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DEVELOPING TEACHERS' DIGITAL COMPETENCIES FOR THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION: AN ANALYSIS OF REFLECTIVE PRACTICE AND EXPERIENTIAL LEARNING

Abstract: Modern education requires continuous professional development of teachers aimed at enhancing digital competencies and the effective use of ICT in teaching, in order to improve the quality of education and respond to the needs of contemporary students. The aim of this study is to examine how training in the application of interactive avatars based on ChatGPT affects teachers' digital competencies, with a particular focus on self-assessment of competency levels before and after training. A total of 156 primary and secondary school teachers from the Republic of Serbia participated in a hybrid training model organised by the Centre for Robotics and Artificial Intelligence in Education (CRAIE) at the University of Belgrade – Faculty of Education, which has recently become the first UNESCO IIOE national centre. Based on teachers' self-assessment of their digital competencies, a statistically significant improvement was identified, unaffected by gender, years of professional experience, or level of qualification. Given the global lack of adequate teacher training and support for the development of digital competencies, the systematic training model introduced in Serbia – the second country to do so after Estonia – represents an important contribution to strengthening teachers' professional capacity.

Keywords: artificial intelligence, CRAIE, digital competencies, educational avatars, professional development.

Introduction

The digital transformation of education has become one of the key issues of contemporary society, which increasingly relies on the use of technology and artificial intelligence (AI) in all areas of life. Teachers, as the central agents of the educational process, play a crucial role in integrating these technologies into teaching, thereby shaping new models of learning, instruction, and professional development. The development of digital competencies has become a prerequisite for quality

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education, as it enables teachers to plan, implement, and evaluate teaching activities effectively in accordance with the demands of the digital age.

In this context, interactive avatars based on AI, such as ChatGPT, occupy a particularly important place, as they enable new forms of interaction between teachers and students, personalisation of content, and experiential learning (Mandić et al., 2025a). Educational systems around the world aim to empower teachers through systematic training, reflective practice, and blended learning models, thereby encouraging continuous professional growth and adaptability to change. Serbia, through the work of the Centre for Robotics and Artificial Intelligence in Education (CRAIE) at the University of Belgrade, is among the first countries in Europe to have developed institutional training programmes for teachers in the field of AI application in education. The aim of this paper is to analyse the effects of such training, particularly in relation to the development of digital competencies, using reflective practice and experiential learning as key mechanisms of professional empowerment.

Theoretical Frameworks

1. Training Teachers to Use Modern Educational Technology

The digital era has brought significant changes to the educational process, requiring teachers to continuously adapt and develop new competencies that go beyond traditional teaching approaches. Traditional classroom instruction, based on frontal teaching and one-way communication, often limits interaction and feedback, highlighting the need for teacher professional development and the integration of digital technologies (Mandić, 2023). Continuous professional development of teachers has become a key factor in improving the quality of education and responding to the needs of contemporary learners. Today's focus on professional growth includes the development of digital competencies, the ability to critically evaluate digital resources, the integration of technology into teaching, and understanding the ethical, legal, and pedagogical dimensions of technology use. The need for digitally competent teachers capable of effectively applying ICT is one of the priorities of modern education, as the quality of technology integration in teaching depends largely on their competencies. Professional development in the digital age does not have to be exclusively formal. Research by Jiang et al. indicates that informal learning activities supported by technology significantly enhance motivation and self-directed learning among teachers. These findings also show that learning beyond formal education frameworks is becoming an increasingly important form of professional growth in the digital era (Jiang et al., 2025). The importance of teachers' personal initiative in professional improvement is increasingly recognised, particularly through participation in online programmes, communities of practice, and the use of contemporary digital learning tools. Blended learning models, which combine online and face-to-face learning, have proven particularly effective, allowing teachers to learn at their own pace and in accordance with real-world challenges. It is important to educate teachers about artificial intelligence, emerging technologies, and their applications, and to design training programmes as long-term initiatives so that professional development does not remain a single isolated step forward. Such training should be planned as a continuous process, enabling teachers to follow technological developments and adapt to an ever-changing world and new generations of students (Gentile et al., 2023). In this way, professional development in the digital age becomes a constant, flexible process aimed at empowering teachers for critical, creative, and responsible use of technology in education.

In contemporary educational settings, digital competencies are one of the key elements of quality teaching. Teachers with well-developed digital competencies plan and implement instruction more effectively, tailoring it to the needs of digitally literate students. An analysis of existing standards of teacher competencies in Serbia compared with those in countries that lead in PISA testing highlights the importance of continuous digital skills development in addressing modern educational

challenges (Teodorović et al., 2019). In today's educational context, digital competencies encompass the management of digital information, data protection, and ethical responsibility in the use of technology. Given the rapid advancement of technologies such as artificial intelligence, virtual and augmented reality, teachers' digital competencies require ongoing improvement. Teachers today must not only be able to use existing digital tools, but also to adapt quickly and evaluate new technological solutions in education. Developing, measuring, and enhancing digital competencies through valid and reliable tools is essential for the successful application of technology in teaching (Tondeur et al., 2023). Various professional development programmes and approaches show that well-designed training is crucial for preparing teachers for the challenges of the digital age and for the successful application of modern technologies in teaching (Alférez-Pastor et al., 2023).

Effective teacher training for the use of digital tools requires modern approaches that combine theory and practice. Modelling the modern teacher who uses digital tools in the classroom involves competencies that foster original and creative solutions in teaching. Strengthening interaction between teachers and students, as well as among students themselves, promotes engagement and stimulates cognitive development. Competencies related to critical thinking, self-expression, and innovative problem-solving are particularly important, as they form the foundation for successful professional development in the future (Kyslitsyn et al., 2025). Blended learning models, integrating online learning with in-person workshops, provide flexibility, continuity, and the opportunity to apply acquired knowledge in real teaching contexts. Active and experiential learning through simulations, practical tasks, and reflection contributes to deeper understanding and long-term skill acquisition. Such models not only enhance teachers' technical abilities but also strengthen their pedagogical confidence in using digital tools. With artificial intelligence, it is possible to identify seven types of cognitive phenomena, each having a specific impact on the development of intellectual activities. Creativity plays a particularly significant role in this context, as digital tools enable it through brainstorming, visual representation of results, and solving complex problems (Fedorets et al., 2024). To create a stimulating environment for their students, teachers should first be aware of their own level of digital competence. The European Commission's online tool *SELFIE for Teachers (Self-reflection on Effective Learning by Fostering Innovation through Educational Technologies*) allows teachers to self-assess and enhance their digital competencies within both classroom practice and professional development. SELFIE for Teachers is based on the DigCompEdu framework (*European Framework for the Digital Competence of Educators*), which defines six areas of teachers' digital competencies:

1. Professional engagement (using digital tools for collaboration and communication)
2. Digital resources
3. Pedagogical practices in digital environments
4. Assessment and feedback through digital technologies
5. Empowering learners
6. Learners' digital competence (European Commission, Joint Research Centre, n.d.)

To encourage the development of the aforementioned competencies, it is crucial to design well-structured training that enhances teachers' readiness for innovation and strengthens their role in shaping modern education. Creating a supportive environment for teachers' professional training across different schools also highlights the need to implement digital tools in schools attended by children with developmental disabilities. The use of digital tools such as Kahoot and PearDeck, enables a personalised approach, greater motivation, and active student engagement in the learning process, which plays a key role in improving the quality of experiential learning among younger pupils with intellectual disabilities (Naimanova et al., 2025).

Professional development significantly influences teachers' pedagogical leadership of their classes (Kausar et al., 2024) and faces numerous challenges, including time constraints and a lack of resources. Therefore, it is important to apply a systemic approach that ensures collaboration and support for teachers. The harmonised interaction of reflective practice, professional development,

and formative assessment contributes to creating a higher-quality educational process in schools (Kausar, 2025). The development of teachers' digital competencies involves much more than mastering technical skills – it also includes understanding the pedagogical value of digital tools, the ethical dilemmas of their use, and active reflection on one's teaching practice. The need for appropriate teacher training in the use of digital avatars in education is confirmed by research indicating that higher levels of teacher education correlate with a greater perceived effectiveness of avatar integration into the teaching process (Mandić et al., 2025b). For teachers to effectively apply digital tools in schools, they must learn how to use them efficiently in instruction and how to guide students in their proper application. It is also of great importance to provide financial support for equipping classrooms and to motivate teachers through dynamic and effective training sessions. Such training enables teachers to directly apply the acquired knowledge of digital tools in their school environments (Mandić, 2023). In this context, the Centre for Robotics and Artificial Intelligence in Education (CRAIE) has developed a training model based on a combination of blended learning with active and experiential learning. The core of this model is the application of ChatGPT in educational practice, with an emphasis on independent exploration and practical implementation. During the training, teachers first explore the functionality and didactic-methodological potential of digital tools independently using online resources and then test their application in simulated teaching scenarios through in-person workshops under the guidance of mentors. A key element of the process is reflective practice, through which teachers, both before and after training, describe their expectations, challenges, perceived benefits, and suggestions for programme improvement. This approach fosters a deeper understanding and conscious use of ChatGPT – not as a mere technical solution, but as a pedagogical assistant that can contribute to personalising instruction, fostering creativity, and enhancing teaching efficiency. In this way, CRAIE not only advances teachers' digital competencies, but also empowers them for responsible, reflective, and professional use of artificial intelligence in education.

2. The Role of Artificial Intelligence in Education

The introduction of artificial intelligence in education brings new opportunities and challenges that require the active involvement of teachers. Unlike previously used ICT tools, artificial intelligence has the ability to learn, adapt, make decisions, and provide support to students according to their individual needs, enabling them to progress at their own pace. The development of generative models such as ChatGPT further expands these possibilities by allowing the creation of educational content, learning support, and interactive communication in ways that were previously impossible (Tan et al., 2024). As a result, teaching becomes more dynamic and tailored to students' needs, while automated assessment enhances efficiency, saves teachers' time, and provides more accurate feedback. However, the implementation of artificial intelligence in education also raises numerous challenges, including issues of privacy and security, data protection, lack of trust, high costs, and risks of bias (Harry, 2023). For this reason, human agency remains essential: teachers not only need to be equipped to work with AI systems, but must also encourage students to think critically and use these technologies responsibly (Cukurova et al., 2024). When introducing artificial intelligence into the educational process, it is crucial to maintain balance between the use of technology and the teacher's role. These systems can significantly improve teaching through the automation of administrative tasks, creation and adaptation of teaching materials, and the design of personalised learning plans for each student. Artificial intelligence does not replace the teacher but supports them, freeing time for more creative, pedagogical, and mentoring activities.

The development of AI-based tools greatly influences modern educational processes. Tools such as ChatGPT enable both students and teachers to create a variety of content, such as quizzes, poems, illustrations, and dialogue simulations. In this way, teaching can be adapted to the individual abilities and interests of students. However, one of the key challenges is unequal access to technology, as not all students have the same technical opportunities. Many teachers also lack sufficiently developed digital competencies to adequately integrate AI tools into teaching (Mandić et al., 2024).

ChatGPT, as a modern digital tool based on artificial intelligence, enables students and teachers to quickly find useful information and receive support in solving problems during instruction. Proper and guided use of AI tools, in combination with traditional teaching methods, can help students develop critical thinking and improve the overall quality of education. The teacher's role remains essential. Educational materials generated by AI tools can have significant pedagogical value when used as support for the teacher, not as a substitute for their multifaceted role. Instead of excluding these technologies from the teaching process, it is necessary to develop clear guidelines and assessment models that encourage understanding and responsible use of content (Jensen et al., 2025). Strategies must be established to maximise the benefits of AI-based tools such as ChatGPT while mitigating risks to academic integrity. Using ChatGPT can be an efficient and time-saving way to conduct academic activities – from lesson planning and idea generation to task creation (Köhler & Hartig, 2024). Overreliance on tools such as ChatGPT, however, can reduce students' independence, limit the development of critical thinking, and hinder problem-solving abilities. Therefore, it is important to define pedagogical guidelines that specify how to use these tools effectively in teaching (Miščević, et al., 2025). Teachers are expected to design personalised learning activities that are adapted to students' age, interests, and abilities. Particular attention should be given to the safety and appropriateness of educational content. At the same time, continuous teacher training in the ethical and methodological use of AI tools is necessary, as well as preparation for analysing and adapting generated materials in line with learning outcomes (Aktay et al., 2023). Only through continuous professional development and ethical implementation of these tools can the quality and responsibility of AI integration in education be ensured.

A virtual avatar is a digital representation of a real or imagined person within a virtual environment: it can be defined as a digital entity within the metaverse that creates a sense of presence and social interaction among users (Sprott et al., 2025). Avatars have evolved in different ways – from 2D to 3D forms (Ding et al., 2024). They can be image-based and non-verbal, or voice-based with natural or synthesised speech (Kao et al., 2021; Zhang, 2023). *Interactive virtual avatars* are AI-connected avatars capable of responding to questions and providing real-time answers. Their knowledge bases are usually formed from scientific and reference sources, particularly when intended for specific domains such as education, medicine, engineering, or economics. Their knowledge can be expanded through the integration of generative AI systems (ChatGPT, Gemini, Microsoft Copilot, etc.). In teaching, they can be used by having the teacher record information to be presented to students, who can then ask follow-up questions and receive personalised responses adapted to their age, prior knowledge, intellectual and other capacities, and learning styles. Some examples of interactive educational avatars currently used in different pedagogical contexts, from primary education to higher education and research environments, include the following:

At CRAIE, there is the AI Avatar – Prof. Danimir Mandić (University of Belgrade)[6], an interactive educational avatar built on the HeyGen platform and integrated into the CRAIE and Beyond42 websites. It is used for communication with students, explaining concepts related to artificial intelligence and educational technology. Its uniqueness lies in combining an avatar, video narration, and dynamic knowledge, enabling students to "ask" the avatar questions as if interacting with a real mentor.

SimStudent[7] uses a *"learning by demonstration"* approach – it learns cognitive skills by analysing solved examples and through guided problem-solving. It can be used to automatically create adaptive educational tutors (as a plug-in for the Cognitive Tutor Authoring Tools) and to conduct controlled studies in education where *synthetic students* act as simulated learners.

[6] https://uciteljskifakultet.beyond42.com/
[7] https://www.hcii.cmu.edu/project/simstudent

Within the broader research of the Virtual Human Interaction Lab (VHIL) at Stanford University[8], it has been shown that the way users represent themselves as avatars (e.g., resembling themselves physically versus using generic avatars) and the virtual environment in which they interact significantly influence their psychological and social responses. There are also VR avatars that adhere to physical laws such as collisions with objects, providing users with a more realistic sense of presence and embodiment within the virtual space.

Method

Research Aim

The aim of this research is to examine the effects of teacher training focused on the application of interactive avatars based on ChatGPT in educational practice.

Research Tasks

- To determine teachers' self-assessment of digital competencies before the training on the use of interactive avatars based on ChatGPT in teaching.
- To determine the level of teachers' digital competencies according to their self-assessment after the training.
- To assess the degree of teachers' progress based on their self-assessment.
- To examine whether gender, years of work experience, and level of education influence the improvement of digital competencies.

Sample

The sample consisted of 156 primary and secondary school teachers from the Republic of Serbia. Among them, 14 participants were male and 142 were female. Data on work experience and level of education are presented in Tables 1 and 2.

Table 1. *Years of Experience in Education*

Years of Experience	Frequency	Percent
Up to 10 years	44	28.2
11–20 years	58	37.2
21–30 years	36	23.1
Over 30 years	18	11.5

Table 2. *Level of Education*

Level of Education	Frequency	Percent
College	3	1.9
Faculty	74	47.4
Master's Degree	77	49.4
Doctorate	2	1.3

[8] https://vhil.stanford.edu/

Procedure

Within the Centre for Robotics and Artificial Intelligence in Education (CRAIE) at the University of Belgrade – Faculty of Education, which has recently become the first UNESCO IIOE national centre, systematic training sessions were organised under the title *"Digital Competencies of Teachers in Contemporary Education."* As part of the project *"Building Key Computing Skills – Towards the Workforce of the Future"*, implemented in cooperation with the Ministry of Education of the Republic of Serbia and UNDP Serbia, a session was dedicated to exploring the possibilities of applying interactive avatars based on ChatGPT in educational practice. The data presented represent the results of a small-scale action research project conducted during the September 2025 training session, which aimed to evaluate its effectiveness. Participants were organised into small groups of approximately 15 teachers per session. Before the training, participants answered questions from an instrument specifically designed for the purposes of this study. The training then followed, during which participants gained theoretical and practical knowledge through a hybrid learning model. Afterwards, their learning outcomes were tested. The research instrument was administered in paper form and given to the participants twice: prior to the implementation of the training and immediately upon its completion. It contained questions regarding gender, years of professional experience in the field of education, level of formal qualification, as well as a self-assessment scale of the participants' digital competencies ranging from 1 to 5. During the practical part of the training, participants at CRAIE worked both independently and in small groups under the mentorship of moderators, enhancing their skills in using modern software tools. The research was conducted in person, using a paper-and-pencil format, and only those participants who provided informed consent took part in the study. The data containing participants' responses are accessible solely to the statistical associate and will not be shared with any third parties.

Results

From Table 3, we can see that the data on self-assessed competencies in using interactive avatars based on ChatGPT before and after the training significantly deviate from the normal distribution. Therefore, the non-parametric Wilcoxon Signed Ranks Test was applied (Table 4).

Table 3. *Tests of Normality*

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Self-assessment before training	,240	156	,000	,886	156	,000
Self-assessment after training	,272	156	,000	,775	156	,000
Difference (before–after)	,268	156	,000	,858	156	,000
a. Lilliefors Significance Correction						

Table 4. *Wilcoxon Signed Ranks Test*

Ranks				
		N	Mean Rank	Sum of Ranks
The difference in self-assessment of competencies before and after the training	Negative Ranks	0[a]	,00	,00
	Positive Ranks	115[b]	58,00	6670,00
	Ties	41[c]		
	Total	156		
a. Self-assessment after training < before training b. Self-assessment after training > before training c. Self-assessment after training = before training				

It can be observed that 41 participants reported no change in self-assessment, whereas 115 participants showed improvement after completing the training. The results of the Wilcoxon Signed Ranks Test indicated a statistically significant difference between self-assessed competencies before and after the training ($Z = -9.59$, $p < .001$). Participants rated their competencies higher after the training, suggesting that the programme positively influenced their self-perceived professional skills. The effect size coefficient ($r = 0.895$) indicates a high level of practical significance, confirming a strong impact of the training intervention. The effect size was calculated using the standard formula for non-parametric paired tests ($r = Z / \sqrt{N}$), which confirms that the observed improvement reflects a very large and practically meaningful effect of the training. To test whether the improvement in self-assessment was related to participants' gender, the Mann–Whitney U Test was used, as shown in Table 5.

Table 5. *Mann–Whitney U Test for Gender Differences in Self-assessment Before and After Training*

Ranks				
	Gender	N	Mean Rank	Sum of Ranks
The difference in self-assessment of competencies before and after the training	1,00	14	70,89	992,50
	2,00	142	79,25	11253,50
	Total	156		

The results of the Mann–Whitney U Test showed no statistically significant difference between male and female participants in their self-assessment of competencies before and after the training ($U = 887.50$; $Z = -0.70$; $p = 0.483$). It can therefore be concluded that gender did not affect the improvement in self-assessed competencies.

To examine the influence of years of professional experience and level of education on the improvement in self-assessment, the Kruskal–Wallis H Test was applied, and it also showed no statistically significant relationship between these variables and the progress achieved.

Table 6. *Kruskal–Wallis H Test for the Relationship Between Work Experience and Progress*

Ranks			
	Work Experience	N	Mean Rank
Progress in self-assessment of competencies	Up to 10 years	44	66,98
	11–20 years	58	86,83
	21–30 years	36	80,43
	Over 30 years	18	75,97
	Total	156	

($\chi^2 = 5.58$, $df = 3$, $p = 0.134$)

Since $p = 0.134$, the Kruskal–Wallis H Test indicates that work experience had no influence on the improvement in teachers' self-assessed digital competencies.

Table 7. *Kruskal–Wallis H Test for the Relationship Between Educational Level and Progress*

Ranks			
	Level of Education	N	Mean Rank
Progress in self-assessment of competencies	College	3	76,00
	Faculty	74	83,48
	Master's Degree	77	72,59
	Doctorate	2	125,50
	Total	156	

($\chi^2 = 4.95$, $df = 3$, $p = 0.176$)

Since $p = 0.176$, the Kruskal–Wallis H Test confirms that the participants' level of education did not influence the improvement in their self-assessed competencies.

Discussion

Professional development of teachers in the digital age requires constant monitoring of contemporary approaches and is associated with a number of complex challenges that can significantly influence its effectiveness. In the Republic of Serbia – currently the second country in Europe, after Estonia, to implement systemic teacher training programmes – this study was conducted, and its preliminary results are presented in this paper. Before and after the training, teachers performed self-assessments of their competencies in using modern educational tools, and statistically significant progress was observed, as confirmed by the Wilcoxon Signed Ranks Test ($Z = -9.59$, $p < .001$) and the effect size coefficient ($r = 0.895$), which indicates a strong impact of the implemented training programme. This result highlights the importance of continuing in this direction and expanding the number of teachers included in such training sessions, as the preliminary results provide valuable feedback. Furthermore, attention should be directed towards a broader range of similar studies, including analyses of their advantages and limitations, to further enhance teacher training programmes. In comparable international research on teacher education, many participants expressed a preference for more practice-oriented programmes, believing that theoretical courses did not provide enough applicable knowledge and skills for real classroom settings (Lee et al., 2024). Additionally, the use of educational robots can contribute to the development of teachers' digital competencies and their readiness to integrate modern technologies, including artificial intelligence, into the teaching process (Mandić et al., 2024). The most frequently identified obstacles include lack of time for continuous professional development, limited access to quality and relevant training, and considerable variation in teachers' initial levels of digital competence. In similar studies concerning the use of the metaverse in education, teachers generally evaluated its role positively, recognising its learning potential but also emphasising technical constraints and the need for additional training in applying artificial intelligence in teaching (Matović et al., 2025). For this reason, the training sessions organised by CRAIE are of particular importance. Another key challenge is resistance to change, often stemming from uncertainty, lack of confidence in working with new technologies, or feelings of professional overload. To overcome these challenges, education systems must adopt a strategic approach that ensures sustainable and inclusive professional development for teachers. Systemic support for schools and centres such as CRAIE includes adequate funding, institutional coordination, and the creation of a motivating environment for learning and knowledge exchange. Attention should also be directed towards the potential of non-formal and informal learning, which opens space for recognising and valuing continuous competency development achieved outside formal education frameworks. Future teacher training should consider differentiated approaches tailored to teachers' individual needs, experience, and interests, to achieve optimal learning outcomes. During the CRAIE training sessions, successful examples of good practice were analysed. These served as inspiration and evidence that digital transformation in education is both achievable and beneficial for all stakeholders in the system. Such an approach not only contributes to the professional empowerment of teachers but also strengthens the capacities of educational institutions to adapt to the dynamic demands of contemporary society and the labour market.

In this research, it was found that gender, years of work experience, and level of education did not influence the progress in teachers' self-assessed competencies. The Mann–Whitney U Test showed no significant difference between male and female participants before and after training ($U = 887.50$; $Z = -0.70$; $p = 0.483$), while the Kruskal–Wallis H Tests confirmed no significant correlation between work experience and progress ($\chi^2 = 5.58$, $df = 3$, $p = 0.134$) or between educational level and progress ($\chi^2 = 4.95$, $df = 3$, $p = 0.176$). These results indicate that the applied training programme was professionally designed, taking into account teachers' diversity and guided by competent mentors who managed the entire process within a hybrid learning model—from developing original materials and structuring the training pace to shaping methodological approaches and interactions. As a result, all participants benefited from the programme, strengthened their competencies, and many concluded that they could further serve as disseminators of knowledge and mentors to

colleagues in their schools who had not yet attended the training. This finding is particularly significant given international experience, which shows that the successful implementation of artificial intelligence in education largely depends on teacher readiness – a readiness that is currently limited by a lack of adequate training and support for developing digital competencies (Kotsis, 2025).

Conclusion

Although professional development in the digital age brings numerous advantages, it also faces a series of obstacles such as lack of time, limited access to quality training, differences in prior knowledge, and resistance to change. It is therefore essential that education systems recognise and address these challenges through:

- systemic support for schools and training centres,
- recognition of non-formal learning,
- differentiated approaches to training based on teachers' needs,
- promotion of successful examples of practice.

The results of this study confirm that systematic training focused on the application of interactive avatars based on ChatGPT has led to a statistically significant improvement in teachers' self-assessed digital competencies. It was established that gender, years of experience, and level of education did not significantly affect progress, indicating the inclusiveness and universality of the training model implemented by CRAIE. These findings confirm the importance of investing in continuous and differentiated professional development programmes that combine theoretical knowledge, practical activities, and reflective learning. For future training programmes, it is recommended to strengthen the research component within training, develop metrics for measuring the transfer of acquired knowledge into teaching practice, and enhance institutional support for the implementation of digital innovations in schools. Furthermore, it is essential to continue improving collaboration between universities, schools, and educational centres, ensuring a sustainable system of teacher support in the era of artificial intelligence. The Centre for Robotics and Artificial Intelligence in Education (CRAIE) thus reaffirms its role as a national and international leader in developing contemporary approaches to education that integrate technology, pedagogy, and human creativity into a unified, adaptive learning framework.

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