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# Adopting AI in education: optimizing human resource management considering teacher perceptions

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There is an intense concern in various fields, in order to quantify in the most complete and explicit way the impact that the accelerated development of the technology that is the basis of AI has on education. A very special issue in this context is represented by the impact AI has on the teaching methods and techniques used by teachers. Still, in order to develop and refine new methods and techniques based on AI technology is necessary that perceptions and attitudes toward this technology in general and its application in education in special to become positive and people to be open to new experiences in using it. The present research explores how different variables like perception towards inclusion of Generative AI tools within teaching materials development, degree of familiarity, challenges of AI implementation in education, importance of AI within the teaching process, resilience to change can influence the perceived utility of AI in education fostering positive attitude towards it and usage intention among teachers. The results are showing that the influence exerted by the above variables can be assessed within an empirical model that can explain the intention of teachers to use effectively AI based tools at different levels of the didactic activity. Implications at the level of human resources management in education are also discussed.

KEYWORDS

**AI adoption in education, teacher perceptions of AI, human resource management in education, generative AI in teaching, educational technology optimization**

## 1 Introduction

The technology that gave birth to AI has been present in early forms since the 50s, after Alan Turing published the paper "Computing machinery and intelligence" (Pires et al., 2025). This technology subsequently experienced sustained development, passing through a series of well-defined stages such as: the foundation of the main specific AI algorithms in the 50s, the introduction of symbolic algorithms and expert systems in the 70s, machine learning in the 90s and deep learning algorithms in the 2010s (Samoili et al., 2020). Over time, AI technology has been incorporated into a variety of fields, with its particular applicability also evident in the field of education.

The integration and application of artificial intelligence (AI) technologies in education aim to enhance, automate, and personalize different facets of the educational process, encompassing a diverse array of tools, techniques, and applications utilizing machine learning, natural language processing, data analytics, and other AI-related technologies capable of revolutionizing conventional teaching and learning approaches. In this context, is important to analyze how artificial intelligence and machine learning algorithms shape personalized learning experiences, adjusting content and assessments according to individual needs. In addition to analyzing the impact of AI technologies in the field of education, is equally important to explore the necessary changes in the teaching approaches of teachers to successfully integrate these innovations into the teaching and learning process.

AI's ability to analyze extensive datasets, discern patterns, and make informed decisions in real-time has ushered in new possibilities in the field of education (Iqbal, 2023). One of the defining applicability of AI in the field of education refers to the tools available to adapt and customize in detail the learning experience to the individual needs that people show at a given moment. Thus, different forms of adaptive learning platforms, which implement complex algorithms, are able to analyze in real time the strengths and weaknesses of each user, adapting the content delivered to him and creating a specific rhythm for the transfer of information – everything to optimize the process of learning and its results (Abulibdeh et al., 2024).

Specific AI technology can provide each consumer of educational services with fully personalized experiences, based on the interpretation of algorithms related to student data, performance measured over time, time required for testing, domains and areas of interest. Following these processes related to the interpretation of complex algorithms, AI systems are able to recommend the creation of personalized learning materials, dynamically adjust the level of difficulty of the tests to which the individuals are subjected and provide access to additional learning resources, all of which are perfectly adapted to the individual level of knowledge and their own educational objectives.

The interaction between teachers and students or pupils is in turn personalized, the use of AI-based systems and applications offering not only a wider range of options to create personalized content but also allocating a greater amount of time for these interactions as a result of the increased degree of automation of routine administrative tasks.

The extensive usage of AI based technology provides more and more evidence that intelligent tutoring system and platforms are capable to enhance the engagement of students in interactive learning experiences, throughout real-time feedback and support. The extensive usage of AI based applications by the students rise some legitimate questions regarding the potential danger referring to the diminishment of their ability to use critical thinking and a new habit to use automated texts in the process of learning tasks fulfillment. Nevertheless, scholars think that actually a well-designed tutoring system has the potential to positively contribute to the stimulation of problem-solving skills and critical thinking among students. If teachers are willing to use in a responsible manner these tools within the process of tutoring, they can easily connect to the students' own motivations of actually develop critical thinking skills and not to rely on AI generated outputs. In fact, it is possible that by incorporating Generative AI into the writing process, the inherently social nature of writing can be preserved, largely eliminating students' subjective perceptions of the excessive effort or pressure that is usually associated with this endeavor (Barrett and Pack, 2023).

In other words, the correct guidance provided by teachers to highlight the true nature of AI technology - that of a simple collaborative tool and not a substitute for human intelligence and creativity, can provide students with the framework to naturally develop their critical thinking, in the context of developing original materials, essential for appreciating the quality of their learning process.

Within the process of adopting AI based systems within educational framework, a special attention is given to the possibility of enhancing the cross-cultural communication and collaboration through the usage of real-time translation capabilities that some AI based application can have. Using such features, the connection between different cultural and linguistic individuals' backgrounds can be easily optimized, thus developing new outcomes for the teaching and learning processes that are involving educational actors.

All these particular trends highlighted above outline a very complex landscape that is already evolving with a pronounced dynamic. Besides the technological advancements that have been amazing in the last years, we may consider that this dynamic is heavily influenced by the perceptions and attitudes of those who are actually responsible for using and promoting this technology in the educational environment—teachers at all levels of instruction. The degree of technology acceptance, the willingness to learn new methods for implementing didactic activities, the desire, and, importantly, the actual capability to use these tools effectively are factors that shape both the diffusion process of new technology in the educational environment and its adaptation to the specific needs of the users—pupils.

Starting from these considerations, our research has as a primary objective to identify the complex relationships between specific variables capable of measuring perceptions of teachers about using AI based applications and technology within their didactic activity and their influence on attitudes. Our research contributes to the development of the scientific literature in the field, proposing an original approach, using variables very similar to the ones used within consecrated models capable to measure the acceptance of technology like TAM (Technology Acceptance Model) or UTAUT (Unified Theory of Acceptance and Use of Technology) – perceived utility, usage intention, positive attitude, degree of familiarity with the use of technology (respectively AI based technology).

The roots of our proposed hypotheses are based also on certain ideas that can be found within various approaches regarding behavior and technology intention to use theories like Theory of Motivated Action (TRA) developed by Ajzen and Fishbein and Theory of Planned Behavior (TPB) model proposed by Azjen. The first one advanced the idea that a certain intention determines a certain behavior, meanwhile the attitude can influence the intention and then the behavior. The second one proposed the idea that the degree of acceptance for technology is influenced by beliefs that have behavioral, normative and control dimensions, the adoption process taking the form of a certain behavior (Ajzen and Fishbein, 1977; Ajzen, 1991; Gârdan et al., 2021). The originality of our approach stems from the fact that we address to a specific issue, that does not have so much research developed around – the attitude of teachers regarding usage of AI application or technology within their classroom or didactic current activities. This implies that they have developed a certain" acceptance," for the idea that AI can be used within educational field, and they have overcome the pressure stem by challenges related to AI usage and their own capacity of resilience related with change. We propose an exploratory research in the form of a field survey, which explores the perceptions and attitudes of teachers regarding the adoption of AI and its implementation in education in general, with a particular focus on the development of teaching materials in the context of the use of AI. More precisely, we have proposed a theoretical model that implies the influence of five variables (perception towards the inclusion of Generative AI in the process of developing school materials, degree of familiarity with AI technology, perception of the challenges posed by the use of AI in the didactic activity, perception of the importance of using AI in teaching processes and resilience to change) over perceived utility of AI usage. The perceived utility will influence the positive attitude over AI usage and this one leads to the effective intention to use. The results of the analyses, carried out using IBM SPSS and AMOS 26.0 software, confirm the practical validation of the proposed theoretical model. The article also presents a discussion section that highlights the impact of each validated hypothesis and the corresponding implications, particularly concerning the management of human resources in education.

The article will conclude with a series of conclusions that supplement the discussions and clarify the limitations of the conducted research, as well as potential future research directions.

## 2 Literature review—hypotheses development

### 2.1 The role of generative AI within the development of learning content process and the utility of AI integration within education field

The scientific literature concerning perceptions and interaction between teachers, students and other actors in the field of education in general and different AI based applications, instruments, platforms etc. is becoming more and more diverse and explicit.

There is already a growing body of research showing certain benefits and challenges that the integration of AI into education framework can have. Thus, diverse benefits like the facilitation of personalized learning, the adaptation to individual needs, the reduction of administrative time used for didactic activity, the possibility to better assess the level of students understanding have been highlighted within a meta-research regarding the evolution of AI within education, along with the lack of ethical considerations in case of majority of the AI applications. Authors have been emphasizing in the same time the need to compute more data from various educational settings, with more actors from the field implied into research (educators, teachers, students, regulatory institutions etc.) (Bond et al., 2024).

As future trends considered relevant for the usage and integration of AI within educational field we may consider personalized learning, predictive analytics, intelligent tutoring systems, content creation systems, Virtual Reality, automated administrative tasks, and chatbots usage as being some of the relevant ones (Ivanashko et al., 2024) as well as a kind of" paradigm shift" in terms of transforming the curriculum towards a personalized approach for every student (Judijanto et al., 2024).

Perceptions of teachers regarding the ways in which AI based tools can be used within the education field are influenced by the background of teachers in terms of their pedagogical beliefs, teaching experiences, prior experience with educational technology, and the effectiveness and necessity of a specific technology (Wardat et al., 2024). Teachers acknowledge AI potential to enhance educational outcomes and streamline teaching processes, considering important to be addressed in the same time their concerns about data privacy and the ethical implications of AI use (Bezjak, 2024).

Benefits related with AI utilization in education are developed around the idea that AI based applications are seeing as possible solutions to reduce instructors' administrative workload by taking over easy and repetitive duties and effective tools capable to be adapted to the students' needs despite the size of the classes (Jarrah et al., 2023). Also, besides the capacity to be supportive for the administrative tasks, AI applications can retrieve and adapt learning materials, simplify and enhance the content creation process (Chounta et al., 2022; Acurio et al., 2022).

In the context of research regarding the degree of AI utility within education field there are also studies that have employed TAM (Technology Acceptance Model). From this perspective, studies have shown that there are positive correlations for TAM variables like self-efficacy, ease of use, expected benefits, attitudes, and behavioral intentions (Al Darayseh, 2023), with more than 70% of the future behavioral changes related to using AI applications in science teaching, being predicted by the teachers' attitude toward the AI applications. Other research based on TAM variables revealed a strong positive correlation between the perceived usefulness of GenAI tools and their acceptance, underscoring the importance of demonstrating tangible benefits to educators. Acceptance is influenced by the perceived ease of use, with levels that are not uniform at the level of different teachers' subgroups (Ghimire and Edwards, 2024). TAM specific variables like perceived usefulness, perceived ease of use, and perceived trust in EAITs (Educational Artificial Intelligence Tool) are also emphasized when we talk about the degree of acceptance for EAITs (Choi et al., 2023), with the intention to integrate educational AI tools more clear for teachers with constructivist approach than the ones showing transmissive orientations.

An interesting observation can be made about the link between the positive attitude towards AI and capacity of individuals to integrate AI based tools into their teaching practices. Thus, teachers that can develop a positive attitude towards AI are successfully using these tools on a regular basis (Baker et al., 2019). Actually, teachers who viewed AI as beneficial were more inclined to use adaptive learning systems and content creation tools to enhance their instructional methods (Luckin et al., 2016). In such situations, teachers report that AI tools not only make the content creation process more efficient but also enhance the quality of the educational materials they produce. Teachers who recognize the broader benefits of AI in education are more likely to explore and utilize AI tools for developing teaching materials. They view these tools as integral to improving educational outcomes and are therefore more willing to integrate them into their teaching practices (Mayer, 2002). Conversely, teachers who are skeptical about AI's role in education may be less inclined to use AI tools, potentially missing the benefits these tools can offer.

The perceived utility of AI integration within education field is positively sustained by the ongoing support and available resources that can be used in order to ensure a sustaining teachers' use of AI tools. Ongoing support and resources are essential for sustaining teachers' use of AI tools. This includes technical support, access to up-to-date resources, and a community of practice where teachers can share their experiences and learn from each other (Kim, 2024). Also, even if teachers are capable to recognize the potential benefits of AI in enhancing personalized learning, automating administrative tasks, and providing real-time feedback, they perceive like a real challenge the lack of training and resources in using AI applications along with the need for ethical guidelines (Alwaqdani, 2024). There is a need for professional development programs to enhance teachers' AI literacy and confidence in using AI tools (Ayanwale et al., 2022). Thereby, within a research focused on the impact of professional development on teachers' ability to integrate AI in their teaching, the results showed that case-based learning and practical training significantly improve teachers' perceptions of AI's utility and their confidence in using AI tools effectively (Ding et al., 2024).

When we talk about perceived utility of AI in education, there is equally important to address the use Large Language Models applications. From this point of view, the usage of such applications within educational field is diversified, nowadays being available a wide range of instruments like Chat GPT-4, Claude, LaMDA, Falcon, Llama, PaLM etc. Chat GPT is one of the most well-known tool based on Large Language Models, being capable of a vast range of functions with direct applicability within the education field—provision of valuable insights and suggestions capable to offer the possibility to refine research questions and methodologies, adjust teaching strategies and materials depending on the students feedback and performance, provision of suggestions that can improve or develop new ideas and approaches of teaching methods and contents, possibility to align curriculum with the latest standards and best practices etc. Despite these possibilities, the majority of specialists suggest that AI powered tools are better in assisting teachers in the process of developing didactic materials or assessment tasks but not to replace completely their efforts. The human factor has to manifest his own creativity and capacity to build assessment instruments adapted to the learning objectives and student's needs (Al-Worafi et al., 2023). Actually, despite all the positive perceptions related with AI potential, there are studies that emphasize also the necessity that teachers and education specialists alike to examine in a critical way the educational transformation based on Generative AI and not to blindly accept the proofs regarding the efficacy (Su and Yang, 2023).

Putting together all the above considerations, becomes evident that teachers seems to be ready to integrate AI into their teaching practices, those who perceive AI as beneficial and easy to use being more likely to adopt these technologies. Many educators recognize the potential of AI to enhance educational outcomes by providing personalized learning experiences, improving administrative efficiency and implementing better students' assessment modalities. Naturally, we can advance the first hypothesis of our research, which highlights the possible link between perceptions regarding the degree of usefulness of integrating generative AI in the development of teaching materials and the usefulness of integrating AI in education in general:

> *H1: There is a positive and direct influence of perception towards inclusion of Generative AI in the process of developing school materials on perceived utility of AI integration in education.*

## 2.2 The role of degree of familiarity with AI software and technology for the perceived utility of AI integration in education

The body of literature concerning the AI perceptions and attitudes among teachers shows also interesting research results regarding the degree of familiarity towards AI software and/or AI based technology that teachers can elicit in a particular setting. We can highlight a research made on 211 primary and secondary school teachers that shows a positive significant relation between trust in AI, knowledge about AI and digital competencies, with knowledge being a robust predictor for trust (Lucas et al., 2024). An interesting fact presented by authors was the lack of influence exerted by descriptive variables like age, sex, teaching experience, ISCED level and different levels of digital competencies upon teachers' attitude towards AI. Still, other research highlights that teachers with good digital competencies generally have positive attitudes towards AI, recognizing its benefits for education (Nazaretsky et al., 2022a; Nazaretsky et al., 2022b). Although, the relationship between teachers' trust in AI and their digital competence was a positive one, the study also points out concerns related to the need for significant pedagogical changes and the lack of transparency in AI decision-making. Teachers' familiarity with AI varied, but many expressed the need for more professional development to increase their theoretical and practical knowledge of AI. The varying degrees of familiarity among professors, with some having a strong understanding of AI and others being less knowledgeable is a normal phenomenon, research revealing that despite these differences most professors see AI as a valuable educational tool, that comes also with some challenges given by the difficulty to understand AI algorithms, financial implications, and concerns about data privacy and the dehumanization of pedagogy (Abdelaal and Al Sawi, 2024). Readiness to use and implement AI related applications in the current didactic activities can be measured through the level of AI-enhanced innovation as a predictor of teachers' job satisfaction. Thus, in a research made on 3,164 primary school teachers, Wang et al. (2023) have been used partial least square structural equation modelling and cluster analysis and found that cognition, ability, and vision in the educational use of AI were positively associated with ethical considerations. In addition, the cluster analysis showed three different groups of teachers, based on their AI readiness level, with teachers having a high level of AI readiness and a low level of perceived threats, high level of AI innovation and high job satisfaction (Wang et al., 2023).

The discussion around the role that the degree of teachers' familiarity with AI software and AI based technology can have for the perceived utility of AI adoption in education can go towards clarifying the link that may exist between the effort to improve digital skills and the abilities to use AI in education and the willingness of teachers to effectively use AI applications in their current teaching activity. If we start from the premise that any solution that contributes to achieving a higher level of student satisfaction and better results is welcome from the perspective of teachers, it becomes obvious that such a solution can have a direct link to improving their digital skills. Supporting teachers in developing the essential digital competencies and skills to use AI in Education (AIED) applications and tools ethically and knowledgeably is crucial for improving the student learning experience and achieving educational outcomes. To assist teachers in this endeavor, human-centered and learning-focused AIED competency frameworks are necessary. These frameworks should guide teachers in planning, self-assessing, and reflecting on their current and new skills, thus facilitating their evolving role. This evolution aims to help students cultivate creative mindsets, develop empathy, and apply their learning to various contexts by engaging with content that resonates with them. Lameras and Arnab (2021) came with an interesting exploratory review that highlights a series of basic ideas - "AIED is employed to support teachers to design and orchestrate adaptive learning content and individualized learning activities aligned to a student's knowledge levels and skills.,"—"AIED is employed to support teachers to design and orchestrate adaptive collaborative learning support that situates teachers and AI agents as collaborators in offering cognitive feedback as well as in stipulating feedback on collaboration and interaction dynamics." Authors are proposing also that AEID can be seen as a part of a broader ecology of learning that involves adaptive representations and models that describe the associated pedagogy, the ways in which students are learning, embedded their experiences, misconceptions and particular styles (Lameras and Arnab, 2021). Teachers with superior levels of digital competencies and enhanced AI literacy can connect themselves easier to such an environment, being able to effectively integrate AI into their teaching. Ding et al. (2024) highlight the need for various types of professional development to enhance teachers' AI literacy. The study shows that case-based learning and practical training significantly improve teachers' familiarity with AI and their confidence in using AI tools in educational settings. It suggests that hands-on experience with AI applications is crucial for teachers to effectively integrate AI into their teaching (Wang et al., 2023).

The perceived utility of AI in education for teachers is also related with their intention to use AI. Research made on 452 pre-service teachers revealed that perceived usefulness (PU) and perceived ease of use (PEU) are primary factors that influence pre-service teachers' behavioral intentions to use AI. Specifically, perceived usefulness was found to be the strongest predictor, indicating that teachers are more likely to adopt AI tools if they believe these tools will enhance their teaching effectiveness (Zhang et al., 2023). Authors also found that AI anxiety and perceived enjoyment of AI significantly differ between male and female pre-service teachers. Female pre-service teachers reported higher levels of AI anxiety, which negatively influenced their perceived ease of use and subsequent acceptance of AI technologies. The study also employs TAM3 model in order to identify various determinants of AI acceptance among pre-service teachers, including AI self-efficacy, perceived enjoyment, AI anxiety, perceived ease of use, and perceived usefulness.

As a conclusion, the above studies shows that the degree of familiarity of the AI based instruments in education, expressed by the AI integration, AI level of trust and AI usage readiness is correlated with the utility of AI within educational field that teachers are capable to be aware of and their willingness to give credit and recognition to the potential of AI tools. Taking account of all of the above, we can issue our second hypothesis:

> *H2: There is a positive and direct influence of the degree of familiarity with AI software and technology on the perceived utility of AI integration in education.*

## 2.3 The importance of the perceived challenges posed by the use of AI in the didactic activity for the utility of AI integration in education

The perception of teachers regarding potential challenges posed by the AI integration in education field is nuanced. From this point of view we can take into consideration various papers from the literature that address this issue and test teachers' perceptions.

Thus, the study made by Holmes et al. (2019), explored the promises and implications of AI in education and found that teachers are aware of the potential challenges, such as the complexity of AI tools and the need for substantial training, but in the same time they can recognize the significant benefits these technologies can bring to the educational process (Holmes et al., 2019). While the positive influence of AI in teaching on perceived utility may be evident, several challenges must be addressed. These include ethical considerations, data privacy concerns, and the need for teacher training. Ensuring that AI systems are transparent, fair, and unbiased is crucial for maintaining trust and maximizing their perceived utility (Aoun, 2017). Otherwise, the pressure exerted by these challenges may affect in a direct and clear manner the degree of perceived utility of AI integration within the education field. Understanding and assessing challenges such ethical considerations and data privacy issues, seems crucial in shaping teachers' perceptions of AI utility (Gardner et al., 2021).

The research proposed by Viberg et al. (2023) investigated teachers' trust and perceptions of AI across different cultural contexts and found that teachers who were aware of and engaged with the challenges of AI integration, such as data security and algorithm transparency, also recognized the utility of AI in enhancing educational processes. If their perceptions about the challenges evolve into the direction of finding proper ways to mitigate with the pressure of these challenges, a positive perception about the utility of AI may be higher as well, otherwise the perceived utility may decrease substantially. Thus, the study highlights the importance of addressing challenges to foster a positive perception of AI's utility, but emphasize in the same time the danger that the perceived utility may become lower (Viberg et al., 2023). The research made by Alwaqdani on 1,101 Saudi teachers, shows that many teachers recognize AIED's potential to save time, assist in designing engaging activities, and personalize learning experiences. However, they also expressed concerns about the effort required for training, potential job displacement, a lack of creativity and critical thinking, unintended consequences, and trust in AI's error-free performance. While teachers are generally optimistic about the benefits of AIED, they adopt a cautious stance due to concerns about its impact on educational quality, the human touch, and potential risks (Alwaqdani, 2024). This means a lower utility level perceived for the full integration of AI technology within educational activities and field.

Another factor that is affecting challenges perception about AI impact is referring to the potential excessive dependence on generative AI empowered software like ChatGPT and others similar applications. This dependence may impede creativity and long-term cognitive development, negatively impacting academic, social, and career performance (Rudolph et al., 2023). A literature review made by Almasri (2024) shows AI's limited ability to understand particular subject matter, its inability to adjust to various educational contexts, and the variation in performance between various AI models. The same review shows that majorities of studies are indicating ethical considerations regarding responsible use appearing to be an important concern. Conclusions of the author implies the fact that addressing these challenges demands an approach that considers a careful thorough evaluation and adaptation to diverse contexts (Almasri, 2024). These results underscore the need for targeted professional development, collaboration between educators and policymakers, and ethical considerations to ensure responsible and effective AIED integration. Understanding teachers' perspectives is vital for informed decision-making and fostering a balanced approach that maximizes AIED's contributions while upholding the principles of effective and inclusive education within the rapidly evolving educational landscape.

As we can see, the literature consistently shows that recognizing and understanding the challenges posed by AI in educational settings can negatively influence the perceived utility of AI technologies. Thus, the study made by Howard et al. (2016) explores factors affecting teachers' attitudes toward technology integration and highlights that perceived difficulties, such as lack of training or support, can reduce perceived usefulness and hinder adoption (Howard et al., 2016). In the same line of thoughts, Ertmer (1999) discusses the role of "first-order" and "second-order" barriers in technology integration in education. First-order barriers include external obstacles such as lack of resources, while second-order barriers are internal, such as beliefs about the technology's complexity and utility. Both types of barriers can negatively affect educators' perceptions of new technologies like AI (Ertmer, 1999).

The research made by Aldosemani et al. (2024), focuses on the factors influencing the adoption of AI in educational contexts and finds that perceived barriers, including technological complexity and lack of support, significantly reduce the perceived utility of AI among teachers (Aldosemani et al., 2024). In turn, Zawacki-Richter et al. (2019) made a review of AI utilization in education, highlighting that perceived risks and challenges, including ethical concerns, data privacy, and the potential disruption of traditional teaching roles, can negatively influence educators' acceptance and perceived utility of AI technologies (Zawacki-Richter et al., 2019). Finally, we can also remember the study made by Mogavi et al. (2024) that explores teachers' perceptions of AI and identifies perceived challenges, such as technical difficulties and lack of training, as significant barriers to the perceived usefulness of AI in education (Mogavi et al., 2024).

All these studies highlight, from several perspectives, the fact that the teachers' perception of the possible challenges that the use of AI in education can have directly influences the perception of the usefulness that AI can have at this moment. As teachers are becoming more aware by the threat imposed by the above challenges, the level of utility associated with AI integration in education decreases. Taking account of all of the above, we may issue our third hypothesis:

> *H3: There is a negative and direct influence of the perception of the challenges posed by the use of AI in the didactic activity on the perceived utility of AI integration in education.*

## 2.4 The usage of AI in teaching processes and the impact upon the perceived utility of AI integration in education

Several studies underscore the importance of AI in enhancing teaching processes. AI-driven tools can provide personalized learning experiences, adapt to individual student needs, and offer real-time feedback. For instance, intelligent tutoring systems have demonstrated efficacy in improving student-learning outcomes by providing tailored instruction (Woolf, 2010).

Additionally, AI can assist teachers by automating routine tasks, allowing them to focus on more critical aspects of teaching, such as student engagement and mentoring (Luckin et al., 2016).

Perceived utility refers to the extent to which users believe that using a particular technology will enhance their performance. In the context of education, the perceived utility of AI integration is influenced by various factors, including the effectiveness of AI tools, ease of use, and the extent to which these tools meet educational objectives. Research indicates that when educators recognize the importance of AI in enhancing teaching processes, their perception of AI's utility in education increases (Hwang et al., 2020). Similarly, a study by Chen L. et al. (2020) found that teachers who valued the role of AI in personalized learning perceived higher utility in integrating AI into their teaching practices (Chen L. et al. 2020), and a research made by Almasri (2024) demonstrated that the perceived importance of AI in facilitating administrative tasks positively influenced the perceived utility of AI in educational settings (Almasri, 2024).

In a study conducted in a high school, the introduction of an AI-driven tutoring system led to significant improvements in student performance and teacher satisfaction. Teachers reported that the system's ability to provide personalized feedback and automate grading tasks was highly valuable, enhancing their perception of AI's utility in the classroom (Holmes et al., 2019). AI's capability to analyze large datasets and provide insights into student performance and learning patterns is increasingly important in modern education. Holmes et al. (2022) found that data-driven decision-making supported by AI tools leads to more informed instructional strategies. Educators who value the importance of data analytics in improving teaching processes are likely to perceive AI's utility positively, as it directly enhances their ability to tailor instruction to student needs (Holmes et al., 2022).

AI integrated in education field encompasses a wide range of applications, including intelligent tutoring systems, automated grading, personalized learning, and administrative task automation. These applications are designed to enhance the efficiency and effectiveness of educational processes. The importance of AI in teaching is driven by the teachers' need to address diverse student needs, streamline administrative tasks, and improve overall educational outcomes (Zawacki-Richter et al., 2019). We all agree that the ultimate goal of AI integration is to improve educational outcomes. Onesi-Ozigagun et al. (2024) emphasize that AI tools designed to enhance academic achievement and student success are crucial in education. Teachers who witness the direct impact of AI on student performance and learning outcomes are more likely to value its utility. The perceived importance of AI in achieving these outcomes reinforces its perceived utility (Onesi-Ozigagun et al., 2024). Results and ideas presented so far make clear the importance that different practical modalities to use AI within the teaching process have an important role in augmenting the perceived utility of AI integration in education. As educators increasingly recognize the benefits of AI in enhancing teaching and learning, their perception of AI's utility in education is likely to improve. Future research should continue to explore this relationship, considering the evolving nature of AI technologies and their applications in education.

Considering all of the above, we may advance our fourth hypothesis:

> *H4: There is a positive and direct influence of the importance of using AI in teaching processes on the perceived utility of AI integration in education.*

## 2.5 Importance of educators' resilience regarding the perceived utility of AI integration in education

In relation to change and innovation, resilience is not seen as a merely" resistance" but as a kind of one's capacity to cope with change (Parish, 2013) and also the expression of a particular set of knowledge, skills, and action competencies to cope with change (Makrakis, 2024). Resilience is a multidimensional, socially constructed concept that is relative, dynamic and developmental in nature (Gu and Day, 2007). Taking into consideration such a variable in the context of technology adoption is justified by diverse studies that are showing the importance of it in adopting a certain attitude toward novelty and innovation (Mehta, 2021; Shahid et al., 2024; Oliveira et al., 2021). A "resilient" teacher is an individual capable to exert control over difficult situations, with the strength and determination to fulfil his professional role by adapting to new challenges and thrive in difficult circumstances (Li, 2023; Mansfield et al., 2016).

If we define educators' resilience to change being their ability to adapt to new circumstances and embrace innovation (Kangas-Dick and O'Shaughnessy, 2020), we can assume that this ability significantly influences their perception of the utility of AI integration in educational settings (Chen L. et al. 2020). This relationship is grounded in the broader literature on technology acceptance and change management, where resilience has been identified as a critical factor in the successful adoption of new technologies (Davis et al., 1989; Venkatesh et al., 2003).

On the other hand, different existing research suggests that individuals who are more resilient are better equipped to navigate the complexities of integrating new technologies into their professional practices (Aburn et al., 2016; Rafferty and Griffin, 2006). The resilience of educators appears to play a crucial role in shaping their perceptions of AI's benefits, particularly in environments where technological change is rapid and often met with resistance. Educators who exhibit high resilience are more likely to see the potential advantages of AI, such as enhanced teaching efficiency, personalized learning opportunities, and improved student engagement. This positive perception, in turn, increases the likelihood of AI being perceived as a valuable tool in educational contexts (Luckin et al., 2016). A possible strong positive relationship between resilience to change and perceived utility suggests that fostering resilience among educators could be a key strategy in promoting the successful integration of AI technologies in education (Ng et al., 2023). Research is showing different types of behavior that teachers can have in relationship with their attitude to change and adoption of innovation. Teachers can be grouped in three different groups taking account their behavior regarding the adoption of innovation and attitude to change: "provocative innovators" who pro-actively change the teaching content of their own accord in compliance with new trends and come up with new ideas, "reactive innovators" who carry out changes only on the basis of certain regulations, new syllabi and "opponents to change" that actually enjoy being stuck in the present (Dostál et al., 2017). Professional development programs designed to enhance educators' adaptability and openness to innovation are likely to have a significant impact on their perceptions of AI's utility. By equipping educators with the skills and mindset needed to embrace change, educational institutions can facilitate a smoother transition towards the adoption of AI-driven tools and methodologies. It becomes clear that individuals more resilient in front of changings with a greater willingness to try and adopt new instruments, methods, behaviors will perceive a greater utility of any advanced technology that promotes innovation—including AI applications. Therefore, we may advance our fifth hypothesis:

> *H5: There is a positive and direct influence of the resilience to change on the perceived utility of AI integration in education.*

## 2.6 The perceived utility of AI integration in education—a prerequisite for positive attitude regarding AI usage in didactic activity

In the following we will assume that a perceived utility for the AI integration can lead to a positive attitude toward the AI usage within the current activity of teachers. In a study that was employing a quantitative and qualitative approach in the same time, Egara and Mosimege (2024) found out that teachers of mathematics who integrate ChatGPT into their daily activities report positive outcomes, including improved teaching effectiveness, heightened student engagement, and enhanced comprehension of complex concepts. The research highlights also some challenges regarding technical adaptability, curriculum alignment, and the need for customization to accommodate diverse learning styles. In the same time, the study shows that teachers who perceive AI as highly useful in streamlining educational tasks and enhancing student learning outcomes develop more favorable attitudes towards its use. The perceived efficiency and effectiveness of AI tools directly contribute to a positive attitude among educators (Egara and Mosimege, 2024). Another research made by Ellikkal and Rajamohan (2024), highlights that AI's ability to personalize learning experiences based on individual student needs significantly influences teachers' positive attitudes. The perceived utility in improving student engagement and performance through personalized learning fosters a supportive attitude towards AI integration (Ellikkal and Rajamohan, 2024), AI's utility in automating administrative tasks such as grading and attendance tracking is found to significantly improve teachers' attitudes towards AI. The reduced administrative burden allows teachers to focus more on instructional activities, which enhances their perception of AI as a beneficial tool (Wang, 2021).

Previous research found also evidence that the perceived utility of AI in achieving better student outcomes leads to positive attitudes among teachers. When educators see tangible improvements in student performance and engagement due to AI tools, their attitude towards AI usage becomes more favorable (Kim et al., 2022).

Other research in the field also sustains the idea that AI tools that provide professional development and support for teachers are perceived as highly useful, contributing to positive attitudes towards

AI. The perceived benefit of continuous professional growth through AI-driven insights and resources strengthens teachers' willingness to adopt AI in their teaching practices (Copur-Gencturk et al., 2024a; Copur-Gencturk et al., 2024b).

Another argument for the positive influence on teacher's attitude regarding AI, is constructed taking account the capacity of AI to offer support in the decision-making processes. Teachers' attitudes towards AI are positively influenced by its utility in data-driven decision-making. The ability to use AI to analyze student performance data and inform instructional strategies is seen as highly beneficial, leading to a more positive attitude towards AI usage (Teng et al., 2023; Alsbou, 2024). AI's perceived utility in addressing diverse learning needs and providing equitable education opportunities fosters positive attitudes among teachers. When educators see AI as a tool that can support inclusive education, their attitude towards its use becomes more positive (Harry and Sayudin, 2023; Yao and Wang, 2024).

The recognition of AI's role in enhancing creativity and innovation in the classroom leads to a stronger endorsement of AI usage (Nugraheni et al., 2024; Duan et al., 2024). While the adoption of AI technologies in education is growing, the true impact on teaching effectiveness depends on more than just ease of use. The integration of these tools must go hand in hand with enhancing instructional quality to drive meaningful change. In other words, even if some AI technologies are easy to use and apply, without improving the quality of teachers' instruction, it would not significantly change teachers' behavior when adopting these technologies in their teaching activities (Wang et al., 2021).

So, it becomes clear that the perceived utility of AI adoption within the education field translates in a natural manner towards a positive attitude regarding the effective usage of AI based applications. Therefore, we can issue our sixth hypothesis:

> *H6: There is a positive and direct influence of the perceived utility of AI integration in education on the positive attitude regarding AI usage in didactic activity.*

## 2.7 The role of positive attitude regarding AI usage in didactic activity in fostering usage intention of AI based applications and technology

If we assume that a positive attitude towards AI usage and integration may emerge, we can develop further the idea that the attitude becomes a proper background for the intention to use and furthermore the actual use. In a very broad view, The Technology Acceptance Model (TAM) and other technology acceptance related frameworks of analysis suggests that positive attitudes towards a technology significantly influence the intention to use that technology (Liu et al., 2010) From this perspective, according to Hopcan et al. (2024), teachers who have a favorable attitude towards AI are more likely to integrate it into their teaching practices. This positive attitude stems from the belief that AI can enhance their teaching effectiveness and student learning outcomes, leading to a stronger intention to use AI in didactic activities (Hopcan et al., 2024). Positive attitudes towards AI are often shaped by perceptions of its usefulness and ease of use. A study by Wang et al. (2024) found that teachers who perceive AI as a beneficial and user-friendly tool are more inclined to adopt it in their instructional practices. When educators believe that AI can simplify their tasks and improve educational outcomes, their intention to use AI increases, reflecting a direct link between positive attitudes and usage intention (Wang et al., 2024).

The paper of Nazaretsky et al. (2022b), propose a survey instrument that aims to capture various dimensions of teachers' trust in AI-EdTech, including perceived benefits, concerns, and overall trust. The study identifies several key factors that influence teachers' trust in AI-EdTech. These include the functionality and helpfulness of AI tools, their reliability, and the transparency of AI algorithms. Teachers' perceived benefits and concerns about AI-EdTech play a crucial role in shaping their trust (Nazaretsky et al., 2022a; Nazaretsky et al., 2022b). So, if such a new technology gains enough trust it becomes easy to adopt as an effective behavior—the implementation in the current didactic tasks and activities becoming a living reality.

From another line of discussion, effective professional development programs that promote positive attitudes towards AI can significantly influence teachers' intentions to use AI. Chen L. et al. (2020) highlight that teachers who undergo comprehensive AI training are more likely to develop positive attitudes towards its use. These positive attitudes, in turn, lead to a higher intention to integrate AI into their teaching activities, as they feel more confident and competent in using AI technologies (Chen L. et al., 2020). Teachers who have a positive attitude towards AI often observe its impact on student engagement and learning outcomes. Chiu et al. (2023) found that educators who see the benefits of AI in fostering interactive and adaptive learning environments are more likely to use AI in their teaching. The recognition of AI's potential to enhance student motivation and achievement strengthens their intention to incorporate AI into their didactic activities (Chiu et al., 2023). AI's ability to reduce teachers' workload by automating routine tasks contributes to positive attitudes towards its use. A research conducted by Hashem et al. (2024) revealed that integrating AI tools optimizes teacher planning, enhances instructional support, and refines resource allocation, contributing to a potential positive perception about the AI's academic potential while stressing burnout mitigation's importance for educational advancement (Hashem et al., 2024).

According to Holmes et al. (2019) teachers who appreciate the efficiency AI brings to administrative tasks, such as grading and attendance tracking, develop positive attitudes towards AI. This appreciation translates into a greater intention to use AI, as it allows teachers to focus more on instructional and student-centered activities (Holmes et al., 2019). Positive attitudes towards AI are often linked to a willingness to innovate and adopt new teaching practices. A research made on 329 respondents applying UTAUT (Unified Theory of Acceptance and Use of Technology) model shows that performance expectancy related with AI usage in education has positively impacted attitude towards AI usage. Along with perceived risk and effort expectancy, the adoption of AI is influenced also by the facilitating conditions – meaning here the implication of authorities and policy makers in the human resources development programs and AI based logistics investments. In the same time, willingness to adopt AI within respondents' current activity was linked to their attitude toward innovation and change (Chatterjee and Bhattacharjee, 2020). Luckin et al. (2016) found that teachers who are open to incorporating AI into their classrooms tend to have a more positive attitude towards its use. This openness to innovation fosters a stronger intention to use AI, as teachers are motivated to explore new methods that can enhance their teaching effectiveness (Luckin et al., 2016). Teachers who recognize AI's potential to address diverse learning needs are more likely to have a positive attitude towards its use. Chen L. et al. (2020) emphasize that AI's ability to provide personalized learning experiences for students with different abilities and learning styles leads to positive attitudes among educators. These positive attitudes enhance teachers' intention to use AI, as they see its value in promoting inclusive education (Chen X. et al., 2020).

In the context of AI adoption, we can discuss also the impact that a supportive school culture can have from this perspective. In general, different authors shows that a technology-oriented school culture represents a positive important factor that can help teachers from the perspective of integration and adoption of that technology (Porto, 2020; Huang and Teo, 2020). A supportive school culture that encourages the use of AI can influence teachers' attitudes and intentions (Al Darayseh, 2023).

Zhang et al. (2023) found that schools with a positive culture towards technology adoption foster positive attitudes among teachers. When the school environment is conducive to AI integration, teachers are more likely to develop a positive attitude towards AI and express a stronger intention to use it in their teaching activities (Zhang et al., 2023). Collaboration and peer influence play a significant role in shaping teachers' attitudes towards AI (Kim, 2024). Hwang et al. (2020) highlight that teachers who collaborate with peers who have a positive attitude towards AI are more likely to adopt a similar attitude. This peer influence contributes to a greater intention to use AI, as teachers are encouraged by their colleagues' positive experiences and successes with AI integration (Hwang et al., 2020).

Exposure to successful AI applications in education can enhance teachers' attitudes and intentions. Holmes et al. (2019) found that teachers who witness the positive impact of AI on student learning and classroom management are more likely to develop a favorable attitude towards its use. This exposure increases their intention to use AI, as they are motivated by the success stories and proven benefits of AI in education (Holmes et al., 2019).

By integrating these arguments, we can substantiate the hypothesis that a positive attitude towards AI usage in didactic activities positively influences the intention to use AI in these activities. Each argument is supported by recent studies, demonstrating the direct relationship between positive attitudes and the intention to integrate AI technologies in educational settings. Therefore, we can issue our seventh and last hypothesis:

> *H7: There is a positive and direct influence of the positive attitude regarding AI usage in didactic activity on the usage intention regarding AI in didactic activity.*

The above literature review helps us to highlight the interdependencies between the following variables taken into consideration: "Degree of familiarity with AI technology (FAI)," "The perception of the challenges posed by the use of AI in the didactic activity (PCAI)," "The perception of the importance of using AI in teaching processes (PIAI)," "Perception towards the inclusion of Generative AI in the process of developing school materials (PAIDM)," "Resilience to change (RC)," "Perceived utility (PUT)," "Positive attitude (PAT)," "Usage intention (UI)."

Based on these hypotheses, we can conceptualize a model that illustrates the interplay between these factors. The model would show how familiarity with AI technology, perception of AI's importance and challenges, and resilience to change directly influence the perceived utility of AI. In turn, this perceived utility shapes educators' attitudes and intentions regarding AI usage in didactic activities. Such a model provides a structured framework for understanding the dynamics of AI adoption in education from the point of view of the teachers. It highlights the importance of addressing both technological and human factors to foster a positive environment for AI integration. This comprehensive approach can guide policymakers, educators, and researchers in designing effective strategies to enhance AI adoption and maximize its benefits in educational settings.

## 3 Methodology of research

In order to grasp teachers' perceptions and attitudes toward AI integration we have employed a quantitative research based on online survey approach.

### 3.1 Participants (sampling and data collection)

The statistical population from which we have extracted the sample is comprising mainly teachers from major cities and cultural centers of Romania—Bucharest, Alba-Iulia, Constanța, selected taking account by variables that are prevailing in the scientific literature concerning research regarding perceptions and attitudes in the education field—gender, age, seniority in education, the level of teaching program, the teaching field, the rural or urban area for the education institution of the teacher, the monthly income (Köksal, 2013; Bentea and Anghelache, 2012; Mills, 2007).

The instrument used to collect data was the online questionnaire comprising items defined for every variable from the proposed model and descriptive variables considered (Table 1).

Thus, after the selection of the proper profile of the statistical population, questionnaires has been sent over the Google Forms online platform for completion within May–June 2024. The number of valid completed questionnaires that could be considered for the further analysis has been of 367.

The structure of the final sample is comprising a preponderance of female teachers with 78.5% from the total sample, with teachers that have more than 20 years of seniority (49.9%) and an income between 6,000–8,000 lei (approx. 1,205–1,607 euro) for 34.9% of the respondents. This structure is reliable, in the context in which the official statistical data available in Romania's National Institute of Statistics in reports regarding educational system of Romania, shows a preponderance of people aged between 40 and 44 years (17.9%) and 30–34 years (14.1%) at the level of teaching staff in pre-school education by age group, both in primary and secondary education; 40–44 years old (20.6%), followed by teaching staff aged between 45 and 49 years, who represented 17.8% of the number of people with a didactic norm employed in primary and secondary education. Female teachers were holding the highest share (92.6% for primary education and 74.0% for secondary education) in the national total and 72.7% for high school education (Andrei, 2023). As regarding the representativeness from the point of view of work environment, due to the fact that more urban related teachers have the possibility to be digital literate than teachers from rural areas, the proportion of teachers from urban area was consistent in comparison with the one from rural areas.

TABLE 1 Sample profile ($N$ = 367).

| Variable | Items | $N$ | % |
|---|---|---|---|
| Gender | Female | 288 | 78.5% |
| | Male | 79 | 21.5% |
| The field of the didactic activity | Primary education (disciplines specific to primary classes) | 120 | 32.7% |
| | Social Sciences (Business, Economics, Tourism and Hospitality, Psychology, Law, etc.) | 79 | 21.5% |
| | Technology (Engineering, Robotics, Computer Science, Mechanics, etc.) | 54 | 14.7% |
| | Arts and Humanities (Foreign Languages, Architecture, History, Literature, Music, Philosophy, etc.) | 86 | 23.4% |
| | Life Sciences and Biomedicine (Biology, Medicine, Agriculture, etc.) | 11 | 3.0% |
| | The exact sciences (Astronomy, Chemistry, Physics, Mathematics, etc.) | 17 | 4.6% |
| Seniority in education | Less than 2 years | 31 | 8.4% |
| | Between 2 and 10 years | 47 | 12.8% |
| | Between 11 and 20 years | 106 | 28.9% |
| | More than 20 years | 183 | 49.9% |
| The level of education at which you carry out teaching activities | kindergarten and primary school | 120 | 32.7% |
| | secondary education | 61 | 16.6% |
| | high school education | 92 | 25.1% |
| | university education | 94 | 25.6% |
| Monthly Income of the respondent * | under 2,500 lei | 20 | 5.4% |
| | 2,500–4,500 lei | 65 | 17.7% |
| | 4,501–6,000 lei | 114 | 31.1% |
| | 6,000–8,000 lei | 128 | 34.9% |
| | Above 8,000 lei | 40 | 10.9% |
| Age | less than 25 years of age | 20 | 5.4% |
| | 26–35 years of age | 49 | 13.4% |
| | 36–45 years of age | 112 | 30.5% |
| | 46–55 years of age | 118 | 32.2% |
| | 56–65 years of age | 68 | 18.5% |
| The environment in which the educational unit where you work is located | rural | 50 | 13.6% |
| | urban | 317 | 86.4% |

* The income groups expressed in euro are: under approx. 502 Euro; approx. 502–904 Euro; approx. 904–1,205 Euro; approx. 1,205–1,607 Euro; 1,607 Euro and over (https://www.cursbnr.ro/).

## 3.2 Measures

The variables used to measure perceptions corresponding to the hypotheses substantiated within the literature review of the paper have been defined adapting constructs and items used in different research settings as it can be seen in the Annex Table 1—Variables from the tested model. Thus, the construct referring to *"Degree of familiarity with AI technology (FAI)"* that was measuring the degree of familiarity of the teachers with AI applications and related technology was measured with the help of two items scale adapted from Wardat et al. (2024). *"The perception of the challenges posed by the use of AI in the didactic activity* (*PCAI*)*"* – referring to the perceptions about challenges determined by the use of AI within the didactic activity was measured with eight items adapted from Wardat et al. (2024). *"The perception of the importance of using AI in teaching processes (PIAI)"* was measured with six items adapted from Wardat et al. (2024), while *"Perception towards the inclusion of Generative AI in the process of developing school materials (PAIDM)"* was measured with a total of five items, two of them adapted from Swargiary and Roy (2023), and the other three adapted from Wardat et al. (2024) and Swargiary and Roy (2023). *Resilience to change (RC)*—meaning a construct that was measuring the degree in which the teaching staff is resilient with respect to innovation and change was measured with the help of five items, the first one being adapted from Swargiary and Roy, 2023, the rest of four items being adapted from Nov and Ye (2009). *Perceived utility (PUT)*—meaning a construct that was measuring the perceived utility of AI integration in didactic activity and education was measured with the help of four items adapted from Venkatesh and Davis (2000). *Positive attitude (PAT)*—meaning the attitude towards AI integration within didactic current activity was measured with five items - the first three adapted from Venkatesh et al. (2012), and the last two from Barrett and Pack (2023).

*"Usage intention (UI)"*—meaning the effective intention of teachers to use AI applications and technology in everyday use within

didactic activity was measured with six items that have been created by the authors, designed for this research, using as a started point similar construct from Venkatesh et al. (2012).

The survey instrument contains mainly 5-point (strongly disagree corresponding to 1—strongly agree corresponding with 5) Likert scale questions. Data was analyzed using version 26.0 of IBM SPSS software with the corresponding extension Amos 26.0, used for the structural equations part. For underlying the relation between different latent variable showed within the conceptual model proposed in Figure 1, we have used structural equation model.

To assess the viability of the proposed model, the Cronbach's Alpha coefficient was computed. This measure determines the model's reliability and its capacity to accurately gauge the intended latent construct. In our study, the model achieved internal reliability, evidenced by a Cronbach's Alpha coefficient of 0.935, calculated using SPSS, which exceeds the acceptable threshold of 0.7 (Arof et al., 2018). Following this, we conducted the confirmatory factor analysis with Amos 26.0, in order to evaluate the significance of each relationship within the tested model. The results, displayed in Table 2, confirm strong relationships between variables. Additionally, we provided the appropriate theoretical statistical values to ensure a thorough assessment of the model's goodness of fit.

# 4 Results

The proposed theoretical framework underwent a validity assessment. The model's components were examined using exploratory factor analysis (EFA), a method that enhances precision and aids in accurately defining the model. EFA also helps in identifying variables that could be excluded from the analysis to streamline the data without compromising the accuracy of the final outcomes. To evaluate the reliability of the scales, the Cronbach's Alpha test was employed. This involved calculating Cronbach's alpha coefficient for each factor to gauge internal consistency. This coefficient assesses the total of observed variables in relation to the overarching variable, enabling the elimination of those with low correlation coefficients. In exploratory analysis, testing the scale's reliability using Cronbach's Alpha is crucial. While a definitive value for Cronbach's alpha to ensure high measurement fidelity is not established, many scholars suggest that coefficients of 0.90 or higher indicate excellent reliability, those of 0.80 or above suggest good reliability, and those of 0.70 or higher are deemed acceptable (Arof et al., 2018). According to the results, Cronbach's alpha coefficient values are above 0.70, for each component measurement (a value of 0.775 for FAI, a value of 0.880 for PIAI, a value of 0.897 for PCAI, a value

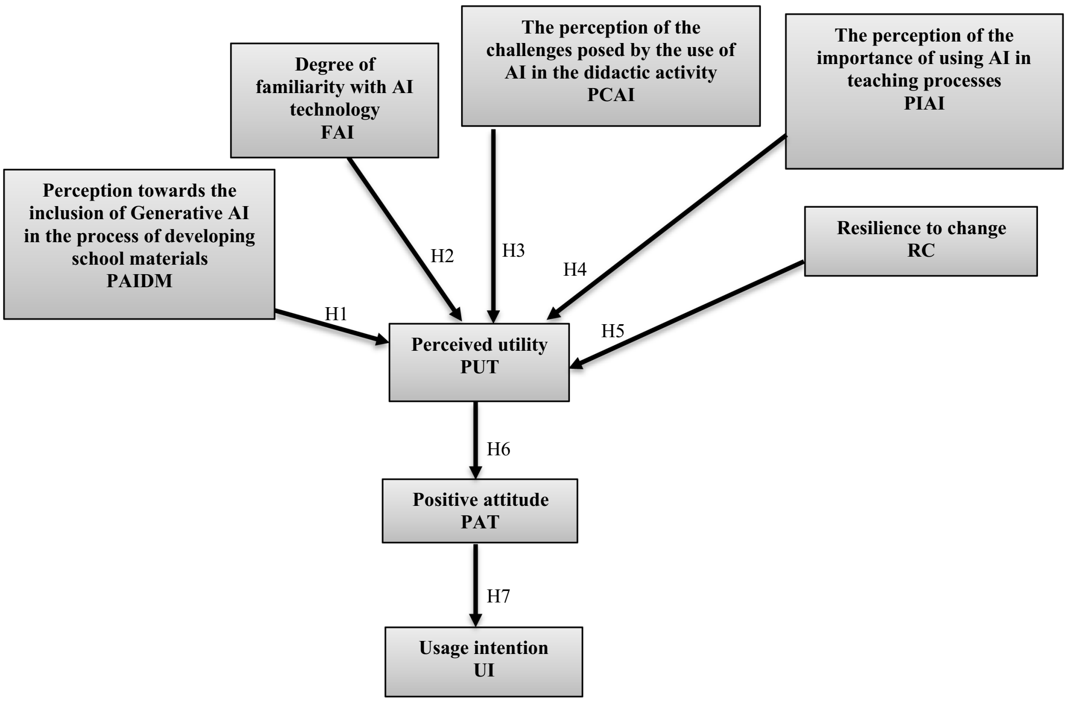


FIGURE 1
The theoretical model proposed. PAIDM—PUT, refers to a direct relationship between perception toward inclusion of generative AI into the development of class materials and support for current didactic activity and the perceived utility for the AI integration in the educational setting; FAI—PUT, refers to a direct relationship between the variable referring to the degree of familiarity with AI technology and the perceived utility for the AI integration in the educational setting; PCAI—PUT, refers to a reverse relationship between perception of the challenges brought by the use of AI technology in the current didactic activity and the perceived utility for the AI integration in the educational setting; PIAI—PUT, refers to a direct relationship between the perception related with the AI usage within current teaching activities and the perceived utility for the AI integration in the educational setting; RC—PUT, refers to the direct relationship between teachers' resilience to change regarding usage of new technology and especially AI related ones and the perceived utility for the AI integration in the educational setting; PUT—PAT, refers to the direct relationship between the perceived utility for the AI integration in the educational setting and the positive attitude of teachers toward AI integration; PAT—UI, refers to the direct relationship between the positive attitude of teachers toward AI integration within the educational setting and the intention to effectively use the AI related technology in the current didactic activity.

of 0.896 for PAIDM, a value of 0.945 for RC, a value of 0.835 for PUT, a value of 0.899 for PAT, a value of 0.948 for UI) which means that the fidelity (consistency) of the scales in case of latent variables is confirmed (Field, 2013; Tavakol and Dennick, 2011).

It can be seen from the table above that for all constructs the conditions are met as Cronbach's Alpha >0.7 (Zhao et al., 2022) and AVE > 0.5 (Byrne, 2016), therefore they can be considered reliable (because high internal consistency) and valid (the items explain

TABLE 2 Factor loading, Cronbach's alpha and AVE of construct.

| Variable | Item | Factor loading | Cronbach's alpha | AVE (Average variance extracted) |
|---|---|---|---|---|
| PAIDM (perception towards inclusion of AI into didactic activity) | PAIDM1 | 0.816 | 0.896 | 0.709 |
| | PAIDM2 | 0.876 | | |
| | PAIDM3 | 0.865 | | |
| | PAIDM4 | 0.846 | | |
| | PAIDM5 | 0.804 | | |
| FAI (degree of familiarity with AI technology) | FAI1 | 0.895 | 0.775 | 0.791 |
| | FAI2 | 0.883 | | |
| PCAI (perception of the challenges brought by the use of AI technology in the current didactic activity) | PCAI1 | 0.738 | 0.897 | 0.623 |
| | PCAI2 | 0.783 | | |
| | PCAI3 | 0.829 | | |
| | PCAI4 | 0.850 | | |
| | PCAI5 | 0.850 | | |
| | PCAI6 | 0.734 | | |
| | PCAI7 | 0.754 | | |
| | PCAI8 | 0.760 | | |
| PIAI (perception related with the AI usage within current teaching activities) | PIAI1 | 0.768 | 0.880 | 0.626 |
| | PIAI2 | 0.843 | | |
| | PIAI3 | 0.785 | | |
| | PIAI4 | 0.778 | | |
| | PIAI5 | 0.817 | | |
| | PIAI6 | 0.752 | | |
| RC (teachers' resilience to change regarding usage of new technology) | RC1 | 0.901 | 0.945 | 0.820 |
| | RC2 | 0.919 | | |
| | RC3 | 0.898 | | |
| | RC4 | 0.912 | | |
| | RC5 | 0.897 | | |
| PUT (perceived utility for the AI integration in the educational setting) | PUT1 | 0.827 | 0.835 | 0.675 |
| | PUT2 | 0.849 | | |
| | PUT3 | 0.855 | | |
| | PUT4 | 0.751 | | |
| PAT (positive attitude of teachers toward AI integration within the educational setting) | PAT1 | 0.864 | 0,899 | 0.768 |
| | PAT2 | 0.907 | | |
| | PAT3 | 0.869 | | |
| | PAT4 | 0.865 | | |
| UI (the intention to effectively use the AI related technology in the current didactic activity) | UI1 | 0.900 | 0.948 | 0.794 |
| | UI2 | 0.876 | | |
| | UI3 | 0.887 | | |
| | UI4 | 0.896 | | |
| | UI5 | 0.869 | | |
| | UI6 | 0.919 | | |

enough of the latent construct). Also, In terms of convergence validity, the factor loading of each variable is greater than 0.7, and the average variance of each variable is also greater than 0.5 (Hair et al., 2014; Zhao et al., 2022).

In calculating the factor scores, orthogonal extraction was applied using the PCA (Principal Component Analysis) method with Varimax rotation. The VIF and Tolerance values for the relationships between factor scores are presented in Table 3 below. Tolerance is a measure of how much of the variability in a variable is explained by other predictors. Tolerance values less than 0.1 suggest severe multicollinearity. Tolerance values above 0.2 are usually considered acceptable for most statistical analysis, and a value of 0.7 is usually considered excellent (Menard, 2002). All Tolerance values are above 0.7, indicating a low degree of collinearity among the predictors. This suggests that each predictor has a minimal relationship with the others, ensuring that there is no problematic correlation between the analyzed variables. The VIF (Variance Inflation Factor) values range from 1.063 to 1.280, which indicates minimal multicollinearity among the predictors. A VIF greater than 10 indicates problematic collinearity, but in many contexts VIF values below 5 are considered acceptable to avoid significant multicollinearity (Kutner et al., 2005). The above values, obtained in the context of our research, can be considered excellent, confirming that the predictors are sufficiently independent to be included together in the same model.

The results obtained for the advanced model, using the KMO and Bartlett's Test, demonstrate that the data are highly suitable for factor analysis. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, with a value of 0.945, suggests a high proportion of variance in the model's variables that could be attributed to underlying latent factors. In other words, the variables exhibit sufficient correlation to justify proceeding with factor analysis. According to Kaiser (1974), KMO values above 0.9 are considered 'excellent,' confirming that the sample is highly adequate for factor analysis (Kaiser, 1974). Bartlett's Test of Sphericity, with an Approximate Chi-Square of 10,894.455 and degrees of freedom (df) of 780, at a significance level ($p$-value) of 0.000, further supports this conclusion. The large Chi-Square value and the p-value of 0.000 indicate that the correlation matrix significantly deviates from an identity matrix (where no correlations between variables would exist). This finding confirms that the observed variables exhibit sufficient inter-correlations, a prerequisite for identifying meaningful factors. These results collectively suggest that the latent constructs derived from the factor analysis will likely provide an accurate and valid representation of the observed data. Moreover, the KMO value of 0.945 indicates an excellent sampling adequacy for factor analysis, and Bartlett's Test, with a significant Chi-Square value and a p-value of 0.000, suggests that the model's variables are sufficiently correlated, allowing for a seamless continuation of factor analysis (Bartlett, 1954).

TABLE 3 VIF and tolerance for factor scores.

| Relations | Tolerance | VIF |
|---|---|---|
| PAIDM → PUT | 0.882 | 1.134 |
| FAI → PUT | 0.941 | 1.063 |
| PCAI → PUT | 0.866 | 1.155 |
| PIAI → PUT | 0.781 | 1.280 |
| RC → PUT | 0.845 | 1.184 |
| PUT → PAT | 1.000 | 1.000 |
| PAT → UI | 1.000 | 1.000 |

The confirmatory factor analysis conducted with Amos 26.0 indicated whether each relationship within the tested model exhibits sufficient relevance. In our evaluation, we applied several criteria to assess model suitability, including CMIN/DF, RMR, IFI, TLI, CFI, and RMSEA. The values derived for these indicators, when compared against theoretical benchmarks from the literature, suggest a good model fit. This strong alignment supports our capacity to validate all the proposed hypotheses within this study. The results, detailed in Table 4, affirm that we achieved favorable values, indicating meaningful relationships between the variables. To enhance the relevance of the obtained data, we also present the corresponding theoretical statistical values, which are crucial for accurately assessing the model's goodness of fit.

The analyzed model demonstrates a good fit with the observed data, as indicated by IFI, TLI, and CFI values of 0.934 and 0.930, which exceed the acceptable threshold of 0.90. An RMSEA value of 0.05, coupled with a PCLOSE of 0.356, further suggests that the model fits well without significant errors. Additionally, Hoelter values of 205 for $p < 0.05$ and 212 for $p < 0.01$ indicate that the model would remain stable even with smaller sample sizes, thereby confirming its robustness.

In the preliminary analysis, we conducted both a descriptive analysis of the variables and an evaluation of the correlations among them. These analyses are crucial for understanding the characteristics of the data and identifying preliminary relationships before proceeding with factor analysis. The descriptive analysis provides key information about each variable, including the mean, standard deviation, coefficient of variation, skewness, and kurtosis. Table 5 presents the descriptive statistics for the variables under study.

Table 5 provides an overview of the variability and distribution of each variable, enabling the identification of potential issues related to normality or variability. According to the table, most variables exhibit coefficients of variation within the acceptable range of 15 to 35%, indicating moderate variability that is suitable for factor analysis. Additionally, the skewness and kurtosis values suggest that the data distribution is relatively close to normality, which is favorable for applying advanced statistical techniques. The correlation among variables helps us understand their relationships and identify possible associations relevant to our model. Table 4 presents the correlation coefficients among the analyzed variables.

Table 6 reveals that most correlations between variables are significant at the 0.01 level. Variables such as PAIDM, FAI, PCAI, PIAI, and RC have significant impacts on PUT, while PUT exerts a considerable influence on PAT, which, in turn, strongly affects UI. These findings suggest that the formulated hypotheses are generally supported by the data. The general analysis of the model shows that perceived utility of the AI integration within didactic activity is influenced positively by Degree of familiarity with AI technology, The perception of the challenges posed by the use of AI in the didactic activity, The perception of the importance of using AI in teaching processes, The Perception towards the inclusion of Generative AI in the process of developing school materials and negatively by The resilience to change.

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TABLE 4 Model Fit Statistics.

| | CMIN/DF* | IFI** | TLI** | CFI** | RMSEA*** | PCLOSE**** | HOELTER 0.05 | HOELTER 0.01 |
|---|---|---|---|---|---|---|---|---|
| Default model | 1.946 | 0.934 | 0.930 | 0.934 | 0.051 | 0.356 | 205 | 212 |

Theoretical statistical values * < 3 (Kline, 2018; Kline, 1998); ** > 0.90 (Xia and Yang, 2019; Bentler and Bonett, 1980); *** that an RMSEA value of < 0.05 indicates a "close fit," and that < 0.08 suggests a reasonable model–data fit (Xia and Yang, 2019; Jöreskog and Sörbom, 1993); **** PCLOSE > 0.05 (James et al., 2009).

TABLE 5 Descriptive statistics of variables.

| Variable | Mean | Std. deviation | Coefficient of variation (%) | Skewness | Kurtosis |
|---|---|---|---|---|---|
| PAIDM | 3.488 | 0.875 | 25.08% | −0.833 | 1.043 |
| FAI | 3.623 | 0.801 | 22.12% | −0.465 | 0.168 |
| PCAI | 3.390 | 0.841 | 24.81% | −0.332 | −0.351 |
| PIAI | 3.428 | 0.835 | 24.34% | −0.637 | 0.218 |
| RC | 3.708 | 0.881 | 23.76% | −0.605 | 0.303 |
| PUT | 3.710 | 0.774 | 20.87% | −0.395 | 0.788 |
| PAT | 3.744 | 0.852 | 22.76% | −0.677 | 0.745 |
| UI | 3.803 | 0.855 | 22.49% | −0.714 | 0.729 |

TABLE 6 Correlations between variables.

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| PAIDM | 1.000 | | | | | | | |
| FAI | 0.144** | 1.000 | | | | | | |
| PCAI | 0.031 | 0.196** | 1.000 | | | | | |
| PIAI | 0.259** | 0.147** | 0.304** | 1.000 | | | | |
| RC | 0.284** | 0.163** | 0.016 | 0.307** | 1.000 | | | |
| PUT | 0.491** | 0.245** | −0.122** | 0.361** | 0.597** | 1.000 | | |
| PAT | 0.464** | 0.236** | −0.015 | 0.353** | 0.657** | 0.773** | 1.000 | |
| UI | 0.524** | 0.228** | −0.023 | 0.347** | 0.631** | 0.799** | 0.910** | 1.000 |

The hypothesis H1 stated that "there is a positive and direct influence of perception towards inclusion of Generative AI in the process of developing school materials on perceived utility of AI integration in education." Results are showing a significant relationship (CR test = 7.193, $p < 0.01$), meaning that the hypothesis H1 is validated. From the perspective of $\beta = 0.254$, we have a positive effect of the perception towards inclusion of Generative AI influence on the perceived utility of AI integration in education.

The hypothesis H2 stated that" there is a positive and direct influence of the degree of familiarity with AI software and technology on the perceived utility of AI integration in education." Values are showing a significant relationship (CR test = 2.424, $p < 0.05$), meaning that also hypothesis H2 is validated. From the perspective of β coefficient that has the value of 3.038, we have a positive effect of the degree of familiarity on the perceived utility of AI integration in education. The value of β shows that the influence of familiarity with AI software and technology is the strongest among all the other influences within our model, as we know that β coefficient gives us the" magnitude" of the relationship between two specific variables.

Hypothesis H3 proposed that" is a negative and direct influence of the perception of the challenges posed by the use of AI in the didactic activity on the perceived utility of AI integration in education." The results indicate a significant relationship (CR test = −2.688, $p < 0.01$), therefore the hypothesis H3 is also validated. From the perspective of the β coefficient value ($\beta = -0.095$), we can observe that we have a negative effect of the perception of the challenges posed by the use of AI in the didactic activity on the perceived utility of AI integration in education. Therefore, the hypothesis that tells us that, as the degree of awareness of the challenges that AI brings increases, the degree in which AI is perceived as useful in the current teaching activity decreases, is validating.

The next two hypotheses—H4 and H5, referring to other two variables that can positively influence the perceived utility of AI integration are also validating with values that are showing a significant relationship between analyzed variables for both of them, respectively (CR test = 3.504, $p < 0.01$) and a β coefficient value of 0.116 in case of H4 and (CR test = 9.299, $p < 0.01$,) and a β coefficient value of 0.386 in case of H5. The values of β coefficient for both the hypotheses shows us a positive effect of perception of the importance of using AI in teaching processes and resilience to change on the perceived utility of AI integration in education (Table 7).

Hypothesis H6 stated that" there is a positive and direct influence of the perceived utility of AI integration in education on the positive attitude regarding AI usage in didactic activity." The results are also

TABLE 7 The structural model results.

| Hypotheses | Correlations | $\beta$ | S.E. | C.R. | $P$ | Decision |
|---|---|---|---|---|---|---|
| H1 | PAIDM → PUT | 0.254 | 0.035 | 7.193 | 0.000* | Supported |
| H2 | FAI → PUT | 3.038 | 1.253 | 2.424 | 0.015** | Supported |
| H3 | PCAI → PUT | −0.095 | 0.036 | −2.688 | 0.007* | Supported |
| H4 | PIAI → PUT | 0.116 | 0.033 | 3.504 | 0.000* | Supported |
| H5 | RC → PUT | 0.386 | 0.041 | 9.299 | 0.000* | Supported |
| H6 | PUT → PAT | 1.239 | 0.113 | 11.012 | 0.000* | Supported |
| H7 | PAT → UI | 1.129 | 0.058 | 19.480 | 0.000* | Supported |

Statistical significance of parameter estimates test of the statistic critical ratio (C.R.) needs to be > 1.96, and $*p < 0.01$ or $**p < 0.05$ (Iacobucci, 2010).

confirming a significant relationship (CR test = 11.012, $p < 0.01$,) meaning that the hypothesis H6 is validating. From the perspective of the β coefficient ($\beta = 1.239$), we may see that there is a positive effect of the perceived utility of AI integration in education on the positive attitude regarding AI usage in didactic activity.

Hypothesis H7 presumes that" there is a positive and direct influence of the positive attitude regarding AI usage in didactic activity on the usage intention regarding AI in didactic activity." The obtained values of (CR test = 19.480, $p < 0.01$,) are showing a significant relationship between the two variables, meaning the validation of H7 hypothesis. From the perspective of β coefficient value ($\beta = 1.129$), we acknowledge a positive effect of the positive attitude regarding AI usage in didactic activity on the usage intention regarding AI in didactic activity.

# 5 Discussion

The validation of the first hypothesis "There is a positive and direct influence of perception towards the inclusion of Generative AI in the process of developing school materials on the perceived utility of AI integration in education" reveals significant insights into educators' attitudes towards AI in educational contexts. The results, with a $\beta$ value of 0.254, $p < 0.01$, and a CR test score of 7.193, indicate a strong and statistically significant relationship between the variables. This suggests that teachers who perceive the integration of Generative AI in material development positively are more likely to recognize the overall utility of AI in educational settings.

The findings of this study align with existing literature, which suggests that positive perceptions towards innovative technologies, particularly those that enhance productivity and creativity, often lead to a higher perceived utility of such technologies in broader educational contexts. The high C.R. value (7.193) observed in this study underscores the robustness of this relationship, implying that as teachers become more familiar with and appreciative of Generative AI tools in developing instructional materials, their belief in the broader applicability and usefulness of AI in education strengthens.

This relationship can be understood through the lens of technology acceptance models, where perceived ease of use and perceived usefulness are critical factors in the adoption of new technologies. Generative AI, by streamlining the creation of educational content, not only reduces the workload for educators but also enhances the quality and diversity of materials available for teaching. As educators engage with these AI-driven tools and experience their benefits firsthand, their confidence in AI's potential in other areas of education likely increases.

Moreover, the significance of the $p$-value ($p < 0.01$) confirms that this relationship is not due to chance, reinforcing the reliability of the findings. The CR test value of 7.193 further supports the hypothesis, indicating a strong model fit and the consistency of the observed relationships. These results also reflect broader trends in the adoption of AI in education, where acceptance is often predicated on direct experience with the technology. Teachers who actively use Generative AI for material development likely develop a more nuanced understanding of its capabilities and limitations, leading to a more informed and positive assessment of AI's role in education. Our findings found a direct support in other previous research, from the point of view of the perceptions that Generative AI tools can be valuable aids in enhancing pedagogical practices, being capable to reduce the workload associated with lesson planning and allowing teachers to focus more on student engagement and personalized instruction (Ghimire and Edwards, 2024). However, while the findings are promising, they also raise important considerations for implementation. The strong influence of perception on perceived utility suggests that successful AI integration in education may depend heavily on how these tools are introduced and supported in schools. Professional development, ongoing support, and clear communication about the benefits and limitations of AI are crucial for fostering positive perceptions among educators. Furthermore, the study highlights the need for a supportive infrastructure that allows educators to experiment with and adopt Generative AI tools without significant barriers. Access to resources, time for experimentation, and peer support can all contribute to building the positive perceptions necessary for broader AI integration in education. In conclusion, the validation of the hypothesis emphasizes the critical role of perception in the adoption of AI in educational contexts. By fostering positive attitudes towards Generative AI, particularly in the development of educational materials, stakeholders can enhance the perceived utility of AI, paving the way for more comprehensive integration of AI technologies in schools. Future research should continue to explore the factors that influence educators' perceptions and how these can be leveraged to support successful AI integration in education. In case of the second hypothesis –" there is a positive and direct influence of the degree of familiarity with AI software and technology on the perceived utility of AI integration in education," the observed $\beta$ value of 3.038, suggests that as educators become more familiar with AI software and technology, their perception of the benefits and utility of AI in education significantly improves. The β coefficient has the highest value among all the relationships from our model, showing a very strong intensity of the relationship between the two variables. This relationship is in line with theories of technology adoption, where users' confidence and positive attitudes towards technology are strongly linked to their level of familiarity and experience with the tools. The statistical significance of the *p*-value ($p < 0.01$) ensures that this relationship is not due to random chance, lending credence to the hypothesis. Moreover, the CR test score of 2.424 sustains the statistical validity of the influence of the degree of familiarity over the perceived utility, underscoring the consistency of these findings. These results highlight an important aspect of AI integration in education: the necessity of building educators' familiarity with AI technologies. The influence of familiarity on perceived utility implies that without adequate exposure and training, teachers may not fully appreciate the potential of AI, thereby hindering its adoption. This underscores the importance of professional development programs that focus not just on the technical aspects of AI tools, but also on building a deeper understanding and comfort with these technologies among educators. Furthermore, this relationship suggests that familiarity can mitigate some of the concerns and apprehensions that educators might have regarding AI. As teachers become more adept at using AI software, they are likely to develop a more realistic and positive perception of its applications, recognizing both its strengths and limitations in enhancing educational outcomes. The findings also point to the need for a supportive environment where educators can explore and experiment with AI technologies. Access to resources, peer support, and opportunities for hands-on learning are crucial for increasing familiarity and, consequently, the perceived utility of AI in education. In conclusion, the validation of this hypothesis underscores the critical role of familiarity in the successful integration of AI in educational settings. As educators become more comfortable with AI software and technology, their perception of its utility improves, leading to a greater likelihood of adoption and integration. Future research should explore strategies for increasing familiarity with AI among educators, as this appears to be a key factor in the broader acceptance and utilization of AI in education. In case of the third hypothesis –" there is a negative and direct influence of the perception of the challenges posed by the use of AI in the didactic activity on the perceived utility of AI integration in education," the results indicate a strong, statistically significant inverse relationship between the perception of challenges associated with AI and the perceived utility of AI in education. The results demonstrate that educators' perceptions of the challenges posed by AI in teaching - such as concerns about technical complexity, the potential to disrupt traditional teaching methods, and fears of diminishing teacher-student interactions - significantly reduce their perception of AI's overall utility in educational contexts. The β value (−0.095) confirms the significance of this negative relationship, suggesting that as these challenges are perceived more acutely, the perceived benefits of AI integration decrease correspondingly. This relationship is consistent with the broader literature on technology adoption, which frequently identifies perceived barriers as a critical factor hindering the acceptance and utilization of new technologies (Menzli et al., 2022; Karahanna et al., 1999). When educators encounter challenges in using AI, these difficulties can overshadow the potential benefits, leading to a more skeptical or resistant attitude towards AI integration. The statistical significance of the *p*-value ($p < 0.05$) further reinforces the validity of this relationship, ensuring that the observed effect is not due to random chance. Additionally, the CR test score of—2.688 indicates that the model fits well with the data, providing confidence in the consistency of these findings. These findings highlight the importance of addressing the perceived challenges associated with AI use in education.

These challenges have different implications at the level of the educational policy at a global level. Governments and institutions should prioritize the development and dissemination of user-friendly AI tools. Simplification of interfaces and functionalities can help reduce technical complexity, particularly in countries where digital literacy among educators may be low. In the same time, Funding initiatives to design AI tools tailored to specific educational needs, while minimizing operational complexity, can enhance adoption across diverse contexts. In terms of AI training incorporation in professional development of teachers, policies should mandate and support continuous professional development programs focused on AI literacy. These programs must address not only technical skills but also practical applications and pedagogical integration. Also, peer-led and mentorship-based approaches can be emphasized to build educators' confidence and reduce apprehension toward AI usage. Challenges brought by AI adoption imply also the need to preserve traditional pedagogical values. Therefore, educational policies must be able to promote AI rather as a complementary tool and not a replacement for traditional teaching methods. AI has to be promoted as an enhancer of teachers' autonomy and students' engagement and not as a disruptor. Educational policies must be able to address educators concerns about ethical implications of AI, proposing and promoting clear regulations on data usage and transparency in AI algorithms. At a global level, it should exist a coordinated effort for international collaborations in order to set global standards for ethical AI education capable to ensure consistency and equity across different national educational systems. In the effort of implementing AI within educational systems, one of the challenges is represented by adaptation of AI to different cultural and contextual backgrounds. There are substantial cultural, social and economic differences between countries, meaning that AI strategies implementation within different educational systems has to adapt to different modalities of traditional interaction models between students and teachers, different assessment systems and social integration of educational outcomes (employment competencies, diffusion of recent graduates on the jobs market, etc.). Another implication of AI adoption related challenges at a global educational policies level may refer to the need to reduce perceived adoption barriers through incentives. Such incentives (like grants or awards for institutions and individuals alike) can motivate educators and contribute to the development of true success stories that can further shift perceptions and encourage broader acceptance for AI technology in education.

If educators perceive AI tools as difficult to implement, overly complex, or potentially disruptive, their overall assessment of AI's value will likely be negatively impacted. This underscores the need for comprehensive support systems, including targeted professional development, technical assistance, and clear communication about the practical benefits of AI, to mitigate these perceived challenges. Moreover, the study suggests that addressing these challenges directly—such as by simplifying AI tools, providing more intuitive interfaces, and ensuring that AI enhances rather than detracts from teacher-student interactions—can significantly improve the perceived utility of AI in education. This approach is crucial for fostering a positive environment where AI can be seen as a valuable addition to the educational toolkit rather than a burdensome or threatening innovation. In conclusion, the validation of this hypothesis highlights the crucial role that perceived challenges play in shaping educators' attitudes towards AI. By acknowledging and addressing these challenges, educational institutions can enhance the perceived utility of AI, making it more likely that these technologies will be successfully integrated into educational practices. Future research should focus on identifying specific challenges that educators face with AI and developing targeted strategies to overcome these barriers, thereby facilitating a more positive and widespread adoption of AI in education. The implications of these findings are significant for educational policymakers and institutions aiming to promote AI integration. Addressing these perceived challenges through comprehensive support systems—such as providing adequate training, simplifying AI tools, and ensuring that AI complements rather than complicates traditional teaching methods—can help mitigate negative perceptions and foster a more favorable view of AI's utility in education. The validation of the fourth hypothesis underscores the crucial role that perceived importance plays in shaping educators' attitudes toward AI integration in educational settings. The $\beta$ value of 0.116 suggests that educators who recognize the significance of AI in enhancing teaching processes are more likely to view AI integration as beneficial overall. This positive correlation aligns with existing research on technology adoption, where the perceived importance of a technology often directly influences its perceived utility and, consequently, its adoption. The $p$-value ($p < 0.01$) confirms that this relationship is statistically significant, ensuring that the observed effect is not due to random variation. Moreover, the CR test score of 3.504 indicates that the model fits well with the data, supporting the reliability of these findings across different educational contexts. These findings highlight that when educators understand and value the role of AI in improving teaching processes—such as through personalized learning, automation of administrative tasks, and enhancing student engagement—they are more likely to perceive AI as a valuable tool in education. This perception is crucial for the successful integration of AI technologies, as it fosters a positive attitude toward their adoption and use. Moreover, the study suggests that efforts to increase the perceived importance of AI in teaching, such as through professional development and showcasing successful AI-driven educational initiatives, can significantly enhance the perceived utility of AI. By emphasizing how AI can address key challenges in teaching, such as differentiating instruction and managing large class sizes, educators may be more inclined to integrate AI into their practices. However, the study also implies that merely introducing AI technologies without addressing the underlying perceptions of their importance may lead to suboptimal outcomes. Educators need to see clear, practical benefits of AI in their teaching processes to fully appreciate its utility. Therefore, it is essential to provide concrete emphasis on the practical benefits of AI in teaching, tailored to educators' specific needs and challenges, is essential for fostering a positive perception of its utility. Furthermore, these findings suggest that the success of AI integration in education is closely tied to how well its importance is communicated and understood by educators. When teachers are convinced of AI's role in addressing pedagogical challenges and enhancing instructional quality, they are more likely to embrace its use, leading to more effective and widespread adoption. In conclusion, the validation of this hypothesis underscores the importance of effectively communicating the value of AI in teaching processes to enhance its perceived utility. By fostering a deeper understanding of AI's potential benefits among educators, educational institutions can facilitate more successful and meaningful integration of AI technologies in the classroom. Future research should explore strategies for increasing awareness of the importance of AI in teaching and its impact on perceived utility, ensuring that AI is seen not just as a tool, but as an integral part of modern educational practices. The validation of the relationship between resilience to change and perceived utility of AI integration in education, suggest that resilience to change plays a crucial role in how educators perceive the utility of AI integration in education. The $\beta$ value of 0.386 indicates a significantly positive relationship, meaning that educators who exhibit higher levels of resilience—characterized by their ability to adapt to new circumstances, embrace innovation, and remain open to changes—are more likely to perceive AI as beneficial and useful within educational contexts. The statistical significance of the $p$-value ($p < 0.01$) ensures that this relationship is robust and not due to random chance. Additionally, the CR test score of 9.299 supports the model's validity, confirming that the observed relationships are consistent across different samples and contexts. These findings align with existing literature on change management and technology adoption, where an individual's or organization's resilience is often linked to successful adoption of new technologies (Roberts et al., 2015).

Resilience to change has been considered a major antecedent for the acceptance of technology models in different settings that are implying technology evolution and impact of it over individuals (Molino et al., 2020; Al-Emran et al., 2018). Also, in terms of teacher resilience we may find important relationship with self-efficacy and capacity to cope with new technological tasks (Abid et al., 2024), as well as with "digital wellbeing" (Yu et al., 2022). An important issue in the context of how teachers are reacting in front of new technological requirements within their activity is the one that also demonstrate a direct relationship between teachers' resilience and their Technological Pedagogical Content Knowledge. Different sets of skills that mixed up technological knowledge and pedagogic skills used within new technologies implementation are determinant for the level of teachers' resilience related to change promoted by the new technologies (Sadaf, 2019).

In educational settings, resilience to change might involve the willingness to experiment with AI tools, to overcome initial challenges, and to adapt teaching practices to incorporate new technological innovations. The study suggests that educators who are more resilient are better equipped to navigate the uncertainties and challenges that often accompany the introduction of new technologies like AI. This resilience allows them to see beyond the initial hurdles and recognize the long-term benefits of AI integration, such as enhanced teaching efficiency, personalized learning opportunities, and improved student outcomes. Moreover, these findings underscore the importance of fostering resilience among educators as a strategy for promoting the successful integration of AI in education. Professional development programs that build resilience—by enhancing teachers' confidence in managing change, providing support networks, and offering practical tools for adapting to new technologies—can play a vital role in improving the perceived utility of AI. In conclusion, the validation of this hypothesis highlights resilience to change as a critical factor influencing educators' perceptions of AI's utility in education. By promoting and supporting resilience, educational institutions can enhance the likelihood that AI technologies will be perceived positively and integrated effectively into teaching practices.

Future research should explore specific strategies to build resilience among educators, as this appears to be a key determinant of successful AI adoption in educational environments. According to our results there is a strong correlation also between the perceived utility of AI integration within education and the positive attitude regarding AI usage in didactic activity. Our findings suggest that the more educators perceive AI as useful in enhancing educational processes, the more likely they are to develop a positive attitude toward incorporating AI into their didactic activities. The $\beta$ value of 1.239 demonstrates a strong positive relationship, indicating that when educators see clear benefits from AI—such as increased efficiency, personalized learning opportunities, and enhanced student engagement—they are more inclined to adopt and positively engage with AI technologies in their teaching practices. The *p*-value ($p < 0.01$) confirms the statistical significance of this relationship, ensuring that the observed effect is not due to random chance. The CR test score of 11.012 supports the model's reliability, indicating that these findings are consistent across various educational contexts. These results are consistent with theories of technology acceptance, where perceived usefulness is a key predictor of users' attitudes and intentions to use a new technology (Hart and Laher, 2015; Polančič et al., 2010). In the context of education, when teachers recognize the practical advantages of AI, they are more likely to embrace its use in their teaching strategies. This positive attitude is crucial for the successful integration of AI in educational settings, as it drives teachers to explore and utilize AI tools effectively. Our research also highlights the importance of demonstrating AI's utility to educators to foster a positive attitude toward its use. Educational institutions should focus on providing clear evidence of AI's benefits in real-world teaching scenarios, offering professional development opportunities that showcase AI's potential, and creating supportive environments where teachers can experiment with AI tools without fear of failure. In conclusion, the validation of this hypothesis underscores the pivotal role that perceived utility plays in shaping positive attitudes toward AI in education. By emphasizing the practical benefits of AI and ensuring that these benefits are clearly communicated and experienced by educators, institutions can foster more positive attitudes and encourage the widespread adoption of AI in teaching activities. Future research should explore specific strategies to enhance the perceived utility of AI among educators, as this appears to be a key factor in promoting positive attitudes and successful AI integration in education. Our last hypothesis stated that there is a positive and direct correlation between teachers' positive attitude regarding AI usage in didactic activity and effective usage intention of it. The results of this study highlight the crucial role that positive attitudes toward AI play in determining educators' intentions to incorporate AI into their teaching activities. The $\beta$ value of 1.129 indicates a strong positive relationship, suggesting that educators who hold favorable views of AI's role in the classroom are much more likely to express intentions to use these technologies in their didactic activities. This correlation aligns with established theories in behavioral science, particularly the Theory of Planned Behavior, which posits that positive attitudes towards a behavior significantly influence the intention to engage in that behavior (Conner and Armitage, 1998). The statistical significance of the *p*-value ($p < 0.01$) confirms the robustness of this relationship, ensuring that the observed effect is not attributable to chance. Furthermore, the CR test score of 19.480 supports the model's validity, indicating enough consistency. This finding underscores the importance of fostering positive attitudes towards AI among educators to drive the actual usage of AI tools in the classroom. When teachers perceive AI as beneficial and align these perceptions with their teaching goals, they are more likely to intend to use AI, leading to increased adoption and integration of these technologies in educational practices. Moreover, these results suggest that interventions aimed at improving attitudes towards AI, such as targeted professional development programs, success stories, and peer-led initiatives, can be effective in enhancing usage intentions. By demonstrating the practical benefits and ease of use of AI in teaching, educators' positive attitudes can be cultivated, which in turn strengthens their intention to incorporate AI into their daily instructional activities. In conclusion, the validation of this hypothesis highlights the critical link between positive attitudes toward AI and the intention to use AI in education. By focusing on strategies that improve educators' The results of this study highlight the crucial role that positive attitudes toward AI play in determining educators' intentions to incorporate AI into their teaching activities. Future research should explore how specific attitude-shaping interventions can be designed and implemented to maximize the positive impact on AI usage intentions, ultimately leading to more effective and widespread use of AI in educational settings.

Starting from our research results, the implications of AI adoption and usage within the education field at the level of human resources management can be summarize on six different directions: the role of attitude in technology adoption, professional development and continuous learning, change management and organizational support, alignment of AI with educational goals, practical and ethical concerns, long-term implications. Our research indicates a strong positive correlation (β = 1.129) between teachers' positive attitudes toward AI and their intention to use AI tools in their teaching. This finding aligns with the Theory of Planned Behavior, which suggests that individuals' intentions to engage in a particular behavior are significantly influenced by their attitudes towards that behavior (Conner and Armitage, 1998). In the context of education, this means that when teachers view AI as beneficial and aligned with their instructional goals, they are more likely to incorporate AI tools into their classrooms. From a human resources management perspective, this insight emphasizes the importance of fostering a positive organizational culture around AI adoption. HR departments and school administrators should prioritize initiatives that cultivate positive attitudes towards AI among educators. This can be achieved through targeted professional development programs, which focus not only on the technical skills required to use AI tools but also on showcasing the potential benefits these technologies can bring to educational practices.

The study's results suggest that effective interventions aimed at improving attitudes towards AI, such as targeted professional development programs and peer-led initiatives, can significantly enhance teachers' intentions to use AI tools. For HR managers in education, this highlights the need to design and implement continuous learning opportunities that focus on AI literacy. This includes workshops, seminars, and hands-on training sessions that provide educators with practical experience in using AI tools (Iqbal et al., 2022). Adopting new technologies like AI often requires significant changes to existing workflows and teaching practices. The study's findings imply that educators' willingness to adopt AI is contingent upon their perception of the technology's value and ease of use. Therefore, HR managers and school leaders must provide robust organizational support to facilitate this transition. This support can take several forms:

Mentorship and Peer Support Networks: Creating opportunities for collaboration among teachers can help foster a supportive environment where educators can share experiences, challenges, and best practices related to AI adoption.

Technical and Emotional Support: Offering both technical support (such as troubleshooting and IT assistance) and emotional support (such as counseling and stress management workshops) can help alleviate concerns and reduce resistance to change.

Incentives for Early Adoption: Incentivizing early adopters with recognition, awards, or additional professional development credits can encourage more teachers to experiment with AI tools and integrate them into their teaching practices (Iqbal et al., 2022). Our study underscores the importance of aligning AI adoption with the overarching educational goals of the institution. Teachers are more likely to adopt AI tools if they perceive these technologies as directly contributing to their instructional objectives, such as enhancing student engagement, improving learning outcomes, or simplifying administrative tasks. HR managers can play a crucial role in facilitating this alignment by ensuring that AI tools and initiatives are clearly connected to the institution's strategic goals and by providing educators with the necessary resources to achieve these goals.

The study also suggests that addressing educators' concerns about AI is essential for fostering positive attitudes and increasing adoption rates. Common concerns include the ethical implications of AI, such as privacy issues, data security, and potential biases in AI algorithms. Human resources management should address these concerns proactively by:

- Developing Clear Guidelines and Policies: Establishing clear guidelines on the ethical use
- Providing Transparency and Open Communication: Ensuring transparent communication about how AI tools are developed, implemented, and used within the educational context. This helps build trust and reduces fear or skepticism among educators (Barrett and Pack, 2023).
- Engaging Teachers in the Development Process: Involving teachers in the selection, evaluation, and implementation processes of AI tools can help ensure that their needs and concerns are considered, leading to greater buy-in and support (Iqbal et al., 2022).

In the long term, the adoption of AI in education will likely require a strategic shift in human resources management, focusing on building digital competencies among educators and fostering a culture of innovation. HR managers will need to anticipate the evolving demands of AI in education and develop talent management strategies that attract and retain educators with the skills and attitudes necessary for effectively integrating AI into their teaching practices.

# 6 Conclusion

This study offers valuable insights into the integration of Generative AI in education, specifically in the Romanian context, spanning all levels of teaching from kindergarten to higher education. The validation of our hypotheses highlights key factors that influence educators' perceptions, attitudes, and intentions regarding AI usage in didactic activities. The results confirm that educators' perceptions towards the inclusion of Generative AI in the development of educational materials have a significant impact on their perceived utility of AI in education. Positive perceptions and especially the increased familiarity with AI software strongly correlate with higher perceived utility and a greater likelihood of AI adoption in teaching practices. These findings underscore the importance of fostering positive attitudes and familiarity with AI among educators to facilitate its successful integration.

However, the study also highlights critical challenges that may impede AI adoption. The inverse relationship between the perception of AI-related challenges and the perceived utility of AI points to the necessity of addressing these concerns through comprehensive support systems. Overcoming resistance to change, simplifying AI tools, and ensuring they enhance rather than disrupt traditional teaching methods are essential steps towards broader AI acceptance. By fostering positive perceptions, increasing familiarity, addressing perceived challenges, and building resilience among educators, institutions can enhance the perceived utility of AI and encourage its integration into educational practices.

## 6.1 Limitations and future research directions

While this study provides important insights, it also has limitations that warrant consideration. The research was conducted within a specific cultural and educational context—Romania—which may limit the generalizability of the findings to other regions or countries. Perceptions and attitudes toward AI integration in education and especially regarding the current usage of AI based application within didactic activity may be shaped in a peculiar way by the socio-cultural background of teachers. In the context in which the integration of AI in education does not refer to just a technological change, but to a very complex and long-term socio-technological process that involves changes on several levels - ethical, pedagogical, as well as policies related to education and learning, contextual factors like the educational system at the level of a certain country, social perceptions, school institution policies, professional development opportunities become very important for specific outcomes regarding teachers future attitudes toward AI inclusion (Bezjak, 2024).

Additionally, the study's reliance on self-reported data through online questionnaires could introduce response biases, as participants may have different interpretations of AI's impact based on their experiences and exposure. In addition, from the point of view of the sampling process, a larger sample would have been more appropriate, with a better distribution at the national level, which would properly reflect the real structure of the statistical population of teachers, both from urban and rural areas.

Future research should aim to address these limitations by exploring the integration of AI in education across diverse cultural contexts and using mixed-method approaches to complement quantitative findings with qualitative insights. Longitudinal studies could also provide a deeper understanding of how educators' perceptions and attitudes towards AI evolve over time, particularly as they gain more experience with AI technologies.

Moreover, future studies should investigate specific interventions that can effectively enhance educators' familiarity with AI and reduce perceived challenges. Research could explore the impact of targeted professional development programs, peer-led initiatives, and hands-on experiences in fostering positive attitudes towards AI. Identifying and mitigating barriers to AI adoption, such as limited access to resources or inadequate training, will be crucial for promoting widespread and effective AI integration in educational settings.

## 6.2 Managerial and policy implications

The results of this study have significant implications for educational institutions and policymakers. To facilitate the successful integration of AI in education, institutions must prioritize professional development that enhances educators' familiarity with AI technologies. Training programs should focus not only on the technical aspects of AI but also on demonstrating its practical benefits in the classroom. By doing so, institutions can cultivate positive attitudes towards AI, which are essential for driving adoption and usage.

The results of the research, presented in detail in the discussion part, helps us to understand better the context in which AI gradual integration in the global educational environment could become possible with a particular emphasis put on the acceptance and effective use of AI based applications and technology within the teaching process, on regularly basis. Based on previous discussed accepted hypothesis of our research we may propose a series of practical steps that can be implemented at the level of educational systems in order to facilitate AI integration. From the beginning we should stress the fact that like any global improvement of the educational paradigm, the acceptance and integration of AI has to be done through a complex of measures and activities that are encompassing specific roles for every actor within the educational systems: education policy makers, educators, educational institutions, students or pupils and parents alike, and local communities also (employers, NGO" s etc). This, because AI adoption cannot be reduced only at the level of teachers or students' usage but has to rely also on good practices mechanisms that are implying the interaction of every actor from the educational system with this technology and a true integration of these practices as a whole.

In the following we will stress out some practical proposals that can be considered specific steps for educators and, respectively, for policy makers to foster AI integration in teaching.

From the perspective of educators, the integration of AI in teaching and at the level of educational systems can rely on:

- Boosting professional development, through attendance in workshops and training sessions on AI tools relevant to teaching and engagement in online courses and certifications meant to enhance AI literacy.
- Pilot AI applications thorough experimentation with AI tools in different small-scale projects like personalized learning platforms or automated grading systems. Collect feedback from students to assess effectiveness and ease of use.
- Enhance collaboration regarding AI usage through joining educator communities focused on technology integration and share experiences and best practices. Also partner with tech experts to learn how to effectively implement AI tools.
- Integrate AI into School Curriculum through the identification of areas in which AI can add value (like adaptive learning tools for differentiated instruction). The AI applications should be gradually introduced in order to ensure sufficient level of comfort and acceptance among students/pupils.
- Develop critical thinking about AI through students teaching about the ethical implications and limitations of AI and encouraging students to critically evaluate AI-generated content.

From the perspective of policy makers, we can propose:

- Develop infrastructure that can offer the necessary background for AI integration through allocation of hardware, software and internet connectivity to support AI tools for schools and other educational institutions; provide technical support systems for teachers.
- Establish educational policy frameworks through developing clear guidelines for the ethical use of AI in education, addressing issues of data privacy and bias and creating standards for evaluating and certifying AI tools for educational use. Monitor and adjust strategies based on the needs and suggestions of teachers and students.
- Drive adoption of AI- based teaching methods by offering grants or rewards to schools and educators who successfully implement innovative AI-based teaching methods; Support research projects focused on integrating AI into education.
- Monitor and evaluate the process of AI integration in educational field through regularly evaluate the impact of AI tools on learning outcomes and gather feedback from educators and students to refine strategies and tools.
- Foster partnerships dedicated to the promotion and integration of AI within the educational field through stimulating public-private partnerships for the development and implementation of AI solutions in education, supporting national research that assesses the impact of AI in education and identifies best practices.
- Communicate constantly the benefits of AI for education through organizing diverse socio-cultural events about the progress that AI based technology is achieving and creative ways in which AI complements traditional teaching methods; Involving teachers in the selection and implementation processes of AI solutions to increase growth and engagement.

Policymakers should consider the need for a supportive infrastructure that enables educators to experiment with AI tools without significant barriers. This includes ensuring access to necessary resources, time for exploration, and peer support networks. Addressing the perceived challenges associated with AI, such as technical complexity and potential disruptions to traditional teaching methods, is also critical. Simplifying AI tools and providing intuitive interfaces can mitigate these challenges and enhance the perceived utility of AI.

Finally, to maximize the potential benefits of AI in education, policymakers should focus on communicating the importance of AI in addressing key educational challenges, such as personalized learning and managing diverse student needs. By fostering a positive environment where AI is seen as a valuable addition rather than a disruptive force, both educators and students can benefit from the transformative potential of AI technologies in education.

The positive relationship between teachers' attitudes toward AI and their intention to use AI tools in the classroom has significant implications for human resources management in education. By fostering a positive culture around AI, providing continuous professional development, supporting change management, and aligning AI adoption with educational goals, HR managers can play a pivotal role in facilitating the effective integration of AI technologies in education. Future research should continue to explore how these strategies can be optimized to maximize the benefits of AI adoption in educational settings. By understanding and leveraging these dynamics, educational institutions can better manage the human aspects of technological change, ensuring that AI adoption contributes to enhanced educational outcomes and a more innovative and responsive teaching environment.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements as the study does not involve sensitive topics such as health, religion, politics, or personal data that could cause harm or discomfort to the participants. There are no privacy risks, as all data were collected and processed according to ethical standards, respecting the anonymity and confidentiality of personal information. All respondents (teachers) gave their informed consent before participating in the study. This consent indicates that they were informed in detail about the purpose of the research, the methods used, the use of the collected data, and their rights (including the right to withdraw at any time).

## Author contributions

IG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. MM: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. DG: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. LN: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. CP: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Software, Validation, Writing – original draft, Writing – review & editing. EG: Conceptualization, Data curation, Formal Analysis, Investigation, Writing – original draft, Writing – review & editing. AZ: Conceptualization, Data curation, Formal Analysis, Investigation, Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1488147/full#supplementary-material

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