policies emphasise the need for teachers to be supported. For example, the Salamanca declaration (UNESCO, 1994) highlighted that teachers should be supported in inclusive educational settings. South African Education White Paper 6 also stipulates that teachers should

be supported to enhance the implementation of inclusive education practices (DoE, 2010). In addition, the Screening, Identification, Assessment, and Support (SIAS) policy guideline further emphasised the provision of support to teachers as an enabler of inclusive pedagogies within classrooms (DBE, 2014). Support structures such as School Based Support Teams (SBST) and District Based Support Teams (DBST) were also established to provide support to teachers and learners in South Africa (DoE, 2001; Adewumi & Mosito, 2019). However, it seems the support needs of teachers in inclusive schools are not prioritised as teachers are still challenged to maintain inclusive pedagogies.

Various studies reported the challenges of meeting the support needs of teachers worldwide. According to Chow (2023), it can be challenging to teach in an inclusive education setting if teachers do not have support and resources. Other challenges include huge workload and time constraints, overcrowded classrooms, and lack of training (Adewumi & Mosito, 2019). Lack of collaboration was highlighted as the challenge in the implementation of inclusion (Ayaya et al., 2020; Chow, De Bruin, and Sharma, 2023). Van Staden-Payne and Nel (2023) reiterated that inadequate training of teachers, the ineffective functioning of the DBE, the incompetence of the school management team, lack of parental involvement, and inadequate resources contribute to ineffective instructional pedagogy that is not inclusive. The lack of resources in inclusive education settings was reported by Engelbrecht (2020). Therefore, a snapshot of the challenges outlined depicts that the support needs of teachers in inclusive schools should be explored.

2. Study objective

This study sought to explore the support needs of teachers in inclusive schools. To successfully achieve this objective, this study was guided by this research question: What are the support needs of teachers teaching in inclusive schools in South Africa?

3. Theoretical framework

The transformative learning (TL) theory that was developed by Mezirow (1978) was used as a theoretical framework for this study. Mezirow defined TL as ‘learning that transforms problematic frames of reference—sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)—to make them more inclusive, discriminating, open, reflective, and emotionally able to change’ (Mezirow, 2003, p. 58-59). As a framework, the transformative learning theory explores how people evolve their understanding and worldview (Rodríguez Aboytes & Barth, 2020) through critical reflection and new information that they would have received. In this study, the transformative learning theory was used to explore the challenges and the support needs of teachers in inclusive schools. This means teachers’ experiences can be used as a benchmark to shape and transform practice through the realisation of their support needs. Thus, transformative learning involves epistemological change (Rodríguez Aboytes & Barth, 2020) where teachers examine, and reflect on their support needs.

4. Methodology

Embedded in the interpretivism paradigm, the study sought to explore the support needs of teachers in inclusive schools. Interpretivist researchers emphasise that the world could be best understood through first-hand experience of the insiders’ perspectives (Creswell & Poth, 2018). Alharahsheh and Pius (2020) also argue that with the interpretivist paradigm, the researchers can benefit from getting in-depth meanings from the participants. A qualitative research approach was used in this study to gain insight into the support needs of teachers in inclusive schools. The qualitative research approach was preferred as it allowed the investigation of the phenomena in a real-world setting (Adeoye-Olatunde & Olenik, 2021) which produced in-depth knowledge of the support needs of teachers in inclusive schools. Purposive sampling which aims to identify participants with the same experiences as the central phenomena of the study (Patton, 2015; Thorne, 2016) was used to recruit 12 participants from two FSS in the North West province. This sampling procedure allowed for the identification of participants who contributed to the shared understanding of the required support needs of teachers in the FFS. Data were collected using semi-structured interviews. Adeoye-Olatunde and Olenik (2021) argue that semi-structured interviews permit interview questions to be focused to further enhance understanding of phenomena. Semi-structured interviews were the preferred data collection method as the aim of this study was to better understand teachers’ support needs. Braun and Clarke’s (2014) six-step thematic data analysis method was used to analyse data. Ethical approval to carry out this study was granted with the ethical approval number (N W U - 0 0 4 1 3 - 2 3 - A 2), and the adherence to respect for participants, anonymity, and confidentiality was safeguarded.

5. Findings and discussion

The findings of the study are discussed in this section. Three main themes that emerged during the data analysis process are presented. Few quotations representing each theme are presented. Pseudonyms are used to safeguard the identity of the teachers. The three themes that emerged in this study included continuous training, teaching and learning resources, and collaboration.

5.1. Continuous teacher training

Teachers emphasised the need for continuous teacher training as it may assist them in effectively supporting the learners in the classrooms. This is evident in the following excerpt:

Yes there is training provided in our school, but the training is seldom, as a result, we do not feel supported enough. I think the department and the support structures can do more (Zakhele).

Siyanda also echoed the same sentiments by indicating the following:

Training is provided by the departmental education specialists, but you know the training is not enough. Last year when I went for training it was for two days only and it focussed on Autism Spectrum disorder... but we didn't know how to complete the SNA1 form from the SIAS document. I wish the training could be more frequent and be more practical (Siyanda).

From the above findings, teachers propose continuous teacher training as their support need. This means that teachers maintain that the training should not be a once-off intervention and should take place as frequently as possible. In addition, the continuous training should focus on the practical completion of Support Need Assessment Form 1 (SNA1) as embedded in the SIAS document. This support need for continuous training is congruent with the findings reported by Van Staden-Payne and Nel (2023) who reported that the training of teachers in FSS is inadequate. These findings further corroborate the findings by Chow et al. (2023) who reported continuous teacher training as the perceived support need within the inclusive education setting.

5.2. Teaching and learning resources

Teachers mentioned the need for teaching and learning resources for the learners to fully benefit in their learning experiences as expressed by Sibusiso and Bulelwa in the excerpts below:

Resources are key. As a teacher, I can do my best, but when the learner does not have an assistive device it means they may not access learning fully. So, it is a problem. At least the school management and the DBST should prioritise the assistive devices for the learners (Sibusiso).

At my school, we have many learners in the foundation phase, but there are no teaching assistants. I wish we can have these assistants so that they can assist us in supporting the learners with barriers to learning. You know if you have many learners in your classroom without a teacher assistant, you struggle to give attention to learners who may need support (Bulelwa).

The above findings depict that teachers recommend the prioritisation of teaching and learning resources to improve instructional pedagogies. This finding further recommends that the availability of teaching and learning resources should not be for the benefit of teachers only but should be available for the learners as well so that they can be able to access learning and improve their educational outcomes. This finding corresponds with the findings by Adewumi and Mosito (2019) and Engelbrecht (2020) who reported that teachers need teaching and learning resources that may enhance inclusion.

5.3. Collaboration

Teachers mentioned that they are collaborating, but they feel that the collaboration is inadequate. See below quote from Precious:

Collaboration is there... I collaborate with other teachers; I involve learners, but parents are not always available for interventions. My challenge is that the collaboration does not involve other key stakeholders like parents (Precious).

In addition, Pheliwe echoed the similar sentiments by indicating the following:

Stakeholders do not always respond to our requests. Sometimes we wait the whole year waiting for the intervention from the education specialists working at the district level (Pheliwe).

The finding above indicates the need for collaboration as a cornerstone of inclusive instructional pedagogies. Further, this finding highlights the unsatisfactory collaborative partnerships between teachers and district officials. This finding makes it clear that collaboration is critical in inclusive education settings. This finding corroborates the findings by Ayaya et al. (2020) and Chow et al. (2023) who reported that collaboration is critical for fostering inclusive practice in schools.

6. Conclusion

The study explored the support needs of teachers in inclusive schools. The findings propose that the teachers in inclusive schools require in-service training and workshops that are continuous. The teaching and learning resources for the benefit of both teachers and learners were also highlighted as the support needs of teachers in inclusive schools. In addition, collaboration with parents and district officials was highlighted as another support need for teachers working in inclusive education settings. It is recommended that the school management teams, SBST and DBST ensure that teachers are trained continuously on various learner barriers and offer practical skills for completing the SNA1 referral form. Furthermore, it is recommended that SMT and SBST should encourage parents to be involved in the learners' learning. This is because parents are seen as the key stakeholders in inclusive education settings. These findings should not be generalised because this qualitative study was undertaken in two FSS in the North West province of South Africa. It is proposed that further research be conducted with a focus on the efficacy of continuous training and the collaboration skills that may assist in enhancing collaboration among stakeholders working in inclusive schools.

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TEACHING AFFINE FUNCTIONS: EVALUATING THE USE OF GAMES WITH AUTOMATIC FEEDBACK IN GEOGEBRA

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Abstract

This work is an excerpt from doctoral research, in development, and aims to evaluate games with automatic feedback, for the teaching of affine functions, through the GeoGebra software. Using the fundamentals of gamification, which consists of using elements of a game in situations that are not necessarily a game, to promote better learning and improve students' levels of engagement and motivation. Based on Raymond Duval's theory of Registers of Semiotic Representation, it is expected that the student will be able to understand and assimilate the content in order to identify the different types of register of an affine function, such as its textual, tabular, algebraic or graphic form. A workshop was offered to four students of the 9th grade of elementary school of a private school in São Paulo, Brazil, to verify the use of the games and possible improvements that can be implemented according to the feedback of the participants. Such activities will be applied, in the future, with other students, for the collection and analysis of study data. All the games developed have automatic feedback, that is, the student receives feedback from the system after answering a certain question. If the answer is correct, there will be encouraging feedback congratulating for completing the activity. If the answer is incorrect, other feedback, according to each possible error, previously predicted, to provide clues that allow the student to identify his error, make new conjectures and try again to solve the question. In an interview with the subjects of the workshop, two participants reported that they had no previous knowledge on the subject and two others stated that they had superficial knowledge. Of the nine available tasks, seven were successfully solved. The automatic feedback provided allowed the students to progress in the activities, each one at their own level and time, according to the new knowledge they were acquiring. All stated that they enjoyed learning by playing games and that this feature is a fun and different way to study. They claimed that the main difficulty was that they did not know the content beforehand and that some issues they did not know how to solve. It should be emphasized that the activities will be applied to future subjects, such as a diagnostic evaluation after the approach to the content, and that the initial applications will allow new possible improvements.

Keywords: *Gamification, digital technologies, mathematics education, affine function, GeoGebra.*

1. Introduction

With the technological advancements increasingly integrated into our daily lives, the implementation of new pedagogical practices in the classroom that incorporate the use of digital resources becomes essential. According to Barbosa, Pontes, and Castro (2020), the use of technology in the classroom enables teachers to stimulate student learning. Silva and Abar (2023) report that a technological approach in an educational context, utilizing gamification techniques, promotes motivation and increases student engagement levels.

Zichermann and Cunningham (2011) define gamification as a process of thought and game mechanics aimed at engaging individuals and solving problems. Deterding (2012) further informs that the concept of gamification is not based on creating a complete game, but rather on using game design elements in non-game contexts to motivate specific behaviors. Conversely, Busarello (2016) defines gamification as a system that employs game elements to solve problems, aiming to increase individual engagement and stimulate intrinsic motivation through playful environments capable of exploring extrinsic motivation.

According to the National Common Curricular Base - BNCC (Brasil, 2018), the use of dynamic geometry software plays an important role in understanding and applying mathematical concepts. GeoGebra software presents itself as an excellent didactic tool, as it is a dynamic geometry software, free, available for download on both computers and smartphones, and can also be accessed online. It can be

used for any level of education, integrating geometry, tables, and graphs into a single platform, and allowing students to manipulate mathematical objects during their understanding (Instituto GeoGebra São Paulo, 2014).

The visualization of various types of representation records in a single application provides a better understanding of the topic being addressed. According to Damm (2008), in the teaching of functions, when studying their graphs, tables, and equations, we understand the partial records of the mathematical object, and when combined, they enable its complete understanding. The author further explains that only when the student can transition between different types of records of the same mathematical object naturally can we say that their learning is meaningful.

Combined with all these resources, it becomes important to develop a feedback system in the creation of a gamified activity that allows the student to learn from their mistakes. According to Narciss (2008), feedback consists of all post-response information provided to the student to inform them about their real learning or performance state, becoming a powerful factor in the learning process, especially in a digital environment. Shute (2008) states that formative feedback enables identifying the level of difference between the student's performance and the desired level, reducing the gap between them and reducing the student's uncertainty about their performance in a particular activity.

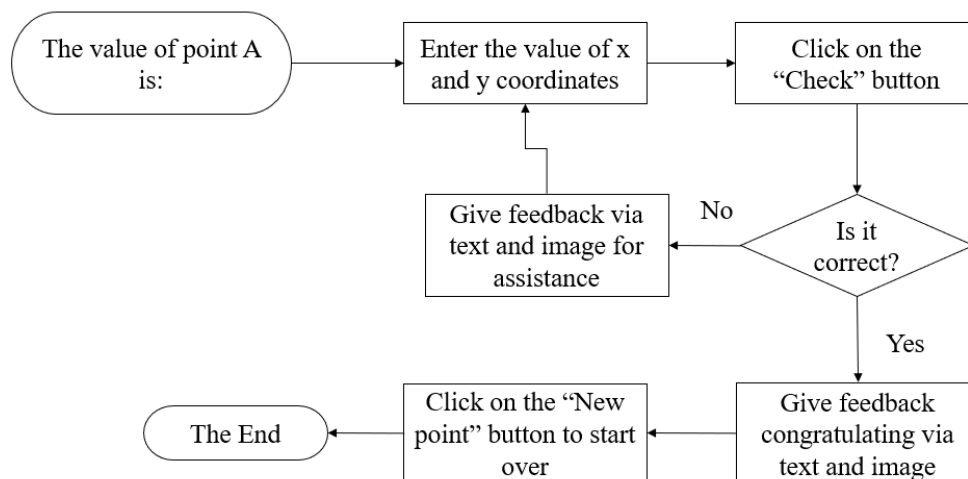
Based on the above, the objective of this work, a segment of an ongoing doctoral research, is to verify the applicability of games with automatic feedback, developed in the GeoGebra software, for teaching linear functions, based on Raymond Duval's Theory of Registers of Semiotic Representation, enabling students to understand the various forms of representation of the studied mathematical object and properly perform the conversion between them.

2. Materials and methods

Four students aged 14 from the ninth grade of Elementary School from a private school located in São Paulo, Brazil, participated in the research. The activities were carried out in the school's computer laboratory, and the subjects had one hour to complete them. The students were provided with the webpage address they should access and then the access password so they could start the game.

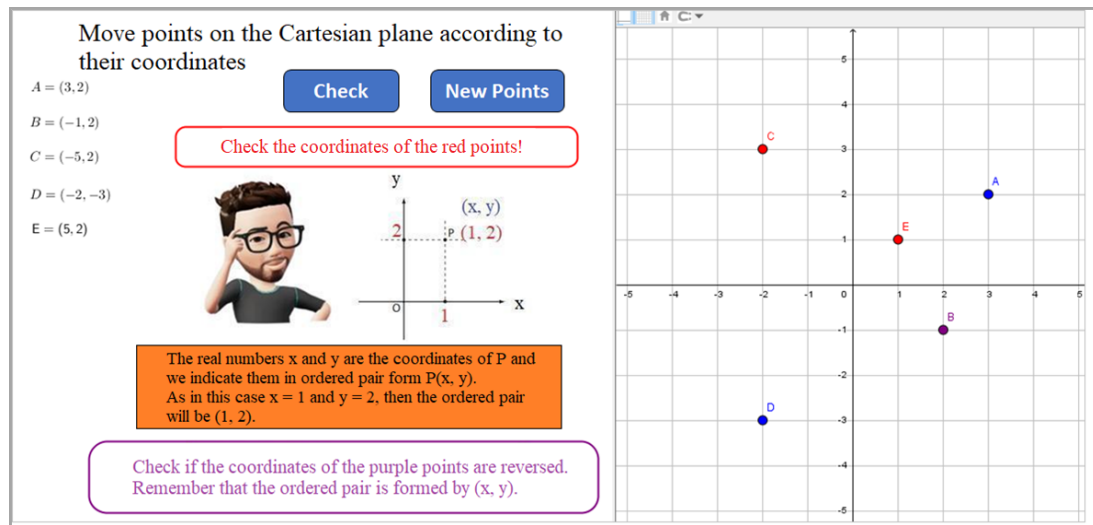
The developed games were based on Raymond Duval's Theory of Registers of Semiotic Representation. The chosen mathematical object for their construction was the study of Linear Functions. In this context, nine games with automatic feedback were developed in the GeoGebra software and were arranged in the form of a task in GeoGebra Classroom. The presented sequence was designed for the subject to perform in order, although the students played them randomly. For each game, a flowchart was created detailing each stage of its construction, as exemplified in Figure 1.

Figure 1. Example of the construction of one of the games.



In all games, students could relate to the different types of records of the studied mathematical object, performing various conversions so they could mobilize their knowledge for a more meaningful learning experience. Different types of records, such as textual, algebraic, tabular, and graphical, were addressed in a way that allowed students to perform the necessary conversions and observe the linear function in different forms. For each type of mistake, specific feedback with tips was developed to guide the student in understanding their mistake and overcoming obstacles, as shown in Figure 2.

Figure 2. Example of feedback in one of the games.



3. Results

The objectives and types of records addressed in each game are presented in Table 1.

Table 1. Objectives and types of conversions addressed in each game.

Game	Objective	Conversion of Records
1	Understand the concept of a function	Algebraic → tabular → graphical
2	Identify coordinates of a Cartesian point	Graphical → algebraic
3	Position points in the appropriate location on the Cartesian plane	Algebraic → graphical
4	Determine the function from a problem	Textual → algebraic
5	Find the corresponding ordinate of the abscissa	Algebraic → tabular → graphical
6	Determine the line corresponding to the function	Algebraic → graphical
7	Find intersection of lines	Algebraic → graphical
8	Analyze characteristics of line coefficients	Algebraic → graphical
9	Identify values of line coefficients	Graphical → algebraic

The initial games, which focused on Cartesian points and were the easiest ones, were completed by all participants. The level of difficulty increased, as players progressed through the tasks. Among the nine games provided to the students, seven were successfully completed by at least one of the students. Only games 6 and 7 were not completed by any student. Both games have the same dynamics, but while in game 6 the student works with only one line on the Cartesian plane, in game 7 they need to manipulate two lines. Since the tasks were performed individually by the students, and half of them had no knowledge of linear functions while the other half had only basic knowledge, it may have caused doubts about how to carry out the activity. Perhaps with the guidance of a teacher, they would have been able to complete the tasks.

In game 8, developed in three phases, the first two phases separately examined the characteristics of the slope and y-intercept coefficients and how their values influence the behavior of the line's graphical representation. In the final phase, the student analyzed their values simultaneously. This game was designed as an introduction to the next game. Game 9, which was the most comprehensive, was played only by one student; the others did not get to play it, perhaps due to limited time or being engrossed in the previous games.

It is worth noting that the proposal, when developing the games, is for them to be applied after the student has learned the mathematical content and for their application to be considered as a diagnostic assessment to verify if the individual can learn from their mistakes, make conjectures, and attempt again correctly. The students who participated in this experiment played without any prior explanation of the content.

At the end, the students responded to a questionnaire about the activities carried out, expressing their main difficulties and their opinion on learning mathematics through games. The questionnaire consisted of seven questions:

- 1) Did you have any prior knowledge about linear functions?
- 2) Were you able to complete the activities after the automatic feedback?
- 3) Were you able to learn by playing alone?
- 4) What was the biggest difficulty?
- 5) Did you enjoy learning this way?
- 6) Would you change anything in the games you participated in?
- 7) Were there any activities you couldn't complete? Why?

When asked about their level of knowledge on the topic, half of the students indicated they had no prior knowledge, while the other half reported having basic knowledge previously studied. Regarding the feedback, all of them mentioned that the hints provided by the games when they made mistakes helped them to reformulate their answers and get the questions right. One student mentioned having a bit of difficulty, and another stated they couldn't complete the tasks due to their level of knowledge. All of them stated they were able to learn by playing and that not knowing the content completely or not knowing what to do in certain games were the main difficulties. Concerning learning through gaming, all of them expressed enjoyment in engaging in activities this way, considering it an ideal tool for learning, using words like "interesting," "practical," "fun," and "engaging" to describe the experiment. When asked if they would change anything in the games, only two students provided suggestions; one would include more examples to facilitate understanding, and the other requested more explanations (this student had no prior knowledge of the topic). Regarding the activities they couldn't complete, they cited lack of knowledge on the subject, time constraints, or not understanding what was required as reasons.

4. Conclusions

By introducing games into mathematics learning, we enable students to learn in a different and enjoyable way, sparking their interest in the subject and enhancing their levels of motivation and engagement. The proposal to develop games with automatic feedback allows students to learn from their mistakes instantly, enabling them to correct them and thus quickly resolve their doubts. Even with limitations regarding the content covered, the unanimous response was that everyone enjoyed learning through gaming. Gamification proves to be an important tool using technological resources that significantly impact performance and interest in studying mathematics. All the difficulties and suggestions provided by the students have been taken into consideration for the improvement of the games, ensuring their successful application in future research endeavors.

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CHALLENGE BASED LEARNING AND SUSTAINABILITY: ZERO WASTE PROGRAMME APPLIED TO THE UNIVERSITY

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Abstract

Challenge Based Learning (CBL) is an engaging multidisciplinary approach to teach and learn that promotes students to use it and take advantage of technology in their day to day to deal with real problems. The approach is collaborative and hands-on, students work with other students, their teachers, and experts in their communities and around the world to develop deeper knowledge of the subjects, accept and solve challenges, take action, share their experience, and enter into a global discussion about important issues. Based on the problem that we produce twice as much plastic waste as two decades ago, almost half of which comes from OECD countries, and considering that only 9% is successfully recycled, a program called “Zero Waste” is proposed. The objective of the program is to know and analyze the problem that there is with recycling within the University of Basque Country UPV-EHU, specifically in the Faculty of Business and Economics. The initial results showed a lack of recycling among students and teachers, a lack of organization of garbage containers, as well as a lack of specific containers for recycling. Based on the results of the previous year, we propose a second school year focusing our efforts on solving the aforementioned problems.

Keywords: *Challenge Based Learning (CBL), sustainability, University of Basque Country UPV-EHU, Zero Waste programme.*

1. Introduction

The need for change in traditional methodologies for learning is increasingly necessary. It is an issue that has been worrying for decades. Some authors (Blumenfeld et al., 1991; Blevins, 2010) have stressed the importance of tasks as an element that links student motivation, student cognition, instruction, and learning. We live in a society based more and more on information and knowledge, which must be reflected in our students and their learning in order to achieve an optimal professional development.

There is, therefore, a continuing need in many education systems to empower students with real skills for their success in the future, and no other way than by solving collaborative problems in practical classes. It is precisely through CLB that we approach the common goal in education. The implementation of CLB allows the students to further develop and advance the technology, leading to industrial advancements; in short, it allows students to engage in learning goals through meaningful contexts.

Thus, it is necessary the development of such strategies and educational tools implementation is paramount, as one of the main challenges of the transition into the digitalization systems, due to the lack of qualified employees in the companies.

Starting from the one of the main problem of plastic use in the world, where 259 million tons of plastic was produced in 2018, compared to a million and a half tons in 1950, the need for a program to reduce the use of plastic in the university is raised, encompassed within the sustainable development goals of the 2030 Agenda from OCDE.

The propose programme is aimed at promoting environmental sustainability linked to SDG 13 (climate action). For that, a programme called "Zero Waste" is proposed. The objective of the program is to know and analyse the problem that there is with recycling within the University of Basque Country UPV-EHU, specifically in the Faculty of Business and Economics.

In order to carry out the program, the challenge-based Learning (CBL) methodology is used, being the main objective of the program to know and analysed the problem related to the use of plastic. Therefore, we could improve the environmental impact of the Faculty of Economics and Business.

The research work is structured in several parts: in the second part, it discusses what the CBL methodology consists of and the relevance and the importance it has been gaining in recent years. The

third section will be based on explaining the importance of the use of this methodology in the university environment. The fourth part relates to explaining the methodology followed, the fifth part explains the main results obtained, and finally, we will expose the conclusions of the study.

2. Challenge Based Learning (CBL): Concept and relevance in educational system

Challenge-based Learning is a learning methodology based on a real experience, where participants face a real problem and deal with it, after working with other students and teachers; they explore possible options for improvement, coming up with the proposal of a solution, which is eventually implemented and evaluated (Gallagher & Savage, 2020 and 2022; Johnson & Adams, 2011). In fact, it focuses on addressing learning from of a generic topic and raise a series of challenges related to this issue, which students must reach (Kohn, et al. 2018).

There are three fundamental pillars (Ramírez-Montoya et al., 2021) on which challenge-based learning is based, as we can see in figure 1: investigate, engage and act.

1. Engage: Personal and accessible by prompting learners to identify and connect with personally relevant challenges.
2. Investigate: Authentic and challenging by supporting learners to conduct rigorous content- and concept-based research.
3. Act: Collaborative and connected by encouraging learners to collaborate on creating and implementing a solution.

Challenged Based Learning methodology, therefore, it is considered a real way to improve knowledge, skills and attitude. In fact, Smith and Van Doren (2004, p. 1) says: “professors will find that they can truly make a difference in their students ‘transferability of knowledge, skills, and attitudes from the confines of a classroom to their interactions in the broader world”.

There are several studies (Xu & Liu, 2010; Zavirov, 2013; Carrión et al., 2015; Agüero Pérez et al., 2019) that reveal how the use of this methodology enhances the results of students. Communication and expression skills are also improved. Academic development acquires an important support with the implementation of this methodology, where students complement the academic contents with the implementation of real cases. Besides, CBL helps in bringing the professional world closer to the academic and improves the employability of participating students. There is no doubt that Challenge based Learning builds a true relationship between the academic world and the professional world, fostering a greater ability of students to solve problems (Membrillo-Hernández, 2018).

After analysing previous studies, we could conclude that the outstanding benefits that students perceived as resulting from the participation in CBL-based programs were leadership, approach to the world professional, improvement of oral and written communication skills, knowledge more in-depth on the topics addressed in the challenges, practical application of concepts and frustration tolerance. In addition, CBL has shown itself to be a program easily applicable to different areas of knowledge and scalable to a large number of students, and, therefore, with an important potential for growth at an international level due to its implementation in the most important universities in the world.

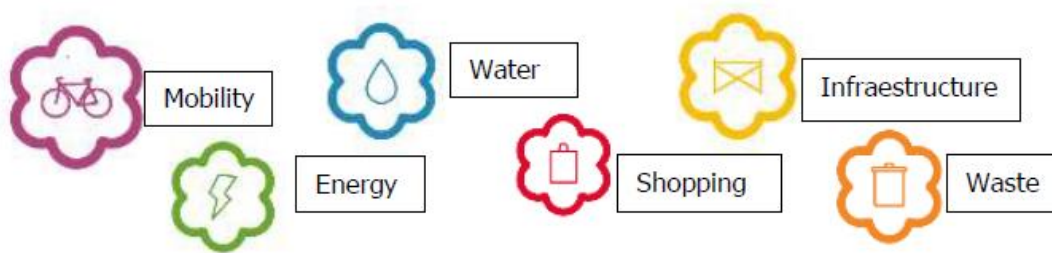
3. CBL applied to university system: Analysis monitoring

3.1. Environmental management of sustainability: Climate Action

Climate change is a phenomenon that affects every country and person in the world. For Antonio Gutiérrez, Secretary-General of the UN, “it is the greatest systemic risk at the global level for the near future”. Global warming is increasing at a much faster rate than anticipated, becoming one of humanity's greatest challenges. SDG 13 aims to introduce climate change as a central issue in the policies, strategies and plans of countries, companies and civil society. The objective, among others, is to manage the transition to a low-carbon economy, which will significantly reduce the risks and impact of climate change (Pacto Mundial, 2023)

Delivering climate solutions through innovation and long-term investments in energy efficiency and low-carbon development can fight climate change. There are six aspects in which to act in the fight against climate change: mobility, energy, water, purchasing, infrastructure and waste. We reflect these six aspects in figure 1.

Figure 1. Relevant aspects to act against climate change.



Source: own.

It is precisely the last point, the waste, where we will put our attention. Twice as much plastic waste is produced as two decades ago and almost half of it comes from OECD countries, yet only 9% is successfully recycled. According to a new OECD report (OECD, 2022), the amount of plastic waste produced globally is on track to almost triple by 2060, with around half ending up in landfill and less than a fifth recycled; this situation being completely unsustainable. For that, it is urgent to make the lifecycle of plastics more circular. This means an expansion of national policies and improved international co-operation to mitigate environmental impacts all along the value chain. Circularity and climate neutrality of the plastics industry is possible. It is from what we propose our main goal of the work: to know the environmental impact of plastic waste generated at the university, specifically at the Faculty of Economics and Business.

3.2. Methodology of the challenge

Within the framework of the I3KD22-36 Erronka on project, a collective challenge is proposed for the students of the Faculty of Economics and Business (Headquarters) in which they can develop and acquire skills in sustainability. The challenge that is proposed is aimed at promoting environmental sustainability linked to SDG 13 (climate action). The challenge that students must face is the analysis of the waste generated in the Faculty of Economics and Business (headquarters) within the University of Basque Country UPV-EHU, analysing its composition and calculating the Carbon, Water and Environmental Footprint. A plan to reduce the volume of waste and with it its environmental impact.

The development of the collective challenge is planned to develop in several academic years in such a way that progress in the research is progressive. As we can see in table 1, during the first two year of the challenge, we completed phase 1 and 2.

Table 1. Phases of the CHALLENGE.

ACADEMIC YEAR	PHASES
2022/2023 & 2023/2024	Phase 1: main idea, questions, design of the challenge Phase 2 (Research): guiding questions, activities and resources.
2024/2025	Phase 3: improvement measures for the reduction and recycling of waste, reduction of environmental impact
2025/2026	Phase 3: involvement of all faculty groups

Source: own.

3.3. Main results

The first step supposes to involve the affected people, in this case, the university students. To this end, *Aguas Alzola Company* held a conference¹. The topic of the conference was the eco-design of containers and packaging, very useful to develop the programme. Later, during the investigate step, we could carry out our work using different modalities: two face-to-face sessions for collaborative work, collaborative work and non-face-to-face activities. For that, we followed five steps: firstly, we developed guiding questions to a better identify the solution to the challenge. For this, we applied the brainstorming technique. Secondly, we reviewed the questions posed; the similar ones were combined, categorized and prioritized. Thirdly, a list of activities and resources that will be used to answer the guiding questions was made. Once the activity resource was identified, a process of searching was made. Fourthly, a summary of the finding found was carried out and the foundation for the solution was created. In addition, finally, a solution concept is proposed.

¹*Aguas Alzola* is a Basque company considered socially sustainable.

Table 2. Step forwards of the challenge (2022/2023 & 2023/2024 academic year).

Phases	Modality	Activity
Step 1: Involve	Face to face session	Conference Waters of Alzola Topic: Ecodesign of containers and packaging
Step 2: Investigate	Two face-to-face sessions for collaborative work	Design of the guiding questions: what we should know GUIDE ACTIVITIES (Learning activities, research, experimentation, exploration (how we obtain information) GUIDE RESOURCES (Web pages, podcasts, movies and documentaries, talks, books)
	Collaborative work	Individual work
	Non-presential activities	Team work
Step 3: Act	Final assessment	Learning outcomes
	Assessment	Environmental impact

Source: own.

The main results of this first contact with the programme are the followings:

1. There is a lack of identification of the types of containers used for recycling, which makes it difficult to use them correctly. Many of them do not specify what needs to be recycled in each of them.

2. There is a disorganization in terms of the placement of containers. They are located separately and without any apparent logic. We found containers to recycle organic, plastic and paper together, but a container for scraps is missing. However, in other areas of the faculty, there is only organic bin, no container for plastic or remains, which means that recycling is not carried out.

3. There is a lack of identification of containers, which makes it difficult to know which material is recycled in each one. To this problem is added the lack of bags of their respective colours for the correct identification of the containers. There is even an incorrect use of coloured bags, using all the same colour for all containers.

4. There is a lack of respect for the use of study rooms, where, even if eating is not allowed, there are organic containers full of all kinds of garbage.

4. Conclusions

It is important to highlight the continuous need for the correct use of available material, such as plastic or paper, among others. As we have commented along this paper, every time we use more plastic and, despite talking about recycling, what is clear is that we are still far from doing it correctly.

The main aim of this paper is to introduce a waste program call “Zero waste”, and to know and analyse the problem that there is with recycling within the University of Basque Country UPV-EHU, specifically in the Faculty of Business and Economics. To carry out this work, CBL methodology has been carried out so that students face a real problem and can work as a team and based on a specific challenge.

After the analysis, we could say there is lack of identification of the types of containers used for recycling, a disorganization in terms of the placement of bins, a lack of identification of containers and a lack of respect for the use of study rooms.

As a pilot test of the “Zero Waste” programme, the results have been satisfactory in terms of participation by teachers and students. It is true that the results in terms of efficiency in the use and recycling of plastic have been very poor. Reality indicates an urgent need for recycling within the faculty. To this end, we propose two proposals that are very easy to implement: a reorganization of garbage containers and a talk to first year students about the need for recycling and the correct use of containers.

Acknowledgments

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PHYSICAL THERAPIST STUDENT PREFERENCE OF A PROGRAM-SPECIFIC YOUTUBE CHANNEL FOR INSTRUCTIONAL VIDEOS

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Abstract

Instructional videos are frequently used in physical therapy education, with a recent increase in use since the COVID-19 pandemic and as more hybrid programs develop. Several studies have shown that inclusion of videos in higher education courses improves student learning outcomes. Instructors often use already existing videos from various sites, including YouTube. It can be time consuming to find videos that demonstrate exactly as an instructor would like and research has shown that the content quality and reliability of these videos can be poor to fair. The purpose of this project was to assess student preferences related to instructional videos, and then develop a private YouTube channel with videos created by the program instructors. A needs assessment survey was sent out to 3 cohorts of students who were current or recent graduates of the physical therapy program. The survey determined areas and topics in which students felt supplemental instructional videos would be beneficial to learning. Most respondents felt the implementation of a program-specific YouTube channel would be a valuable resource. Most topics identified for video development were related to skills within the Movement Science, Musculoskeletal, Advanced Manual Therapy, and Neuroscience courses. These videos were developed and edited with the assistance of 3 students working on their doctoral project. Videos were uploaded to the program-specific YouTube channel and their use was initiated within the courses during the past year. Students were provided with links to the videos, and some were embedded into the learning management system for the courses. Students in the graduating class of 2023 completed a survey to assess their use and preferences related to these videos. There was an overall response rate of 81.8%, and of the respondents, 94.4% of them reported using the instructional videos provided in the courses. 76.5% of respondents found the videos with their course instructors to be more helpful than other videos found on the internet and 88.9% of the respondents agreed or strongly agreed that they preferred videos with their course instructors demonstrating skills as compared to other videos. The follow-up survey results showed a strong student preference for the use of instructional videos featuring their own course instructors. These results have led to the continuation and further development of DPT program instructor-featured videos and the use of the program-specific YouTube channel.

Keywords: *Instruction, video, YouTube.*

1. Background

Instructional videos are frequently used in higher education, with a substantial increase in utilization since the COVID-19 pandemic and as more online and hybrid programs have developed. Several studies have shown that inclusion of videos in higher education courses improves student learning outcomes. Demonstration and instructional videos are often incorporated into health professions education programs with most studies focused on nursing programs. Clerkin et al. (2022) found demonstration videos to be effective teaching tools for nursing students learning psychomotor skills. When compared to either traditional in-class teaching approaches or instructional video alone, Noetel et al. (2021) found that supplementing existing teaching methods with video had the most significant learning benefits. Miner and Stefaniak (2018) found that undergraduate students perceived multimedia videos as aiding in their learning. Similarly, nursing students have reported a preference for instructional videos via the YouTube platform rather than traditional in-class demonstrations (Burton, 2022). Weeks and Horan (2013) found that physiotherapy students who used video resources when preparing for practical examinations reported it to be a positive learning activity that assisted their learning.

Course instructors who incorporate instructional or demonstration multimedia, often use already existing videos from various sites, including YouTube. It can be time consuming to find videos that demonstrate exactly as an instructor would like. Many videos related to allied health professions have been created by students and may not convey accurate or comprehensive information (Bachman, 2020). Studies have shown that the content quality and reliability of many healthcare related education videos found on YouTube can be poor to fair at best (Kunze et al., 2022; McMahon et al., 2022). Instructors may also create their own videos to ensure the content is aligned with their objectives. However, some faculty may be hesitant due to the time commitment to create the content and others may lack comfort with the technology required to do so (Miner & Stefaniak, 2018).

2. Purpose

In response to student feedback following the increased use of instructional videos during the COVID-19 pandemic, a project was initiated within the Doctor of Physical Therapy (DPT) program to create a program-specific video library. This study investigated the need for and preferences of students pertaining to instructional videos within the DPT curriculum. Specifically, this project sought to determine if DPT students preferred instructional videos made by and featuring their instructors versus those from outside sources that do not feature their faculty members.

3. Methods

A needs assessment was conducted via an online, anonymous survey sent to the graduating classes of 2021, 2022, and 2023. The assessment surveyed if students felt a centralized DPT program YouTube channel with supplemental video demonstrations and mini-lectures would be beneficial to student learning. Additionally, the needs assessment asked a series of questions to identify topics across all courses of the curriculum that students felt could be better understood with access to supplementary videos (Figure 1). The question options for each course were determined in consultation with 3 DPT students who assisted on the project. Respondents were given the option to specify any other topics they felt could benefit from supplemental videos.

Figure 1. Sample question from needs assessment.

7. Please select any topics in the Clinical Skills I course that you feel would be easier to understand with access to video demonstration or a mini-lecture.
- Goniometric measurement performance
 - Manual muscle test performance
 - Manual muscle test grading
 - Draping and positioning
 - Transfers
 - Wheelchair management
 - None
 - Other (please specify)

The assessment yielded 41 responses with 95% of those indicating that the development of a program-specific YouTube channel would advance learning. Most areas identified as potentially being enhanced by the addition of instructional videos fell within the following courses: Clinical Skills, Neuroscience, Movement Science, Advanced Manual Therapy, and Musculoskeletal Management. Videos specific to the topics identified in the needs assessment were developed and edited with the assistance of 3 students working on their doctoral project. The videos were uploaded to the program-specific, private YouTube channel and their use was initiated within the courses during 2022 – 2023 school year. Students were provided with links to the videos, and some were embedded into the learning management system for the courses.

An anonymous survey was administered to the graduating class of 2023 to assess their use and preferences related to these videos after having access to them in their courses. This specific cohort was chosen for the follow-up survey due to the timing in which they entered the program. These students had significant exposure to non-instructor created videos that were used during 2020 and the spring of 2021 when many courses were taught online or in hybrid format. Given the sequence of the curriculum, these students also had significant exposure to the instructor created content on the program-specific YouTube

channel. Therefore, these students were thought to have the greatest ability to compare the two types of videos. Students were specifically asked about the videos utilized in their Musculoskeletal Management II course due to the timing within the curriculum and the large number of videos incorporated into the class.

4. Results

The follow-up questionnaire had an 81.8% response rate, with 18 of 22 students in the cohort completing the survey. Of the respondents, 94.4% reported viewing the videos associated with the course materials. 76.5% of the students felt the videos featuring their own instructors were more helpful than those not made by, nor featuring, their faculty (Figure 2). The remaining 23.5% of respondents were unsure if the instructor videos were more helpful than those not including their DPT faculty. Additionally, when asked to rate their level of agreement with the statement, “I prefer instructional videos that show my course instructor demonstrating skills as compared to others found on the internet,” 88.9% of students either strongly agreed or agreed. The majority strongly agreed (66.7%) with this statement, indicating a solid student preference. The remaining 11.1% of respondents were neutral with respect to their agreement with the statement of preference (Figure 3).

Figure 2. Follow-up survey response data regarding helpfulness of videos.

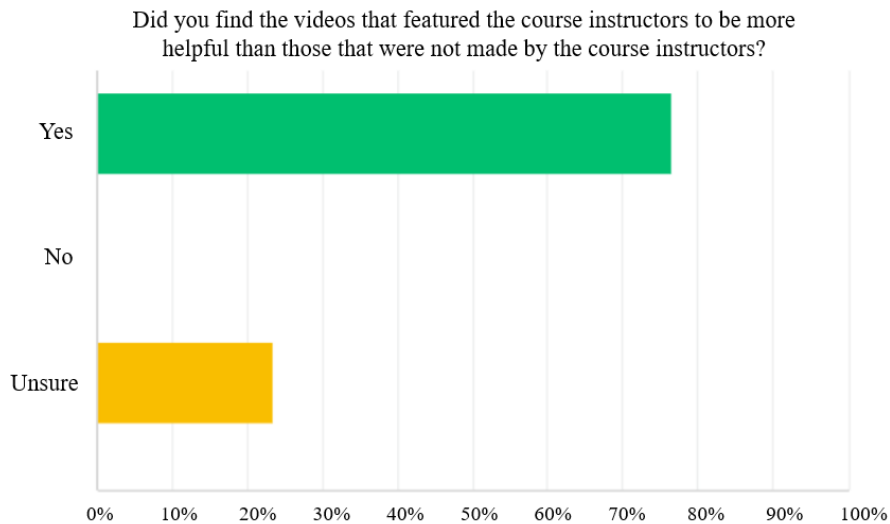
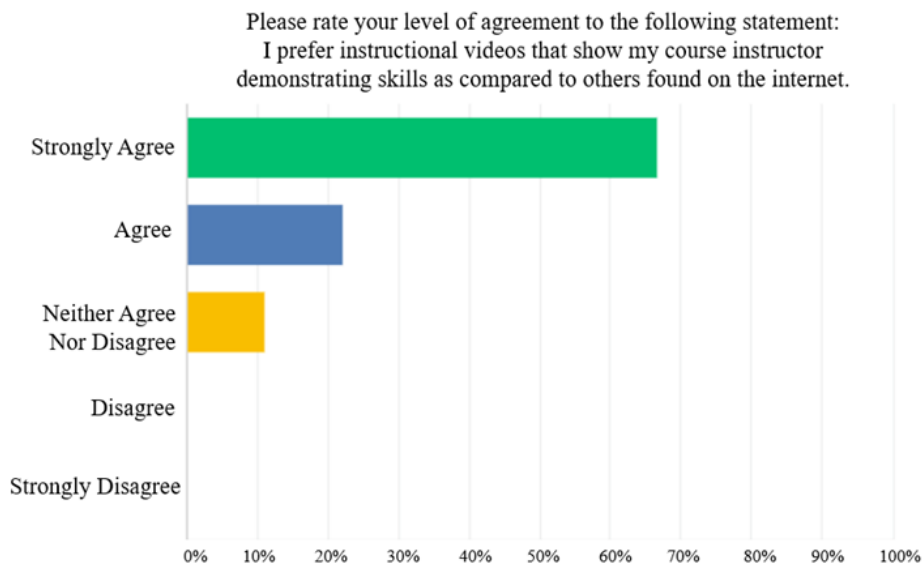


Figure 3. Follow-up survey response data regarding student preference.



5. Discussion

The initial needs assessment showed a strong student desire for a program-specific YouTube channel to access instructional videos to supplement other learning resources. Most students responding to the follow-up survey in the class of 2023 preferred videos that showed their own course instructors demonstrating skills and felt these videos were more helpful in their learning than those not made by their faculty. While this was a small sample size, the results did support findings from previous studies that showed students wanted multimedia videos included in their learning. Additionally, this found that students may be more interested in utilizing supplemental videos that are created by their own instructors.

While there can be a substantial time-commitment to initially develop the videos, DPT faculty may be wise to invest in creating their own multimedia to support their other teaching methods. Once the videos have been established, they may be easily integrated into courses in future years. Faculty creation of their own video content can also ensure validity and accuracy as compared to what may be found in other online sources. Those who may be uncomfortable with the technology necessary to develop instructional videos are encouraged to seek out assistance from their institutions' digital education or information technology department, or instructional design specialists if available.

Prior studies have shown students who utilize demonstration-based videos have positive learning outcomes. It is quite possible that instructor-featured videos may increase the likelihood of these videos being utilized given student preferences. As the program-specific video library continues to grow and develop, follow-up studies may be conducted to assess the impact on learning outcomes specifically in DPT programs, in addition to student perceptions within a larger sample size.

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LEARNING COMMUNITY SCHOOLS IN THE ALENTEJO – ANALYSIS OF INCLUSIVE EDUCATION PRACTICES

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Abstract

The diversity of the school population that currently attends school embraces a great cultural, social, ethnic richness that implies many challenges that need to be addressed effectively, so that all children, without exception, have the right to an (inclusive) education that responds to their (this) plurality. In this context, an inclusive school identifies and overcomes the barriers and obstacles caused by the students' circumstances that difficult their learning and participation in the life of the school and the community in which they live. By promoting and implementing differentiated pedagogical strategies that take into account and respect the singularity and specificity of each student, they can fulfil all their potential, promoting real participation, an increased sense of belonging and school success (Booth & Ainscow, 2002). The INCLUD-ED project, having identified Successful Educational Actions (SEAs) that are universal and transferable to all types of contexts (Flecha, 2015), aims to achieve school success for all, promoting social cohesion. In this process, it transforms schools into learning communities (LC), emphasising family and community interaction and participation as fundamental aspects. The present research has a qualitative nature, based on case studies, and aims to understand how schools which are implementing the INCLUD-ED project, located in Alentejo/Portugal, operationalise the guidelines for inclusive education. In this study, we used semi-structured interviews, focus groups and observation of SEAs in different contexts. The sample is made up of teachers, family members, volunteers and students, with the objective of understanding the degree of adhesion (and difficulties) in implementing this approach by the educational community. The aim is to find out which SEAs have been implemented, at which levels of education, what impact they have had on the inclusion of all students, on their educational success and learning, and, in general, on improving relationships and social coexistence between all members of the educational community, as well as understanding whether the school is understood as a LC, in the sense proposed by INCLUD-ED, or at what stage it is in this process. We discuss the impact of this approach on children's learning and conviviality in educational community.

Keywords: *Inclusive education, schools, learning communities, INCLUD-ED project.*

1. Introduction

The student's diversity and the acknowledgement of their differences substantiates the importance that should be given to issues of inclusive education.

In this matter, we shouldn't refer only to the inclusion of children and young people with difficulties or disabilities, as it was in the past (Roldán et al., 2021), but to all children and young people attending school. In this sense, we should refer to everyone that, not only reveal some kind of learning difficulty or disability, but also to all that are in a fragile and vulnerable social, economic, and cultural situation, that can lead to exclusion (Martins et al., 2023).

Inclusive education considers a holistic approach of the student, creating mechanisms, changes in school policies and practices, that are responsive and effective to address the individuality of each student, thus accommodating their needs and weaknesses and their strengths and potential as well. It also aims to enable real participation in school life, and to increase their sense of belonging and academic success (Booth & Ainscow, 2002).

In Portugal, inclusive education is a legal imperative, as it is the law itself that establishes the principles and standards that "guarantee inclusion, as a process that aims to respond to the diversity of needs and potential of each and every student, through increased participation in the learning processes

and in the life of the educational community” (Decree-Law No. 54/2018, p. 2919). According with this document, each school must find ways of coping with students’ differences and to adapt teaching processes to the individual characteristics and conditions of each student (Martins et al., 2023).

2. INCLUD-ED project, inclusion, and school as a learning community

The INCLUD-ED project - Strategies for inclusion and social cohesion in Europe, is a research project, coordinated by the Research Centre for Theories and Practices for Overcoming Inequalities – Community of Research in Excellence for All (CREA) at the University of Barcelona.

The INCLUD-ED project identified practices, successful educational actions (SEAs) in communities that improve academic results and coexistence, contributing to greater social cohesion, which should be implemented in schools that want to become learning communities (LC).

The SEA’s proposed for implementation in a LC are divided in two main groups: “inclusion actions, which are based on specific approaches to grouping pupils and allocating human resources. The second is successful types of family and community participation in schools, which are promoting school success” (Universitat de Barcelona, 2012, p. 20).

Therefore, the SEAs identified were interactive groups, extending learning time and dialogic reading. SEAs based on family involvement in schools consist in family involvement in learning activities, family education through dialogic literary gatherings, and participation in school evaluations and decision-making (Flecha, 2015).

A LC is a proposal for social and cultural transformation that starts in schools and spreads to the whole community through the participation of families and volunteers in school decisions and activities, and the implementation of a set of educational successful actions.

3. Case Study

Our case study was developed in a cluster of schools located in the south of Portugal, in the Alentejo’s Region, made up of twelve schools from urban and rural communities. It covers school levels from pre-school to secondary education.

It has a school population of 1885 students, of which 142, that represent 7,5%, are foreign, from 17 countries and 4 continents (with particular emphasis on students from Brazil, Angola, India, China and Pakistan). Its staff consists of 240 teachers and 122 non-teaching staff.

This cluster of schools is implemented in an educational territory of priority intervention, due to the contexts of low socioeconomic status of the community it serves. It’s implementing SEAs since 2019.

3.1. Materials and method

Our study has a qualitative nature, based on case studies. The data collection techniques used were semistructured interviews with teachers, parents, and community volunteers (as described in table 1), focus groups with students (table 2) and observation of SEAs in different contexts. Interviews and focus groups were audio recorded and transcribed.

Table 1. Adults’ interviews sample description.

Sample	N°	Gender		Ages (years)	Sample description
	18	F	M	35 - 81	
Teachers	8	2	6	48 - 66	School headmaster Project coordinator Special education coordinator 2 Primary education teachers (implementing dialogic reading and interactive groups with primary education students) 2 Secondary teachers (implementing dialogic reading; attending Dialogic Pedagogical Training; liaising with Senior University 1 Special education teacher
Parents	8	1	7	35-46	4 Participants in interactive groups 4 With children enrolled in dialogic reading From those, 1 is an operative worker and 2 are teachers at the school; and 1 is a specialized expert of the municipality, also working at the school)
Volunteers	2		2	80 - 81	2 Senior University students usually engaged in SEAs

Of the 18 interviews carried out, 8 were with teachers, with different school roles. Another 8 were with parents, with different experience in participating in SEAs: some with experience in interactive groups, others with experience helping their children, at home, preparing dialogic reading. We have to highlight that some of the parents interviewed also have professional roles at the school: teachers and non-teaching staff. Of the latter, a specialised expert and an operative worker. We also interviewed 2 volunteers, Senior University students, usually engaged in SEAs.

Three focus groups were held with students from different educational levels (see table 2).

Table 2. Students' focus group sample description.

Students	Education Level	N. °	Gender		Ages (years)
			F	M	
Focus group 1	Primary	5	2	3	7 and 8
Focus group 2	Middle primary	5	4	1	11
Focus group 3	Secondary	7	4	3	14-16

One of the observed SEAs was a dialogical reading, in the school library, with the tenth graders, with 27 students (14 girls and 13 boys) and 3 teachers present (including the teacher/mediator), where a Vincent Van Gogh's painting was analysed. We also observed a dialogic literary gathering, in the school library too, open to everyone in the local community, which was attended by 19 people (17 women and 2 men): teachers, students, elderly people/students from the Senior University, representatives of the municipality, ...). A scientific paper concerning gratitude was discussed.

Our aim was to understand how this cluster of schools, which is implementing the INCLUD-ED Project, operationalizes the guidelines for inclusive education. Particularly:

- Which SEAs have been implemented, at which levels of education;
- Which degree of enrolment (and difficulties) in implementing this approach by the educational community.
- What impact they have had on the inclusion of all students, on their educational success and learning, and, in general, on improving relationships and social coexistence between all members of the educational community.
- Whether the school is understood as a LC in the sense proposed by INCLUD-ED, or at what stage it is in this process.

3.2. School case study – first conclusions

Our first conclusions, based on our case study, are that the implementation of the INCLUD-ED project was a challenge from the Ministry of Education (ME), in July 2019.

Since the beginning, training was a huge concern, and so ME (and CREA) provided initial training, in Lisbon, to four elements of the school, considered key elements to the implementation and dissemination of the project. As this school has its own training centre, it's possible to continue the training of teachers from this and other schools.

The main obstacles in the implementation of the project, besides the pandemia, had to do with the teachers, their role and profile. The chosen coordinator has to be someone that besides dynamizing the project in the whole school, must truly believe in it and has to be inspiring to others. There has been some resistance from some teachers in the implementation of the SEAs. Teachers have some concerns adopting approaches and methodologies different from those that they usually apply in the classroom. They think this will overload them with work, and they are very focused on the formal curriculum as well. There has also been some questions about its applicability at more advanced levels of education. For one hand regarding students ages, younger students can be more easily captivated for this type of action, and in the other hand, particularly in secondary education, there is a huge concern with the external assessment by

final exams. Moreover, it was reported that these actions are easier to develop within certain subjects, such as Portuguese, History and Maths, than Science and Chemistry.

In this cluster of schools, those interviewed consider that there are projects/initiatives that promote (and allow) inclusion at school. They give particular emphasis to the diversification of the existing training offer in the different education levels, mainly in the secondary, with a great range of vocational education, with a strong "hands-on" content, available to students. Regarding students who don't speak Portuguese, there has been a time reinforcement in Portuguese as a second language classes. Tutoring has also been a measure applied, with some effect, as well as sports-related projects dynamized through partnerships with external entities. In this matter, we must highlight measures applied to students with specific needs, emphasizing the partnership with the municipality, which ensures that the school has a team of specialized experts at its disposal.

The SEAs implemented so far are dialogic readings, mainly in primary education, and some in English classes at the secondary level; interactive groups in primary education classes; and monthly online dialogic pedagogical training.

In our study we identified four recurrent themes (that we transformed into categories of analysis) that emerged from the interviews and focus group transcriptions: (1) Impact of SEAs on learning and academic skills; (2) Impact of SEAs on socio-emotional competences and good coexistence between students; (3) Impact of SEAs on family involvement and communication and (4) Impact of SEAs on involvement and communication with the community (see table 3).

Table 3. Categories of analysis of adults and students.

Category & definition	Interviews	examples	Focus group	examples	Total (%)
	Adults		Students		
Impact of SEAs on learning and academic skills (evidence of gains in cognitive skills and students' academic progress).	37 quotes (12 adults)	"Developed love of learning" (DX5PS)	17 (10 students)	"We learn to read more" (YEPS2)	54 (38,3%)
Impact of SEAs on socio-emotional competences and good coexistence between students (evidence of improved social relationships between students and acceptance of differences).	50 (13 adults)	"Students who respect and support each other" (DX9PS)	5 (3 students)	"I think it's more of a convivial moment. We're all dealing with the same subject..." (XGPS6)	55 (39%)
Impact of SEAs on family involvement and communication (evidence of greater family involvement in the school, with impacts on students' well-being and learning, and improvements in school-family communication).	27 (13 adults)	"Families feeling integral part of the school as well" (DX6PS)	1 (1 student)	"I like it too (...) Because it's my mum, isn't it? And everyone likes to see their mums..." (YFPS2)	28 (19,9%)
Impact of SEAs on involvement and communication with the community (evidence of greater community involvement, and improvement in school-community communication).	5 (3 adults)	"We also help them... They like our presence" (VX16PS)	-	-	4 (2,8%)
Total					141

D, teacher; V, volunteer; X, female student; Y, male student

The impact of SEAs on socio-emotional competences and good coexistence between students is recognised as the biggest impact of SEAs on that cluster of school, followed closely by the impact of SEAs on learning and academic skills. It was also mentioned the impact of SEAs on family involvement and communication, and with less expression the impact of SEAs on involvement and communication with the community.

From our case study, we can also conclude that volunteers in the dynamized SEAs are mainly parents but there are also elderly people/ Senior University students.

The cluster of school is not yet considered a "real" LC, it is taking its first steps, however the existence of some small LCs is recognised by those interviewed.

The school's main challenge is the great linguistic, cultural, social, economic, geographical, ... diversity of its public, which triggers difficulties of various kinds, including lack of resources and language issues. Moreover, the classes have too many students, and their behaviour, often caused by society's or families' devaluation of the school's role, raise some concern.

4. Discussion and conclusions

Our case study covers a very heterogeneous school population, as illustrated by the number of students' nationalities. This poses certain challenges that need to be addressed. With this purpose the cluster of schools develops a series of initiatives and projects aimed at inclusion. As far as students with specific needs are concerned, the (active) role of the partnership with the municipality in providing specialised experts should be highlighted.

SEAs are more widespread in primary education, which is justified by the profile of the teachers at this level of education, who are more motivated to implement them. However, with the transition to the next levels of education, there is a gap in the dynamization of SEAs, and only at the end of middle education or even secondary, do teachers resume the implementation of SEAs. The (equal) participation of students with specific needs in these actions should be underlined, as a result of the individualised work by the teachers who accompany them.

Also noteworthy is the innovative aspect of the English teacher's implementation of dialogic readings in his classes, which is recognised as being very enriching for the students, promoting and stimulating their ability to express themselves in this language.

The greatest impact of SEAs was related with socio-emotional competences and good coexistence between students. Learning and academic skills were also emphasized. Also, the project promoted better family and community involvement in school life. These outcomes support the school's desire to expand SEAs to all levels of education, starting with pre-school, as well as to broaden the range of actions organised.

Globally, the INCLUD-ED approach as well as the other projects implemented by the cluster of schools contribute to the inclusive process.

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MITIGATING THE MICRO-POLITICAL DIMENSION OF DISTRIBUTED LEADERSHIP IN EDUCATIONAL LEADERSHIP: AN UBUNTU PERSPECTIVE

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Abstract

Distributed leadership has been widely adopted as an apolitical leadership model with little attention paid to its political dimension and its attendant implications. This study explored the inherent dynamics of the grossly overlooked micro-politics within the distributed leadership framework. It offers a novel perspective on conflict resolution anchored in Ubuntu principles. Grounded in the interpretive paradigm, the study employs qualitative methods and draws primarily from secondary data sources. The Ubuntu Theory serves as our conceptual lens with emphasis on its principles of interconnectedness, collective responsibility, and conflict resolution. Rodger's Concept Analysis Research Design (CARD) was employed to depict distributed leadership's fluid and dynamic nature with emphasis on contextual variability. The design also enables us to make sense of the data from academic literature, pertinent texts and theory. The study proposed a framework that can be harnessed to counteract the effects of micro-politics distributed leadership practice. This we believe will empower educational leaders to foster inclusivity, equity and collaborative decision-making. This study contributes to the evolving discourse on distributed leadership by offering a fresh perspective anchored in African philosophy with global implications for educational leadership practices.

Keywords: *Distributed leadership, educational leadership, micro-politics, Ubuntu perspective, conceptual analysis.*

1. Introduction

Over the last three decades, distributed leadership model has garnered significant attention as a transformative framework among scholars, policy makers and education practitioners. The model challenges the conventional hierarchical structures that were prevalent in educational institutions (Spillane, 2006; Joslyn, 2018; Potter, 2023). Central to distributed leadership is decentralising leadership practices across stakeholders deemed capable of holding leadership positions rather than ascribing authority to the school principal or administrative leader. The model has been applauded for its attribute to cultivating an inclusive, participatory, and dynamically responsive school system. However, the normative proponents of the model depict it as apolitical- showcasing it as immune from the entanglements of micro politics (Harris, 2008; Berkovich, 2020; Or & Berkovich, 2023). The apolitical perspective overlooks the complexities of distributed leadership, especially in educational settings characterised by power relations, networks of influence, and subtle political manoeuvres. Regardless of their magnitude of influence, such micro-political forces shape distributed leadership practices in schools (Gronn, 2000; Bush, 2022). Therefore, ignoring these political implications in distributed leadership may undermine its objectives (Piot & Kelchtermans, 2016).

This study attempt to fill the identified in previous studies by examining the overlooked roles of micro-politics in distributed school leadership. The study utilised Ubuntu Theory principles to counteract the adverse effects of micro-politics with a view to enhance school leadership effectiveness cum inclusivity. It is our hope that this exploration will not only expand theoretical understanding but also offer practical insights. Thus, we propose a framework that leverages Ubuntu's philosophy to mitigate the potential negative impact of micro politics within the distributed leadership model. This we believe will be beneficial to educational practitioners and policy makers.

Research Questions

The study sought to answer the following questions:

1. How do micro-political dynamics manifest within distributed leadership structures in educational settings?

2. What are the implications of these micro-political influences on decision-making and leadership effectiveness within distributed leadership models?
3. How can the principles of Ubuntu Philosophy be leveraged to mitigate the negative impact of micro-politics and enhance the functioning of distributed leadership structures?

2. Theoretical underpinning

2.1. Distributed leadership theory: An overview

Distributed leadership theory is a perspective that views leadership as a collective phenomenon that is distributed among multiple actors in an organisation rather than a role or position that is assigned to a single individual (Spillane, 2006; Bush, 2023; Sasere & Makhasane, 2023). It is a leadership model that challenges the traditional assumptions of hierarchical, top-down, and individualistic models of leadership by emphasising the importance of collaboration, interaction and shared decision-making among leaders and followers (Harris & Lambert, 2003; Leithwood et. al., 2006). However, distributed leadership theory also faces some challenges and criticisms, such as the lack of clarity and consistency in its definition and measurement, the potential for role confusion and conflict among leaders and followers, and the difficulty of balancing distributed and formal authority in schools (Göksoy, 2015). Specifically, the challenge of role confusion and balancing formal authority gave room for micro-politics to manifest within a distributed leadership structure. Therefore, distributed leadership theory requires further empirical and conceptual development to address these issues and to enhance its relevance and applicability for educational institutions.

2.2. Ubuntu theory

Ubuntu is an humanistic philosophy from African tradition that emphasises the value of community, compassion, and respect for others. (Rasweswe, 2024). It is encapsulated by the aphorism that states "I am because we are," meaning personal identity is formed through communal relationships (Tutu, 2011; Paulson, 2019; Chigangaidze et al., 2021). It is worth noting that Ubuntu was instrumental in fostering social transformation and justice in post-apartheid South Africa – a politically polarised country in the past (Tutu, 2011). Ubuntu is enshrined in the principles of *interconnectedness, collective responsibility, respect and dignity as well as conflict resolution and reconciliation*. **Interconnectedness:** This principle underscores the consciousness of connection that exists among community members. It holds that individual well-being is inextricably linked to and depicts communal health. By extension, the tenet holds that the connection transcends human-to-human relations to include the relationship between humans and nature (Poovan et al., 2006; Gade, 2012). Drawing from interconnectedness principle, individual derive their relevance from others. Hence, people should be kind and compassionate while dealing with others. **Collective Responsibility:** Given that Ubuntu is characterised with a sense of community togetherness, this principle promotes joint responsibility among community members. It encourages individuals to contribute to the common good and support one another. This ethos fosters solidarity and generosity especially towards the needy and vulnerable (Poovan et al., 2006; Richard, 2009). **Respect and Dignity:** Ubuntu places emphasis on the respect and dignity of community members in addition to the principles mentioned earlier. Through this principle, Ubuntu promotes empathy, compassion, and concern for others' well-being while also valuing diversity, tolerance and inclusion across different cultures (Paulson, 2019; Thompson, 2023). **Conflict Resolution and Reconciliation:** Noting that conflict is inevitable where protection of interests are involved, Ubuntu advocates open dialogue, forgiveness, and reconciliation with a view to heal divisions and strengthen community ties. Additionally, the principle emphasis restorative justice rather than punitive measures (Paulson, 2019; Tutu, 2011).

3. Methodology

3.1. Concept analysis research design

The study adopts a Concept Analysis Research Design (CARD) to bridge the gap in the normative apolitical distributed leadership perspective. Concept analysis, as proposed by Rodgers (1989), is a systematic approach used to clarify and provide a deeper understanding of complex concepts within a specific context. It involves developing and clarifying concepts (Toftthagen & Fagerström, 2010). The design assumes that concepts are dynamic and change over time which indicates the evolution of knowledge and practice. In the context of the present study, the normative distributed leadership model has gained global momentum as an ideal leadership framework that is apolitical. Essentially, CARD offers a structured and thorough comprehension of a concept and its interconnections with other concepts. Its purpose extends to guiding research, education, and practical applications. This design is particularly suitable for unpacking the intertwined nature of distributed leadership and politics in educational institutions. In addition, during analysis, we adhere to Laurence & Margolis (2003) principles of logical induction, deductions, and critical arguments within the existing literature.

4. Literature review

This section presents the literature review with a view to locating this study within the body of knowledge in the domain of education leadership with a special focus on micro-politics and distributed leadership.

4.1. Distributed leadership: The revelation of its political dimension

Distributed Leadership Theory is one of the leadership models used in contemporary contexts to understand and improve educational leadership. It advocates for a collective and collaborative approach to decision-making, where leadership roles and responsibilities are shared among multiple actors. However, some scholars question the political nature of distributed leadership and whether it is truly apolitical or neutral. Hence, we examine some of the scholarly debates on this topic and explore the implications and limitations of the prevailing normative and prescriptive distributed leadership theory from a political perspective. This we do first by asking a pertinent question: Is distributed leadership truly apolitical? We also examined the intricacies of balancing collaboration with authority, the inadequacy and variability of empirical evidence, contextual variations and the decision-making process vis-a-vis leadership effectiveness.

4.2. Is distributed leadership truly apolitical?

One of the main debates on the political nature of distributed leadership is whether it is possible to distribute leadership without introducing political elements. Some scholars contend that the very act of distributing leadership inherently involves negotiations, power dynamics, and the potential for conflict (Hangartner & Svaton, 2022). They argue that decision-making, regardless of the structure, is influenced by different actors' interests, values, and agendas. For instance, Maxcy and Nguyen (2006) explored the intricate political dimension of distributed leadership within the education system. They contend that these frameworks often adopt a traditional and depoliticised approach to the concept of leadership distribution. Literature indicates the challenge of balancing collaboration with authority and contextual variability as a basis for micro politics as indicators of micro politics that characterised distributed leadership. ***The challenge of balancing collaboration with Authority:*** According to Spillane (2006), leadership responsibility could be conferred on a staff member who demonstrates competency in a given area, even if such staff have no formal leadership portfolio. However, distributing leadership responsibilities to individuals with no formal/official portfolio often results in difficulty in balancing collaboration with authority in leadership. This situation raises questions of legitimacy in exercising authority by those conferred with such responsibility. This view was shared by Atencio and Herbst (2022), who noted that maintaining the balance between collaboration and authority within distributed leadership could be challenging. Additionally, the challenges of collaboration with authority in distributed leadership include difficulty, lack of follow-through, lack of efficiency, lack of acceptance, and dealing with immature team members. In a recent study, Hangartner and Svaton (2022) explored power relations between headteachers and teachers in the context of distributed leadership in Switzerland. The study reveals that New Public Management reforms (which subscribe to distributed leadership) lead to tensions between headteachers and teachers due to conflicting expectations. ***Contextual Variability as a Basis for Micro Politics:*** The apolitical perspective of distributed leadership models acknowledged the role of institutional forces in introducing a distributed leadership model into an organisation. However, it overlooked the specific effects of unique organisational contexts. Harris et al. (2022) state that "it is more difficult to empirically investigate distributed leadership because of the multiple sources of influence, but it is not impossible", p. 441. From a continental perspective, Lumby, Crow and Pashiardis (2009) compare how distributed leadership is practised in different countries and regions, such as England, South Africa, China, and Latin America. The result suggests that various factors influence distributed leadership, such as historical traditions, cultural norms, institutional policies, and external pressures. In another study, Ciuk and Schedlitzki (2022) investigated how context influences the development and distribution of leadership within an organisation. The study was an in-depth case study of a private organisation trying to recover from a turbulent past by adopting a distributed leadership model. The findings indicate that social and political dynamics cum overarching forces significantly shape the objectives and effectiveness of distributed leadership.

4.3. Micro-politics influences on decision-making process and leadership effectiveness

The impact of micro-political influences on decision-making and leadership effectiveness within distributed leadership models is a subject of growing interest and importance (Or & Berkovich, 2023). Micro-politics encompasses the subtle and often concealed forces that shape organisational behaviour and actions, including factors such as power, values, emotions, and personal agendas. In the context of distributed leadership models, where leadership responsibilities are shared among multiple individuals,

these micro-political influences exert a profound effect. Recent research by Or and Berkovich (2023) underscores the impact of micro-political influences on decision-making and leadership effectiveness within distributed leadership models. Their study explored participative decision-making processes in both individualist and collectivist cultural school contexts. The findings reveal that micro-political tactics, such as information manipulation, coalition formation, and social influence are frequently employed during participative decision-making processes. Given the above exploration, it is evident that distributed leadership is not totally devoid of politics. Hence, we advance a framework to mitigate the negative impact of micro-politics within distributed school leadership.

5. Proposed framework: Ubuntu-Informed Distributed Leadership Framework (UIDLF)

Drawing from the Ubuntu theoretical underpinning, we proposed an Ubuntu-Informed Distributed Leadership Framework (UIDLF) as a remedy to the micro-political dimension of distributed leadership. Specifically, UIDLF aims to mitigate micro-politics by emphasising interconnectedness, collective responsibility, respect and dignity, and conflict resolution. We posit that, *interconnectedness* fosters stakeholder collaboration (Radwan, 2019), while *collective responsibility* diffuses power concentration and power struggle (Rogers et al., 2020). We also advance that, *respect and dignity* guide leaders to value diverse viewpoints (Leithwood & Mascall, 2008; Mkhasibe, 2023), while *conflict resolution* promotes enduring peace (Tiky, 2018; Ngunjiri & Hernandez, 2017). Overall, it is believed that UIDLF will serve as a framework for school leaders to mitigate and navigate micro politics in their schools.

6. UIDLF implications for global educational leadership practices

It is pertinent to state that Ubuntu-Informed Distributed Leadership framework transcends cultural and geographical boundaries; it is globally adaptable across diverse educational contexts. Regarding its global relevance, the framework promotes inclusivity and equity, fosters collaborative decision-making, enhances cultural sensitivity and tolerance and mitigates power struggles and micro-politics.

7. Conclusion

The study examined the intersection of distributed leadership theory, micro-politics dynamics influencing school leadership and the mediating potential of Ubuntu Theory. We unpacked the interconnectedness of these concepts to illuminate a new trajectory for school leadership that transcends apolitical distributed leadership paradigms. Hence, we advanced an Ubuntu-Informed Distributed Leadership Framework (UIDLF) as a strategy to mitigate the detrimental influence of micropolitics in school leadership.

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RELEVANCE OF STUDENTS' MENTAL HEALTH AND WELLBEING IN HIGHER EDUCATION: A COMPARATIVE CASE STUDY

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Abstract

Mental health and wellbeing of students in European higher education institutions have gained significant attention in recent years, moreover after Covid-19 pandemic. And even though a couple of years have already passed since the pandemic, the current events in Europe and in all the world as well as the problems of mental health and psychological well-being now are no less relevant, which is why it is appropriate to study them. Educational management plays a crucial role in addressing these concerns, as it encompasses various practices and policies that can either support or hinder students' mental health. This study aims execute a comparative case study to explore the relationship between educational management, mental health and wellbeing of European higher education students in two countries: Lithuania and Spain. Research in two countries will enable to validate the methodology and the questionnaire, which could be applied in other contexts also. This survey also enables to assess students' mental health status, levels of stress, anxiety, and depression, as well as their perception of the support services and resources available to them. Comparative analysis of survey responses will provide insights into the variations in educational management approaches and their impact on students' mental health and wellbeing. The comparative case study approach will enable the identification of best practices, effective strategies, and innovative initiatives that positively influence student mental health outcomes. The study's outcomes will inform policy recommendations and provide guidance for higher education institutions seeking to enhance their educational management practices to better support student mental health and wellbeing.

Keywords: *Mental health, wellbeing, higher education institutions, Spain, Lithuania.*

1. Introduction

Mental health and wellbeing of students in European higher education institutions have gained significant attention in recent years, moreover after Covid-19 pandemic. And even though a couple of years have already passed since the pandemic, the current events in Europe and in all the world as well as the problems of mental health and psychological well-being now are no less relevant, which is why it is appropriate to study them. Educational management plays a crucial role in addressing these concerns, as it encompasses various practices and policies that can either support or hinder students' mental health.

Quality of life represents a core concept of this proposal and is understood in the sense of the realization of the possibilities of satisfying basic or survival needs (food, shelter, shelter), as well as other equally important needs, since they make existence richer, fuller, more dignified and happier, especially in relation to health and mental well-being.

How to ensure that students as future full citizens participate effectively in the various spheres of economic, political and cultural activity; that they have the opportunities to live in dignity and develop their capacities; that they can choose and acquire power over their lives, in harmony with individual and social values and interests?

Objectives: The purpose of this study is to develop a research methodology and instrument and to conduct a comparative case study, the purpose of which is to investigate the relationship between educational management, mental health and well-being of European high school students in two countries - Lithuania and Spain. Research in two countries would allow validation of the methodology and questionnaire, which could be applied in other contexts.

Methodology: The comparative case study approach was chosen for the empirical research, which enables the identification of best practices, effective strategies, and innovative initiatives that positively influence student mental health outcomes. Creating instrument and method of the research

there was chosen method of survey, which also enables to assess students' mental health status, levels of stress, anxiety, and depression, as well as their perception of the support services and resources available to them. Comparative analysis of survey responses enables to provide insights into the variations in educational management approaches and their impact on students' mental health and wellbeing. Taking into account these elements, we posed the following goals in this study: to determine the factors of students' psychological feeling and well-being; to assess the emotional feeling of students, to identify the needs of students to use psychological consultations, to evaluate the existing competencies for the reinforcement of psychological well-being and psychic health in different cultural contexts.

The research methodics and instrument was tested in a pilot survey, where 40 students from both countries and different study programmes were participated. One of the aims here was to design a comparative case study to explore the relationship between educational management, mental health and wellbeing of European higher education students in two countries and validate it for wider research in those as well as in other countries and contexts.

2. Design of the research

An approach that has nowadays gained significant consensus is based on understanding education as a mechanism for satisfying human needs, since it allows us to respond to our demands for subsistence, participation in social, economic, cultural and political life, self-realization, creation, mutual understanding with other people, among others (Lavin de Arrivé, 1996).

Certainly, education is an indispensable condition - although not sufficient on its own - for development and improvement of the quality of life. However, it should not be forgotten that the debate on educational quality might be a utopian and distant discourse in many regions and vulnerable groups, which face the daily scourges of economic decline, critical poverty, foreign debt, population explosion and the weakening of the social fabric.

Education is a fulfilment of human needs, but above all, it is a right protected by the Universal Declaration of Human Rights. Therefore, policies in this field must ensure, as stated in the Report of the International Commission on Education for the 21st Century, the double objective of quality and equity, which is ultimately linked to profound socio-structural changes and to the problem of mental health and well-being.

At the same time, UNESCO considers that the necessary transformations to achieve this end must be based on three primary functions to be enhanced by education: the acquisition, updating and use of knowledge from a holistic point of view with mental health. Indeed, the development of the information society has led to the vertiginous production and renewal of science and technology, which requires people to be able to obtain, select, process and apply these large volumes of data with a view to their successful performance in the various social spaces and, therefore, to greater stress in the teaching-learning process (Comission Internationale sur l'Education por le Vingt et Unième Siècle, 1996). Precisely, the issue of performance profiles has currently become one of the driving forces behind educational changes and the learning revolution, considering that the new production processes require new competencies, knowledge, skills and abilities that traditional curricula are unable to develop in the younger generations. For example, if production tends to become increasingly decentralized in terms of organizational management, performance in the corresponding spheres requires great autonomy, creativity, mastery of strategies to solve problems and seek alternatives, among other competencies that today's schools and universities do not promote in most cases.

Psychological well-being, as a socially important aspect of a person's well-being, is increasingly being actualized. According to the Description of the procedure for the provision of psychological well-being and mental health strengthening services (2020), psychological well-being is satisfaction with life and its individual areas (family, friends, financial situation, etc.), oneself, the experience of purposefulness and meaningfulness of life, happiness. In February 2021, the Lithuanian Students' Union conducted a survey, the topic of which is "Psychological state of students and support", in order to identify the well-being of students and possible reasons for changes, taking into account the changes in schools and the quarantine of the last two years. The results of the study emphasize the deterioration of the students' psychological state, three out of 4 students experience severe stress, every third - a panic attack. Negative psychological states such as great anxiety, fear or severe stress, depression, eating disorders, etc. are also experienced.

Lithuanian Students' Union in 2021 initiated and signed an agreement with Lithuanian higher schools on strengthening mental health in March. In March-April 2021, the research group of Šiaulių Valstybinė Kolegija (hereinafter - ŠVK) conducted a psychological well-being study of ŠVK students, the purpose of which is to find out the psychological well-being of students during the Covid-19 pandemic and quarantine. The survey data revealed that:

- the majority (56%) of those who participated in the survey stated that the study load increased during the quarantine;
- that their daily life (81%) and daily routine (80%) changed or changed completely;
- 57 percent stated that he/she goes to bed and gets up at different times, the sleep and activity regime is not balanced, it is difficult to plan daily activities, the beginning and end of the working day changes, the working day is extended, and rest breaks are rarely taken;
- 69 percent of respondents indicated that they had disturbed sleep during the last two weeks, for 70% - it was difficult to overcome various difficulties, 62 percent - felt constant tension, but 67 percent did not have the opportunity to discuss the problems that oppressed them during the study process;
- according to the respondents, both general mental health (49%) and emotional well-being worsened during the second quarantine (44%);
- when assessing their emotional state, the respondents stated that in the last two weeks they often felt unhappy and depressed (76%), lost self-confidence (61%), nervous (54%) and restless (43%);
- during both quarantines, the majority (74%) named conversations with family/friends/colleagues as a way to help themselves.
- However, if there was an opportunity to use psychologist's consultations in the institution, 46 percent would use it subjects.

Successful professional and social activities of students, as well as integration, require not only high professional, but also sufficiently developed general competences, which should be developed permanently. In addition to other generic competences, lifelong learning competences, especially competencies of self-directed learning (Pocevičienė, 2014, 2019, 2021a, 2021b, 2021c) are very important in this regard. All these competences are equally important, many of them are related and complement each other - aspects specific to one area strengthen the abilities of another area. Skills such as critical thinking, creativity, initiative, problem solving, risk assessment, decision-making, and constructive emotion management play a central role in the development of all eight competencies.

The study of psychological well-being in order to identify changes in the psychological and mental health of students would help to reduce the risk of similar problems in professional and social activities in the future. Especially in the case when the students themselves are actively involved in the research. In this case, students' scientific competences and positive attitudes towards evidence-based practice are also developed.

Scientific sources state that the psychosocial learning environment is an environment that includes psychological and social factors that can influence students' satisfaction, health and opportunities to study. The learning environment has a direct impact on the development of students' higher order thinking skills, psychological well-being and learning. Since the psychosocial environment also contributes to the effectiveness of learning, it is very important to assess the psychosocial factors experienced by students that affect their psychological well-being and health. Academic adaptation is also considered a key factor in the quality of academic results, as students' successful adaptation to the life of the academic community also leads to better learning outcomes. In addition, academic achievements are influenced by students' self-esteem, which increases as students' results improve and vice versa, having more knowledge and abilities increases students' self-esteem. It should be emphasized that a negative psychological learning environment can lead to the emergence of anxiety, stress, and depression among students. Stress can be related to the difficult adjustment in higher education, especially for first-year, Erasmus+ students and students from foreign countries. Students use a variety of coping strategies to deal with the stress of academic challenges, from problem solving, help seeking, healthy eating, meditation, or other pleasurable activities to tranquilizers, addictions, and other addictions.

In 2022 in the project "Strengthening the psychological well-being and mental health of Šiaulių Valstybinė Kolegija students", financed by the Lithuanian State Study Fund, after each implemented activity, students submitted written reflections on how they evaluated the organized activities. Most of the students said that participation in the activities (seminar series, individual psychologist consultations, training, board game workshops, etc.) was very useful for them, gave them the opportunity to develop practical skills and competencies (self-knowledge and assessment, stress management, emotion management, etc.). In addition, the majority stated that such activities are very necessary and useful, so they should not be one-time events, but organized regularly. Taking into account the results obtained during this project, students' general competencies will continue to be developed through the activities carried out. By creating a favourable psychological learning environment, students will have the opportunity to improve their ability to learn, cognitive and scientific competencies. In order to strengthen the adequate expression of emotions and reduce stress, project participants will strengthen mental health

competencies. By implementing activities in a multicultural environment, cultural and social civic competences will be deepened.

Based on theoretical and empirical content analysis the main parts of the survey were identified:

1. Living and studying conditions (physical aspect). Here students were asked to evaluate their living and studying conditions in their residential setting (Where they live, how they evaluate the living and studying conditions, how many people live together etc.)
2. Studying conditions (academical aspect). The main focus here is on the academical aspect of studying. The main questions are the following: How many hours per day on average do you spend studying (including lessons and independent work after lectures); How, in your opinion, the load of your studies has changed in this academic year; What do you think is a possibility that you are going to discontinue or suspend the study process in the near future (in six months) and etc.
3. Evaluation of material condition. To know about students 'material status is also relevant because if because of the lack of incomes even for the essential needs students need to work and combine studies and work their living and studying conditions could become even more complicated. Psychological welfare is related with objective factors, but it is also very important and subjective feeling and evaluation of students themselves. That's why in the survey were included questions about their opinion about how they could describe their material state; their opinion about how their material state will change in the near future (for example, in six months) and etc.
4. Evaluation of feelings. Evaluate how often in the past two weeks they felt relaxed, nervous, energetic, incompetent, active, restless, happy, annoyed, fun, do everything with great efforts, attention, negligible, cheerful, isolated, quiet, marginalized, positive, left, necessary, angry and etc. In addition, how their routine changed when they started their studies. Here could such questions as, for example, do you get up and go to bed at similar times or at different, do you plan your work time and follow the agenda, do you have regular breaks; are the beginning and end of your work day changed depending on the amount of work; is your sleep and work routine disordered, is it difficult to plan the day's activity, is your work day prolonged very often. Also, how they evaluate their feeling in general or are and what differences they meet when they started their studies.

Because psychological welfare has big impact not only on physiological but also on social aspects of people's life, into the questionnaire it is also logical to include questions about sleep, mood, happiness and etc. It is no less important to know where they able to concentrate on their present work/studies; to make important decisions independently; to find the ways to overcome different difficulties; to be confident; even to enjoy their daily activities.

It's obvious that stress, tension, especially permanent, can lead to the emergence or strengthening of bad habits (for example, drinking alcoholic, using drugs or different kinds of stimulates) those questions also were included into the questionnaire.

Living in the global world it would be difficult escape influence of the events that physically take place far from us, but psychologically, because internet, social media etc., seems that they happened near. Therefore, the reaction to them also is important and can influence about psychological welfare even if we are not directly related with them. On the other hand, some events, situation or phenomenon (for example, Covid-19 pandemic and quarantine, the war in Ukraine, inflation, the economic and energy crisis) has direct relation with our feelings and, of course, our welfare. Not less relevant, especially for the support in future, is knowledge how students overcome complicated situations in their life and daily worries. What they prefer more : to talk, to communicate a lot with family/friends/colleagues; to fall at work/studies; to look for an interesting activity, to do hobbies, physical activity (for example, walks, running, sports, manual work, etc.), to do regular exercises; to spend time on social media or/and play computer games; to go to a psychologist/psychotherapist or to psychiatrist; to take homeopathic medications/products; to read psychological articles, use emotional help apps; to write, I call emotional help lines, or even to do nothing. In addition, what opportunities are to do all this in the higher educational institution.

5. Skills evaluation. This aspect is very relevant and much related with the previous question, because to overcome challenges and difficulties it is not enough to have knowledge. It is necessary to have proper skills. And the most important skills here are general skills, especially those that are related with self-directed learning skills and competences (Pocevičienė, 2014, 2019, 2021a, 2021b, 2021c) such as to be able to reflect and evaluate problem areas and changes as well as state of psychological well-being and mental health; to integrate into the execution of project activities; to identify, indicate and overcome difficulties; to set a goal, manage time and

etc. Some special skills, that is, calculation, logical and strategic thinking, reading skills, development of creativity, etc.), to educate and use as a self-help method to overcome stress, also could be relevant.

The questionnaire was validated by the pilot research with small group of students and the results confirmed its suitability for deeper and wider research, already at least in the two countries.

Conducting a similar study in another country, i.e., in other social, cultural, economic and/or other in an environment that would enable us to understand the context of existing data, see the deeper causes of emerging challenges and problems, and provide more optimal measures for solving and/or preventing these problems.

3. Conclusions

- A survey was designed and administered to students in participating institutions.
- The main focus of the survey assessed students' mental health status, levels of stress, anxiety, and depression, emotional status, as well as their perception of the mental health support services and resources available to them.
- Comparative analysis of survey responses provides insights into the variations in educational management approaches and cultural contexts and their impact on students' mental health and wellbeing.
- An exploratory analysis was conducted with a small intentional sample of subjects in both countries to refine the research instrument. In particular, cultural, language biases and contextual specific adaptations were addressed.

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URBAN LANDSCAPES AS THIRD EDUCATOR: THE CASE OF PALAZZO MICCICHÈ AS AN EDUCATIONAL PLATFORM FOR CO-LEARNING IN NATURE

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Abstract

Reconsidering urban spaces as places of learning is essential to develop a new coexistence between humans and nonhumans. However, traditional urban development models often prioritize economic and pragmatic concerns over ecological considerations, resulting in the degradation of natural ecosystems and a disconnection between humans and the environment. This paper examines the potential of Palazzo Miccichè as transformative educational landscapes, aiming to promote sustainable urban development goals through a coexistence between humans and non-humans. The accelerated urbanization process has led to the fragmentation and degradation of natural habitats, exacerbating biodiversity loss and environmental hazards. Ecological sanctuaries as part of ecological corridors emerge as tools for mitigating these impacts by connecting fragmented green spaces, facilitating flora and fauna movement, and providing opportunities for human-nature interaction. Despite their significance, the educational potential of ecological sanctuary remains underexplored. This paper seeks to bridge this gap by investigating how ecological sanctuaries can serve as platforms for environmental education, instilling relational values with nature, and fostering collective consciousness towards environmental preservation. Through an analysis of the experience in Palazzo Miccichè, this paper outlines a conceptual framework for understanding the role of ecological sanctuary as educational landscapes in developing new routes for new alliances between humans and nature. In the course of history, man has slowly distanced himself from nature to the point of conceiving the anthropocentric vision of which we are part. To develop a sustainable future, it is essential to educate the society to new sensitivities and approaches to nature, the urban environment in this context is considered as a third educator. Moreover, the paper examines how to maximize the educational and ecological benefits of ecological sanctuaries, emphasizing the importance of community engagement and participatory processes. Learning, in fact, is an active process. By reconceptualizing urban spaces as intertwined with nature, ecological sanctuaries and ecological corridors offer promising avenues for nurturing harmonious relationships between humans and the natural world. Through education and awareness-building initiatives, these sanctuaries can serve as agents of change, inspiring sustainable behaviors and fostering a deeper appreciation for the interconnectedness of all living beings. Ultimately, the integration of ecological sanctuaries as educational landscape into urban landscapes represents a critical step towards creating more resilient, inclusive, and nature-based cities for current and future generations.

Keywords: *Co-learning, environmental education, ecological sanctuary, nature based solutions, sustainable urban development.*

1. Introduction

Cities are responsible for a significant transformation of the natural ecosystems in which they are situated, affecting biodiversity and their ability to provide services closely tied to the wellbeing of urban dwellers. At the same time, cities also serve as preferred learning arenas to experience new ways to relate to the natural world and to become more aware of the necessity to have a more balanced relationship with the animal and plant kingdoms. Within the European Commission's document on biodiversity education, it is highlighted that "Low public awareness on nature and biodiversity has been identified as a major cause for inadequate action on protecting the environment. Increased urbanization is weakening the human-nature relationship, with detrimental effects on humans as well as the environment." (European Commission, 2023) It is also emphasized that education plays a significant role

in the preservation of biodiversity. We depend on biodiversity in multiple ways, yet public awareness of its importance is scarce.

Developing a more aware relationship with nature is essential to provide a more sustainable future. The overall objective of the United Nations 'Sustainable Development Goals (United Nations Human Settlements Programme, 2020) is to address social, economic, and environmental challenges in an integrated manner, encouraging a global approach to sustainability. These goals serve as a guide for governments, organizations, and citizens, promoting concrete actions and collaborations to achieve significant results by. Furthermore, the New Urban Agenda (UN-Habitat, 2017) outlines a set of objectives aimed at fostering a more sustainable future for urban development. Specifically, it emphasizes the pursuit of social integration for vulnerable populations, economic stability, environmental preservation, and spatial organization. It underscores the importance of incorporating cultural elements into the promotion and adoption of sustainable consumption and production practices, which in turn contribute to responsible resource utilization and mitigating the adverse effects of climate change. Ecological sanctuaries and ecological corridors emerge as indispensable tools for advancing education and sustainability in economic, social, and spatial realms.

Moreover, they are a tool capable of supporting tenets of ESD's Sustainable Urbanization theme (United Nations, n.d.), including lifelong learning, learning as participation in urban life, and learning in diverse contexts, as well as a long-standing tradition of participatory processes in environmental education. In fact, ecological corridors and sanctuaries not only serve as areas to preserve biodiversity but also act as learning spaces by proposing a reconciliation between urban fabric and the surrounding natural environment. Ecological sanctuaries, serving as educational landscapes, offer the opportunity for people to reconsider their connection with the non-human world, develop new cooperative methods to preserve nature, and reconnect with the natural world.

2. State of art

The recent urban landscapes have led to a gradual reduction of the connection between humans and the surrounding natural world.

The urban environment, historically, was a place of certainty where solid walls excluded natural forces and surrounding biodiversity. This destructive process, rooted in a threatening view of nature, persists, although contemporary reasons are more pragmatic and economic (Inostroza, 2022). Despite the shift in environmental awareness, urban development in the majority of the world's cities is still grounded in outdated concepts—essentially aesthetic, pragmatic, and economic—that do not embrace new paradigms incorporating ecological processes and biodiversity as essential components for the wellbeing of local populations (Inostroza, 2022). Moreover, the urgent need to address the challenges of climate change and environmental crisis intersects with the demand to foster a conscious coexistence between the human and non-human elements.

Ecological sanctuaries in the urban environment are vehicles to explore how coevolution with nature may take place, and where multispecies and more-than-human approaches may take place in innovative ways. The exploration of ecological sanctuaries, through multidisciplinary approach, is an instrument that provide environmental and ecological education through the relational values developed with nature to pursue a more sustainable future in the urban environment.

Conceiving of cities as environments separate from nature and the ecosystem has led to extremely critical consequences. Loss of biodiversity carries profound implications for both urban and peri-urban inhabitants. The deterioration of natural ecosystems can exacerbate economic fragility and environmental hazards, particularly affecting impoverished households and those residing in peri-urban areas, as well as biodiversity itself. Ecological sanctuary can help mitigate the loss of biodiversity, an alarming problem. As highlighted in the Global Risk Report 2023, the World Economic Forum considers it one of the most rapidly deteriorating global risks over the next decade. Hence, focusing on ecological sanctuary becomes an essential element in conserving biodiversity and the proper functioning of ecosystems. It is crucial to work towards its strengthening as a system of connection and interchange between isolated areas and natural elements, thus counteracting fragmentation and its negative effects on biodiversity. (Fogli, S, 2023)

The natural world is viewed merely as a resource to exploit, leading to activities like logging, mining, or poaching of wild animals. This exploitation is fueled by the misconception that ecosystem services are free and, therefore, lack inherent value. While concern for environmental protection is prevalent in many regions, a considerable gap exists between concern and action, attributed to low levels of understanding of environmental issues and a lack of emphasis on social, emotional, or behavioral learning (European Commission, 2023).

Furthermore, to improve the quality of the cities it is necessary to provide a more aware relationship between ecosystems and the humankind. The history of the relationship between man and the environment has changed. Some of our ancestors had a relationship of coexistence and balance. They lived on the move and their movements considered the changing seasons, the annual migrations of animals and the growth cycles of plants. Analyzing the evolution of worldviews, it is interesting to highlight how the relationship between mankind and the environment began with animist beliefs that testify to a genuine concern for nature as it was considered sacred. (Harari, 2015). Every barrier between nature and man was broken down, the world did not revolve around humans or any other group of beings. In the course of history, man has slowly distanced himself from nature to the point of conceiving the anthropocentric vision of which we are part.

The increasing trend of urbanization has weakened the humankind connection with the natural world and played a significant role in diminishing public awareness of biodiversity. Approximately half of the world's population resides in urban areas, with fewer opportunities for direct contact with nature. This ongoing alienation, often referred to as the 'extinction of experience', has two interconnected consequences, both of which raise significant concerns. Firstly, it reduces the diverse benefits derived from human-nature interactions for physical health, psychological well-being, and cognitive performance. Secondly, there is mounting evidence from research indicating that limited contact with nature during childhood can initiate a cycle of disaffection towards the environment, diminishing the willingness to support conservation initiatives later in life. This establishes a feedback loop leading to the gradual deterioration of the human-nature relationship, extending across generations, and proving detrimental to both humans and the environment. (Soga, & Gaston, 2016). Ecological sanctuaries are essential as a tool for environmental awareness to reestablish the relationship between mankind and nature.

The design of open and natural spaces in urban areas for urban biodiversity and ecological education is a critical issue. Thus, preserving these areas as wildlife habitats and spaces where people can learn is extremely important nowadays. (Nakagoshi, & Mabuhay, 2014). Ecological sanctuaries present significant opportunities for participation and interaction, and as urban landscapes, they demonstrate the positive role of humans in restoring biodiversity and degraded social-ecological systems in cities. In various experiences, it has been shown how through the involvement of the population in the restoration and conservation of urban ecosystems, the community has developed new ways of connecting with the environment, thus making the ecological corridor a pedagogical tool to promote sustainable communities. Ecological restoration and native biodiversity knowledge have led to a cultural transformation of communities from an educational perspective.

Restoration initiatives led by citizen activists, non-profit organizations, and municipal governments offer platforms for active learning, contributing directly to the sustainable management of urban biodiversity and ecosystem services. Urbanization has resulted in the destruction and fragmentation of native habitats, leading to biodiversity loss. However, many urban areas still harbor pockets of ecological diversity. Organizations like PECT (Peterborough Environment City Trust) (Peterborough Environment City Trust, n.d.) are at the forefront of initiatives aimed at restoring urban biodiversity. For instance, PECT's Eco Charter for schools integrates sustainability education into the curriculum, engaging students in activities such as creating wildlife corridors through seed bombing. These corridors not only attract diverse wildlife but also serve as outdoor classrooms, offering hands-on learning experiences for students and community members.

Specifically with the B-Lines project (Peterborough Environment City Trust, n.d.), PECT addresses the decline in pollinator habitats by creating a network of wildlife pathways and green spaces across Peterborough. With over 3 million hectares of wildflower-rich grassland lost in England over the last 70 years, there's an urgent need to protect pollinators like bees and butterflies. The B-Lines Initiative contributes to ecological restoration by creating pollinator pathways and restoring habitat. By collaborating with landowners, communities, schools, and businesses, the project aims to restore habitats through wildflower planting and seeding. Besides enhancing biodiversity, the project emphasizes education, community engagement, and awareness-raising to promote the importance of pollinator conservation.

3. Favara Cultural Park Palazzo Miccichè

Palazzo Miccichè within the Favara Cultural Park, located in Sicily, Italy, is an example of how a place can become a tool for environmental awareness and the transformation of urban spaces into ecological sanctuaries can contribute to urban regeneration in a context awaiting redevelopment. Palazzo Miccichè is a late 19th-century aristocratic palace that was restored to unity after some 30 years during which the property had been fractionated.

The planet and living beings' life depend on plant world. The palace has been transformed into a forest becoming a container for different species of plants with a variety including ivy, tropical palms, ferns and various shrubs. (Bartoli, A, 2024) It is an oasis that celebrates the beauty and the diversity of flora. It becomes a sanctuary where the relationship between humankind and nature can find space and be amplified, in which the citizens are called to question their relationship with the plant world and the possibility of experiencing new ways of inhabiting the planet. A space that had been abandoned acquires new life and accompanies man toward a redefinition of himself and his surroundings, learning to get in tune with the planet by practicing listening at the expense of exploitation. The palace, in this new guise, taking on subjectivity can say, "I no longer want to be a palace but a forest". Thus, the project redefines the physical and theoretical meaning of a historic-monumental building, such as Palazzo Miccichè, which aspires to become something else: a forest, a jungle, a mental place, an environment for encounter, a secular-sacred space. It contributes significantly to ecological restoration by providing habitat for diverse plant and animal species. It fosters a connection between humans and nature, encouraging residents to become caretakers of their environment.

The project, known as Human Forest, redefines the purpose of historical buildings like Palazzo Miccichè, envisioning them as havens for biodiversity and cultural exchange. Human Forest demonstrates the power of community involvement and education in fostering a deeper connection between humans and nature while promoting environmental stewardship.

The transformation of Palazzo Miccichè into an ecological hub involved extensive community engagement.

Residents, businesses, and organizations were actively involved in the project. This collaborative effort not only enhanced biodiversity but also fostered a sense of ownership and pride among residents. Education plays a central role in the Favara Cultural Park project, aiming to raise awareness about environmental issues and promote a deeper understanding of the natural world. It serves as an outdoor classroom where residents, especially children, visitors and students can learn about ecology.

4. Workshop memory la città incantata at Palazzo Miccichè

The architectural design workshop "Memory: la città incantata" was an activity offered to students of the Politecnico di Milano during the current academic year and integrated into the training path of architects and urban planners in the second and third years. The workshop originated from the collaboration among various entities active in urban regeneration and social innovation, including, the DASTU (Department of Architecture and Urban Studies) of the Politecnico di Milano and Farm Cultural Park, lead partner of the RUF project implemented under the PNRR - European Union funding - NextGeneration EU, Managed by the Ministry of Culture. The workshop aims at field experimentation in which an attempt is made with local people to trigger processes that can lead territories to become permanent laboratories in which to build new understandings of the meaning of living.

During the workshop, students reflected on the relationship between humans and the environment following a guided tour of Palazzo Miccichè. They were then given the task of imagining specific aspects of human habitation and collective life that did not explicitly address the relationship between humans and the plant kingdom. These reflections were to be transformed into installations at Farm, a space of their choice, to showcase their ideas. Interestingly, more than half of the students chose the spaces at Palazzo Miccichè as the location for their installations. It became evident that these installations at Palazzo Miccichè were responsive to the needs of the plant species present, reflecting a growing awareness among the student community of the importance of the plant kingdom beyond its utility for human habitation.

Moreover, the students have been asked to answer a questionnaire about the experience of the workshop in Palazzo Miccichè. The results highlight that a more specific environmental and ecological education among people and inhabitants and experience such as the one in Palazzo Miccichè are extremely needed nowadays. It has been also shown how experiences like this has helped to develop a more conscious relationship with the non-human world.

5. Conclusion

In today's rapidly urbanizing world, the disconnection between humans and nature has become increasingly evident, leading to diminished public awareness of the importance of creating a more balanced. However, urban landscapes as third educators provide valuable learning experiences about exploring new relationships with the natural world. Ecological sanctuaries serve as dynamic platforms for co-learning in nature, not only providing habitats for diverse plant and animal species but also

opportunities for environmental education and community engagement, serving as pathways for the coexistence of humans and nature within urban environments.

This paper has explored the potential of ecological sanctuaries as transformative tools for urban sustainability and education, highlighting their role in reconnecting urban dwellers with the natural world and fostering a deeper understanding of biodiversity. Particularly, Favara Cultural Park exemplifies how urban spaces can be transformed into ecological sanctuaries, promoting biodiversity and cultural exchange while reconnecting residents with nature. Furthermore, the findings from the workshop at Palazzo Miccichè underscore that by engaging in experiential learning activities that emphasize the interconnectedness of humans and the natural world, individuals can develop a more conscious relationship with their environment and contribute to efforts aimed at preserving biodiversity and fostering sustainable communities. By involving local communities in the regeneration of urban landscapes, this project creates opportunities for meaningful engagement and learning.

This workshop experience highlights the potential for historical buildings like Palazzo Miccichè to serve as platforms for environmental education and community engagement. By integrating ecological principles into architectural design and urban planning, projects like this contribute to the regeneration of urban spaces while fostering a deeper connection between humans and nature. Considering the pressing challenges posed by climate change and biodiversity loss, it is essential to prioritize the integration of co-learning with nature. Through education and community engagement, cities can work towards creating more sustainable and resilient urban environments for present and future generations.

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BEYOND TRADITIONAL METRICS: RETHINKING HUMAN CAPITAL IN SCHOOL LEADERSHIP THROUGH EMOTIONAL INTELLIGENCE

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Abstract

This paper examines the traditional metrics to establish the degree to which emotional intelligence and qualitative instruments are accorded recognition in assessing school leadership effectiveness. Traditional metrics adopt quantitative indices such as standardised test scores, matriculation rates and teacher evaluation scores. They measure effectiveness across various leadership models, including distributed, transformational, transactional, instructional, and shared leadership. However, the weakness of traditional metrics lies in their over-reliance on numerical data - which downplays the qualitative dimensions of leadership. The study adopts Trait Emotional Intelligence Theory (TEI) and Team Emotional Intelligence (TEI) as units of analysis to reconceptualise school leadership assessment. The Integrative literature review was adopted as a methodological approach to make sense of the principles of the adopted frameworks and related literature. It was discovered that emotional intelligence is an essential component in gauging leadership effectiveness. The study reveals that school leaders' emotional composition and their awareness of it impact their leadership effectiveness. We also found that leaders who are aware and sensitive to their teams' emotional configuration engender cohesion, collaboration, and goal attainment. In addition, the role of adaptable qualitative instruments for measuring school leadership effectiveness was underscored. The study proposed an adaptable framework drawing from theoretical exploration and empirical evidence.

Keywords: *Traditional metrics, emotional intelligence, school leadership, human capital, conceptual analysis.*

1. Introduction and background

In the evaluation of school leadership effectiveness, traditional quantitative metrics such as the Principal Instructional Management Rating Scale (PIMRS), Multifactor Leadership Questionnaire (MLQ), Principal Leadership Questionnaire (PLQ), Successful School Leadership Survey (SSLS), and Distributed Leadership Inventory (DLI) have provided valuable insights into leadership practices and organizational performance but often overlook crucial aspects such as emotional intelligence (Leithwood, Harris & Hopkins, 2020; Wang & Dapat, 2023). It is worth noting that emotional intelligence is a subtle yet essential component of human capital (Gendron, 2004; Sabie, Bricariu, Pîrvu, & Gatan, 2020). While these metrics offer numerical data on outcomes, they fail to capture the nuanced influence of emotional intelligence on leadership performance, hindering efforts to cultivate positive school climate and enhance leadership effectiveness (Brackett et al., 2011). Moreover, the weaknesses of traditional metrics lie in their inability to measure non-numerical indicators of effective leadership. For instance, not paying attention to the implications of culture on leadership raises concerns about traditional metrics generalizability across diverse contexts (Leithwood et al., 2023; Adewale & Adekunle, 2023). Consequently, there is a recognized need to integrate emotional intelligence into leadership assessment frameworks and develop adaptable qualitative instruments to provide a holistic understanding of school leadership effectiveness (Kramer, 2023). This paper aims to address these gaps by exploring the role of emotional intelligence in shaping human capital expressed through leadership practices. It also advocates for the integration of adaptable qualitative instruments into traditional metrics to enhance the measurement of leadership effectiveness in education (Leithwood, Sun, Schumacker, Hua, 2023). Specifically, the study seeks to answer the following questions:

1. How does emotional intelligence influence the effectiveness of school leadership practices?
2. To what extent do traditional metrics for measuring school leadership effectiveness cater to emotional intelligence as a construct contributing to leadership effectiveness?
3. What are the advantages of adaptable and contextual-oriented qualitative instruments in gauging non-numerically measurable attributes in leadership?

4. How can emotional intelligence constructs and qualitative instruments be infused into the existing quantitative instruments for assessing school leadership effectiveness?

2. Theoretical underpinning

This study is underpinned by Trait Emotional Intelligence Theory (TEI) and Team Emotional Intelligence Theory (TEI).

2.1. Theoretical rationale

The rationale for adopting Trait Emotional Intelligence Theory and Team Emotional Intelligence Theory hinges on their ability to offer comprehensive frameworks for understanding emotional competencies in school leaders and teams (Petrides & Mavroveli, 2018). Trait Emotional Intelligence Theory focuses on the stable dispositions underlying individual emotional functioning. On the other hand, Team Emotional Intelligence Theory recognises the impact of the collective emotional composition of team members in an organization (Jordan, Ashkanasy, Härtel & Hooper, 2002). Additionally, TEI positively influences team cohesion, adaptability, and overall team performance. (Jordan et al., 2002).

2.2. Trait Emotional Intelligence Theory (TEI)

Trait Emotional Intelligence Theory (TEI) represents a framework for understanding emotional intelligence (EI) within the context of school leadership. The theory was initially proposed by Konstantinos Petrides and Adrian Furnham in the early 2000s. TEI diverges from the traditional view of emotional intelligence as a set of competencies and skills, focusing instead on the underlying personality traits associated with emotional functioning (Petrides & Furnham, 2001). TEI Components include factors emotionality, self-control, sociability, and well-being, which collectively contribute to individuals' emotional functioning.

2.3. Team Emotional Intelligence (TEI)

Team Emotional Intelligence (TEI) is the aggregate of team members' emotional disposition which influences their satisfaction and performance (Brown, 2022; Aritzeta et al., 2021). This theory underscores the need to understand how the interplay of team members' emotional awareness, regulation, and interpersonal skills shape team dynamics and effectiveness. This implies that effective teams transcend individual competencies to include group emotional synergy.

2.4. Implications of Trait and Team Emotional Intelligence on school leadership effectiveness

While traditional leadership theories emphasise cognitive abilities and management skills, recent research underscores the significance of emotional intelligence in leadership effectiveness (Kim, & Kim, 2017). In the context of school leadership, TEI holds significant implications for leaders' ability to understand and effectively manage their emotions, navigate interpersonal relationships and inspire others. Research has shown that school leaders with high levels of TEI are better equipped to foster positive school climates, build trust and rapport with stakeholders and promote collaboration among faculty members (Day et al., 2020). On the other hand, Team Emotional Intelligence (TEI) holds implications for collaborative leadership models, distributed decision-making processes, and the cultivation of a supportive team culture (Chang, Sy & Choi, 2012). School leaders who foster TEI among their teams prioritise open communication, empathy, and mutual respect, increasing team cohesion, adaptability, and innovation (Druskat & Wolff, 2001). Drawing from the preceding, Trait Emotional Intelligence (TEI) and Team Emotional Intelligence (TEI) offer valuable insights and strategies for enhancing school leadership effectiveness.

3. Methodological approach

The study adopts Integrative Literature Review (ILR) methodology to investigate the intersection of emotional intelligence and traditional metrics in assessing school leadership effectiveness. The lack of emotional intelligence construct and contextually adaptable qualitative instruments for measuring school leadership effectiveness was also accounted for by using ILR. The rationale for adopting ILR for this study hinges on several factors. First, ILR offers a flexible and iterative approach to synthesising diverse perspectives and theories to understand a phenomenon (Torraco, 2005). Second, it encourages critical analysis, theoretical synthesis and the generation of novel conceptual frameworks (Torraco, 2004). Given the complex and multifaceted relationship between emotional intelligence and leadership effectiveness, ILR provided an ideal framework for integrating diverse literature sources to generate new insights and

perspectives (Bem, 1995). Given the foregoing, we adhere to the principles of ILR by defining the research questions, searching for relevant literature, analysing and synthesising relevant literature, identifying patterns and gaps and writing the final review.

4. Literature review

4.1. Shifting perspectives: Emotional Intelligence in Leadership from critique to recognition

As knowledge evolves in leadership theory and practice, the role of emotional intelligence (EI) has sparked considerable debate. Initially, doubts were raised regarding the significance of EI in leadership effectiveness, with questions surrounding its construct validity and predictive power lingering in academic circles. Antonakis, Ashkanasy and Dasborough (2009) delved into critical reflections on the relevance of the theoretical underpinnings of EI in leadership roles, the efficacy of different measurement tools, and the neurological basis of emotional intelligence. These deliberations laid the groundwork for subsequent investigations into the links between leader EI and their effectiveness. However, a growing body of evidence spanning disciplines, including psychology, medicine, and education, has steadily bolstered the case for emotional intelligence as a crucial component in measuring leadership effectiveness (Arora, et al., 2010). In a recent study, Dasborough, Ashkanasy, Humphrey, Harms et al. (2021) revisited and reevaluated the arguments surrounding EI's role in leadership effectiveness. Contrary to earlier scepticism, the authors highlight a wealth of new evidence confirming that leaders' emotional capacities contribute to their effectiveness.

4.2. Implications of lack of emotional intelligence gauge as a component of traditional metrics

Extant literature indicates that the absence of emotional intelligence (EI) poses significant challenges to effective school leadership. School leaders who are emotionally deficient struggle to cultivate positive relationships with teachers, students and parents (Brackett & Katulak, 2013). This deficiency also manifests in ineffective communication, a lack of empathy and poor conflict resolution skills (Bradberry & Greaves, 2009). Moreover, such leaders tend to undervalue and disrespect teachers, which results in low morale and productivity among staff (Gómez-Leal et al., 2021). Low teacher morale diminishes educator effectiveness and negatively impacts student engagement and school climate (Ciarrochi, Chan, & Bajjar, 2001). Furthermore, leaders deficient in EI are prone to stress and burnout due to their inability to regulate emotions effectively (Wiens, 2016). Stress and burnout impair decision-making, problem-solving and overall leadership effectiveness.

4.3. The role of adaptable qualitative instruments in measuring leadership effectiveness

Evaluating school leadership effectiveness reveals the limitations of traditional quantitative metrics, which fail to comprehensively grasp leadership attributes and behaviours (Leithwood, Harris, & Hopkins, 2008). Without incorporating qualitative instruments, assessments overlook contextual nuances essential for understanding leadership practices within diverse educational settings (Leithwood et al., 2023). While quantitative metrics provide numerical data on outcomes, they overlook intricate factors influencing leadership performance, hindering the customisation of leadership approaches to specific school contexts (Leithwood et al., 2008). The absence of qualitative instruments also deprives evaluations of critical insights into leaders' behavioural patterns and interpersonal interactions (Spillane, 2006), thus impeding the assessment process and offering a narrow view of leadership effectiveness primarily focused on quantifiable outcomes (Day, Leithwood & Sammons, 2008). Moreover, without qualitative feedback mechanisms, leaders lack personalised insights into their strengths and areas for improvement, hindering their professional growth and ability to enhance leadership practices over time (Marzano, Waters & McNulty, 2005). Therefore, integrating qualitative methodologies into the assessment process is crucial for a more holistic understanding of school leadership effectiveness.

4.3.1. The necessity of qualitative measures for assessing leadership in schools. The lack of qualitative evaluation methods implies missing important insights into leaders' behavioural patterns and interpersonal dynamics. This results in a narrow and outcome-centric assessment of leadership effectiveness (Day, Leithwood & Sammons, 2008; Leithwood, Harris, & Hopkins, 2008). Unlike quantitative-oriented metrics, qualitative tools capture the seemingly obscure components of leadership and contextual nuances crucial for evaluating leadership in diverse educational environments (Leithwood et al., 2023). Moreover, without qualitative feedback, leaders do not receive personalised feedback necessary for their professional development and the improvement of their leadership skills (Marzano, Waters & McNulty, 2005). Thus, integrating qualitative methodologies is essential for comprehensively understanding school leadership effectiveness.

4.4. The blind spots in conventional metrics for evaluating school leadership effectiveness

The assessment of school leadership effectiveness traditionally relies on quantitative research approaches and metrics. These often overlook the nuanced role of emotional intelligence skills in leadership effectiveness. Specifically, instruments such as Principal Instructional Management Rating Scale (PIMRS), Multifactor Leadership Questionnaire (MLQ), Principal Leadership Questionnaire (PLQ), Successful School Leadership Survey (SSLS), and Distributed Leadership Inventory (DLI) do not explicitly accommodate emotional intelligence construct. They are also not qualitative-oriented in measuring school leadership effectiveness.

4.5. Proposed framework: Holistic School Leadership Assessment Framework (HSLAF)

Informed by literature on leadership and the frameworks of Trait Emotional Intelligence (TEI) and Team Emotional Intelligence (TEI), the Holistic School Leadership Assessment Framework (HSLAF) is introduced to improve the assessment of school leadership effectiveness. This integrated approach integrates emotional intelligence components into traditional metrics and emphasises using adaptable qualitative instruments for a comprehensive leadership evaluation. The framework has four components: *expanded traditional metrics*, *contextual adaptability*, *comprehensive evaluation and continuous improvement*. *Expanded Traditional Metrics* holds that while validated metrics are foundational for evaluating leadership, they should incorporate emotional intelligence competencies such as self-awareness, empathy, and relationship management. *Contextual Adaptability* acknowledges that, given the diverse educational contexts, HSLAF advocates the development of adaptable qualitative instruments for measuring leadership effectiveness, including interviews and focus group discussions. These tailored instruments provide deeper insights into leadership practices and effectiveness. *Comprehensive Evaluation* advocates for a comprehensive evaluation of school leadership effectiveness by combining quantitative data with qualitative insights. This approach engenders a nuanced understanding of leadership behaviours, emotional dynamics, and contextual factors shaping effectiveness. *Continuous Improvement* embraces a cyclical assessment and improvement process while implementing HSLAF as a strategy. This is because, assessment feedback informs targeted professional development efforts, strengthening emotional intelligence competencies and enhancing leadership effectiveness over time. In summary, integrating emotional intelligence into traditional metrics alongside adaptable qualitative instruments offers a comprehensive approach to evaluating school leadership effectiveness. By fostering cognitive and emotional competencies, this framework aims to cultivate emotionally intelligent leaders capable of driving positive transformation in educational environments.

5. Conclusion

This study underscored the significance of integrating emotional intelligence frameworks with traditional metrics in assessing leadership effectiveness within educational contexts. The study offered a nuanced understanding of how emotional intelligence influences leadership practices and effectiveness by adopting a theoretical framework that blends Trait Emotional Intelligence Theory (TEI) and Team Emotional Intelligence (TEI). The importance of adaptive qualitative instruments was also explored. Leadership development and implementing organisational interventions within educational settings.

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WORKSHOP



FREE TOOLS FOR USING DATA TO TELL A STORY

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Abstract

It is important to see how data can shape effective decisions, playing a key role in regulatory decisions, statewide policy decisions, programmatic decisions on service delivery and staffing, and even family decisions about program enrollment. For 15 years, the Illinois Early Childhood Asset Map (IECAM) has equipped its users with the necessary tools to harness education and demographic data. Presenters will demonstrate how IECAM uses these tools to present data for its users. Participants will have the opportunity to (1) engage with the storytelling tools, (2) ask questions about education and demographic data, and (3) start talking about how data can connect families, local programs, policymakers, educators, and researchers using readily available online resources. Participants will be able to use their devices (laptops) to interact with open source tools, and they will learn how they can create visualizations to tell the story about their data. Participants also will be able to interact with the presenters, explore the arc of a story, delve into what is needed to tell that story, and gain a comprehensive perspective on the significance of the data. There will be a maximum of 25 participants for the workshop. Anyone interested in using data to tell significant stories is welcome.

Keywords: *Data, education, visualization, research.*

1. Introduction

Despite the growth of connectivity, software, and advanced analysis tools, it can be a challenge to find reliable, free tools for data analysis and visualization. Educators and researchers who are not members of institutions with licenses for data analysis tools, or who do not have deep experience with more sophisticated (and expensive) data software, can still make insightful and attractive data visualizations.

In this workshop we identify and demonstrate a few accessible, free data tools that require a relatively low level of technical expertise. Making use of reliable data tools will help draw legitimate conclusions and allow transparent presentation of the data on which these conclusions are based. This workshop is geared toward education researchers and advocates who already know their data but who are in need of basic data visualization tools. For example, a policy advocate may want to know what social variables are associated with teacher and staff vacancies. A classroom teacher may use test scores to self-evaluate their teaching practices based on student performance. A government agency official may want to know what areas of the state exhibit the greatest need for increased preschool funding. A school administrator may use classroom test scores to determine changes in academic policy or make employment decisions regarding faculty. Such questions can be addressed using interactive charts and graphs and/or a web map. With this in mind, the purpose of this workshop is to provide explanation and demonstration of a few free tools to empower people to use data to tell their stories.

Numerous professional-grade software options exist for creating maps and visualizations. However, because of their complexity, beginners often find them overwhelming. When faced with several options, users may struggle to articulate their ideas and become lost in the process. The objective of this workshop is to introduce two user-friendly tools available online that are suitable for beginners and can be used to answer research questions and tell a story. Additionally, we will demonstrate one advanced tool to showcase its capabilities and empower attendees to explore the potential of these tools.

2. Workshop

This workshop will begin with a brief introduction of the Illinois Early Childhood Asset Map and the presenting team, followed by a short explanation of three free data tools: My Maps by Google, Datawrapper, and Dash Python (Plotly). The presenters will then engage with workshop participants in an

interactive demonstration of these tools with provided data using participants’ laptops. Presenters will be available to answer questions and provide some guidance. The workshop will end with a short recap and acknowledgment.

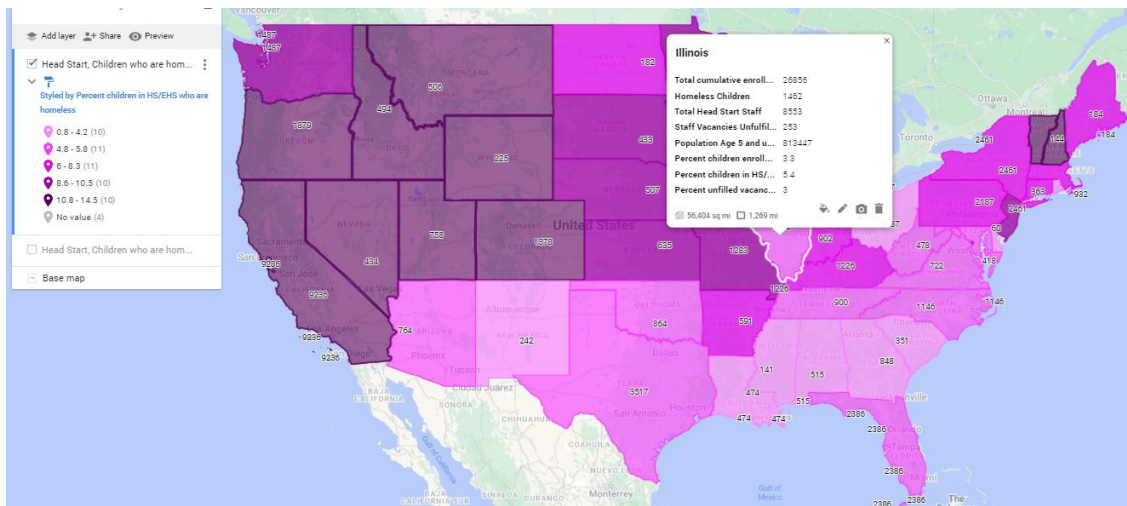
We will provide a sample dataset from the U.S. federal early childhood and preschool program, Head Start. We will seek to answer some basic questions about these data and visualize state comparisons.

2.1. My Maps

Google’s My Maps is a free platform where users can create sharable maps merged with any available tabular data. The prerequisite for this demonstration is an active (free) Google account. Some familiarity with Google Drive also would be helpful. The resulting map will include symbolization, popup boxes for each feature, text labels, and the option to further configure with images and additional layers. The demonstration involves connecting two distinct files to My Maps: a spatial dataset of states and the tabular Head Start data. Multiple interactive layers can be produced in a relatively short amount of time. With some stylization and popup configurations, a sharable web map can show data with clarity (see Figure 1).

The platform is unfortunately limited by a 5 MB spatial dataset maximum upload. There are only a few options for configuring styles and color ramps, so design features are also limited. Despite such limitations, there is considerable potential for such tools to prompt deeper questions and spur further research.

Figure 1. Mapped, styled Head Start data using My Maps.



2.2. Datawrapper

Sometimes you need to create a simple visualization where you need to display some trends from your data or create a bar chart to summarize information. There are many applications you could use, such as Excel, Python, or the statistical software R. However, some of them require programming knowledge or a very expensive subscription. In this workshop participants will learn how to create a bar chart from the provided data using Datawrapper. Within Datawrapper, users can create simple data visualizations and even complex ones, which may require some knowledge or further experience with the software. Datawrapper is usable simply by pasting data into a prompt or uploading a Microsoft Excel workbook or Google Sheet. It is capable of taking current data and quickly creating a variety of results for any audience. Limitations for Datawrapper include Internet connectivity and lack of detailed statistical features, such as geospatial analysis. However, the user-friendly capabilities provide for simple data visualization at no cost.

2.3. Dash Python (Plotly)

Finally, users with programming knowledge could explore Dash Python (Plotly) as an option for data visualizations. In this section, we will show the possibilities for displaying data with open source software such as Python and Dash. Two years ago, IECAM was asked to create a summary data report for a select few regions in the state. This summary webpage format became in demand among the early childhood community in the state, so IECAM decided to create a dashboard with information about the state, counties, Birth to Five Action Council areas, and local school districts. When users select any of these regions via our online tool, the dashboard shows up-to-date data from our database. Users can also create a full report and export it to a PDF file.

3. Conclusions

The objective of this workshop is to provide users with free, readily accessible tools. Further, these tools are useful with a variety of data to create a wide array of data visualizations to suit the needs of the user. With the brief introduction to these tools, we also provide data for workshop participants to use to build competence and confidence in using these tools for their needs. Lastly, we implemented this workshop with the hope that anyone, with or without knowledge of data tools, could freely access these tools to use their data to present their data in a variety of ways without extensive knowledge or resources.

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