

INTEGRATING ARTIFICIAL INTELLIGENCE IN CURRICULAR DESIGN FROM PRE-SERVICE TEACHERS' PERSPECTIVES: THE ROLE OF PEDAGOGICAL COMPETENCE

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Abstract

Generative artificial Intelligence (GenAI) is increasingly integrated into modern life, including education, where both students and teachers use it in various ways. This raises important questions about future educators' preparedness to utilize GenAI in key tasks like curricular design. Our research focused on the perspectives of future teachers regarding GenAI's role in educational pathways, conducted at the University of Verona within the primary teacher education program. Participants, during a course on "Active Methodologies and Didactic Technologies," designed an educational unit using GenAI tools (Eduaide.ai or Magic School AI) and reflected on the experience. Qualitative analysis revealed that while students actively engaged in quality control and structure organization using GenAI, they often found the process challenging. They recognized the importance of good prompting and believed pedagogical competence was essential to adapt activities to real-world contexts. The findings emphasize the need for teacher involvement in the GenAI design phase to enhance its effectiveness in classrooms. GenAI can support pre-service teachers by fostering creativity and streamlining lesson planning, but educators must remain critical mediators to ensure the curriculum is pedagogically sound and suitable for primary school students.

Keywords: *AI, pre-service teacher, AI literacy.*

1. Introduction

Artificial Intelligence (AI) is deeply integrated into modern life, present in everyday devices such as smartphones, computers, and tablets, thereby entering the educational landscape. AI, particularly its generative form (GenAI), presents opportunities and risks that the educational field can choose to embrace or reject. These tools involve different grades and students of various ages, reaching until primary school, where specific GenAI designed for children could enhance the acquisition of essential digital skills (Voulgari et al., 2021). To achieve this goal, teachers must be prepared to manage this technology effectively (Velander et al., 2024). GenAI catalyze the redefinition of the teachers' role in a more learner-centered paradigm (Khalil & Alsenaidi, 2024). This innovation requires a new adaptive expertise to integrate its possibilities with teachers' pedagogical skills, thereby transforming GenAI from a generic tool into a professional one, adaptable to the context and students' needs (Sperling et al., 2024). AI literacy must be integrated from the beginning of teachers' education, and this is the reason why pre-service teacher training could be a lush soil. Pre-service teachers are in the middle of their training, composed by both theoretical knowledge and practical experiences (such as internship), which enable them to acquire classroom knowledge and develop teaching skills (Park, 2023). These opportunities make them able to grasp reality and ground the theory into practice. During their educational path, they have the opportunity to explore different teaching methods and design learning paths. This teaching competence could be integrated with GenAI tools (Hu et al., 2024), and, to achieve this, it is essential to investigate their perceptions including their feelings, points of view and perspectives. Understanding the challenges and benefits of this collaboration can promote a positive approach that could facilitate a critical and responsible integration of GenAI in teaching and learning practice (Mah & Groß, 2024).

2. Objective

The research aims to fill that niche, answering the following research question: What is the experience in terms of feelings, perceptions and role of pre-service future teachers when GenAI is utilised in the design phase of educational pathways?

Understanding their views could guide the design of pre-service teachers' courses and the integration of AI literacy. This leads to the creation of informed and equipped professionals who incorporate innovative tools, remaining the leader of the educational process.

3. Design

The research was conducted within the course *Active Teaching Methodologies and Educational Technologies* in the Degree Programme in Primary Education at the University of Verona. The course topics included: (a) active teaching methodologies, key principles and transversal elements; (b) instructional design for active methodologies; (c) guidelines for planning active approaches; (d) the role of technology in teaching practice; (e) educational robotics; and (f) AI in education. Teaching modalities combined lectures with active learning strategies. The research focused on the section of the course devoted to AI and education, which consisted of two sessions of two and a half hours each. This paper reports on the first session, which aimed to provide a theoretical introduction to AI, its historical development, functioning, and integration into educational contexts. Participants were introduced to general-purpose GenAI tools, prompt formulation, and GenAI-based supports for lesson planning. At the end of the session, participants were asked to engage in a collaborative design task. Working in groups of four or five, they were instructed to design a didactic sequence of 6 to 10 hours for either primary or pre-primary school, using one of two GenAI tools proposed, such as Eduaide.AI or MagicSchool.AI, according to their preference. We provided support during the activity process. Fourteen groups were formed: thirteen used MagicSchool.AI, while one selected Eduaide.AI. Upon completion, the groups uploaded their outputs to a shared online platform. Participants were asked to answer six open-ended questions to reflect on their experience and gain awareness of their impressions, thoughts, and processes.

4. Methods

The research sample consisted of participants from the course: approximately 100 students were enrolled, but only 43* attended in person regularly (these participants represent our sample). The responses were unevenly distributed across the six questions: Question 1 (36; students' role), Question 2 (27 responses; interactions with GenAI), Question 3 (25; positive and negative disclosure), Question 4 (23; efficiency and critical points), Question 5 (22; pedagogic and teaching skills), and Question 6 (21; GenAI possible role). For reasons of relevance and analytical depth, this paper reports the analysis and interpretation of Questions 1, 2, and 5, which together provide an overview of pre-service teachers' perceptions regarding the integration of GenAI in lesson planning and highlight the continuing importance of human pedagogical competence in fostering productive collaboration with GenAI. Data were analyzed using Inductive Content Analysis (Elo & Kyngäs, 2008), which allowed categories to emerge directly from participants' responses. This approach was chosen to capture the experience-based perspectives of future teachers as they engage with GenAI tools in a pedagogical design context.

5. Results

This section presents the results of the analysis of the data from the three questions of interest for the paper. The research results outline a complex picture based on the following dimensions: management of the task, experiential interaction, and the critical role of pedagogical competence.

5.1. Roles during interaction with GenAI: A dialogue

The first question was phrased as follows: What was your role during the design work with GenAI? The analysis focused on the role assumed by participants during the activity. From the 43 occurrences detected, a code was generated that highlights two categories: "Input/Output Management" and "Idea Management" (Table 1). There was a clear prevalence of the former (32) over the latter (11). It can therefore be seen that the role of the participants was to lead the interaction in various stages, from conception to the final product, with constant intervention during the process, exercising decision-making powers over form, content, and actions. The students mainly acted as prompt writers (9) and devoted themselves to enriching and improving the generated texts (7), both in terms of content quality and quantity of information to be included. They then performed correction (5) and control (5) functions. Other minor tasks included translation, time alignment of activities, and organization of materials. At the same time, participants also describe themselves as contributors at the level of concept generation (5), sharing proposals within the group (4), as well as sporadic planning and evaluation activities.

*The number of responses varied because students could choose to participate in all or only some.

This scenario as a whole indicates a cycle that determines how interaction takes place: the prompt is the fundamental element for creating a dialogue with GenAI and obtaining possibilities. The prompt serves as a connection between the individual and the machine: it begins with an idea from the individual, gets elaborated on by the machine, and then returns to the user as output. Then this output can, in turn, be modified by new prompts with a continuous exchange between inside and outside the machine. This suggests two directions: if prompting is the key to establishing collaboration, then future teachers must be trained to be effective in this regard; if generation, transformation, and correction of output is necessary, then future teachers need to have a wealth of resources, both internal and external, complementary to those of GenAI, in order to exponentially enhance hypothesis and solutions.

Table 1. Coding Participants' Management in GenAI Interaction.

Category	Label	Count
Input/Output Management	Prompt Writing	9
	Enrichment and Improvement	7
	Correction	5
	Monitoring/Control	5
	Content Alignment	3
	Translation	1
	Time Alignment	1
	Materials Organization	1
<i>Subtotal</i>		32
Idea Management	Generation	5
	Sharing	4
	Evaluation	1
	Planning	1
<i>Subtotal</i>		11
Total		43

5.2. GenAI experience evaluation: A polarization

Analysis of participants' experiences (Table 2) reveals a perception of GenAI in an educational design experience as an extremely polarizing tool. We asked them: What was it like interacting with an GenAI tool to design educational activities?

Table 2. Participants' Experience and Perceptions of GenAI Interaction.

Category	Description	Count
Challenging Interaction	Interaction perceived as demanding or requiring effort	7
Difficulty Interacting	Problems with the interface or software usability	5
Effective Interaction	Constructive and useful interaction	5
Frustrating Interaction	Interaction causing stress or de-humanizing feelings	5
Source of Reflection	Triggers critical thinking on professional skills	2
Sterile Interaction	Interaction perceived as unstimulating	2
Total		26

The most represented category is challenging interaction (7), described as a “fun but tiring” process due to technical issues with the tool or lack of familiarity with the programs. Also significant are the occurrences of frustrating interaction (5) and difficulty interacting (5), with students describing the experience as “dehumanizing,” “stressful,” or “unintuitive.” At the same time, part of the sample experienced effective interaction (5), finding the tool “constructive” and useful for providing “good starting points.” The use of GenAI was also a source of reflection (2), triggering fears about the possible replacement of professional training or awareness of the precision required in providing input. For some, the experience was fruitless (2), as they did not recognize any opportunities for learning or professional growth. These results raise many questions. First of all, participants need to learn more about the programs and experiment with them more in order to alleviate frustration and fatigue and reduce difficulties. They need to be given opportunities to do so through structured learning experiences. In fact, interaction has been stimulating in various ways, including reflective and creative aspects; therefore, it is worth investing in

training and systematizing such activities, which should combine an initial theoretical phase focused on the functioning of AI with hands-on activities that apply this knowledge to potential educational designs. Another consideration, however, concerns identity. It is noted that the presence of GenAI in design calls into question the value of a human teacher and, more generally, of humans. This means thinking deeply about how to propose GenAI and offering opportunities to develop awareness of one's personal and professional meaning.

5.3. Pedagogical knowledge and expertise: Foundational elements

The third coding (Table 3) is based on the question: What pedagogical and teaching skills were necessary for working on the proposal?

Table 3. The Role of Pedagogical and Didactic Competence.

Category	Description	Count
Adaptation and Contextualization	Adjusting AI solutions to real school contexts and student needs	12
Conceptual Depth and Quality	Enhancing the educational quality and avoiding superficiality	6
Scientific and Practical Mastery	Using theoretical knowledge to interact with AI	4
Total		22

In this case, it is clear that the students' professional competence was the decisive factor in transforming the GenAI's suggestions into a valid teaching proposal (22). The participants recognize that the skills they have acquired to date serve the purpose of adaptation and contextualization (12). The essential need emerged to make the proposals realistic and flexible, adapting them to the Italian school context, the available resources, and the specific needs of the class. The students, through prompts, had to compensate for the rigidity of the GenAI, calibrating the activities according to the actual school timetable, the age of the children, and the objectives to be achieved. Conceptual depth and quality are also highlighted (6 occurrences). The participants' intervention was necessary to raise the quality of the proposals, which were often judged trivial or superficial from an educational point of view. It is therefore a question of carefully considering the nuances of methodologies, resources, and goals to ensure that the design is wisely guided. Finally, competence brings with it scientific and practical mastery (4). Participants find support for effective planning in their theoretical foundations, methods, and real-life experiences, as well as for skillfully and positively managing their relationship with GenAI, evaluating whether and how to use its suggestions. Overall, the result, already highlighted above, is that students, future teachers, place great value and trust in the knowledge and skills acquired outside the GenAI, entrusting them with the role of guiding design even in new contexts. Considering this idea, we can then reflect on the organization of training plans in which theoretical principles and practical application must be offered in an essential way so as to then promote dedicated opportunities for an enriching exchange with GenAI.

6. Conclusion

The research involved the students enrolled in the course Active Teaching Methodologies and Educational Technologies, included in the Primary Teacher Education program at the University of Verona. The aim was understanding their perspectives toward GenAI use in teaching design phase. Firstly, students emphasize their struggle for a successful and satisfying communication, to the point that some students find it frustrating, linked to the notion of technostress and resistance to change (Mah & Groß, 2024). It is therefore necessary to overcome this obstacle and AI literacy can serve as mitigator for this aim. A deeper knowledge in the more technical aspects of GenAI allows them to interact effectively with the machine (Brandão et al., 2024), reducing technology overload (Muslimin et al., 2023) and put the basis for effective communication, in which teachers direct the tool toward the desired objectives (Sperling et al., 2024). Despite this, even those who show a more positive approach to GenAI emphasise how essential it is to maintain control throughout the process, from the prompting to the machine to the output evaluation. This relates to the concept of a human-in-the-loop considered essential to promote a human-centred mindset where technology expands rather than replaces human agency (UNESCO, 2023). To do this, however, students emphasised that this constructive interaction, would not have been possible without their knowledge and pedagogical skills. This ability allowed them to adapt outputs to the context and make them more flexible (Sperling et al., 2024), leading to a crucial consideration: AI literacy must be included in teacher training programs, but only as a supplement, an enrichment after pedagogical, educational, and didactic skills. Alongside these, reflective practice is structured as a pillar. Thanks to an intentional and systematic inquiry during and after the teaching practice, pre-service teachers can inform future decision-making and restructure their teaching (Sperling et al., 2024). Reflective thinking becomes the vital

catalyst also for a professional identity shift, with which teachers re-evaluate their role, exploring new shape of teaching identity associated to GenAI transformation (Ng et al., 2023). The study therefore contributes by showing that AI literacy is necessary to address basic AI issues, both in technical and pedagogical terms, not only with a theoretical perspective but also with concrete, hands-on activities. This training program be integrated into the training curriculum in a cross-cutting manner, as one of the tools that teachers develop throughout the course. Furthermore, it is necessary to develop reflective skills to adapt and choose appropriately when, where, and how to integrate this tool, ensuring a constructive approach that sees it as a resource rather than an enemy that could replace them. The study has several limitations that future research could address. Firstly, the number of participants is small and restricted to a single context, which prevents generalizations or the possibility of broader implications. Moreover, the research is based on a session lasting only two and a half hours. Due to the limited amount of time, this could represent only an instant perception rather than a significant shift in perspective. Future research should adopt a longitudinal approach with larger, multi-institutional cohorts to examine how pre-service teachers' perceptions of GenAI evolve as they transition from theoretical training to practical classroom implementation. Furthermore, subsequent studies should complement qualitative insights with an objective assessment of the pedagogical quality effectiveness of AI-generated lesson plans to validate the actual impact of human-AI collaboration on student learning.

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