ISSN: 2716-9189 E-ISSN: 2676-1750
Journal of Studies in Language, Culture, and Society (JSLCS). (08) 01, 2025 (PP. 67-78)
Received: 07/03/2025 Accepted: 24/03/2025 Published: 30/04/2025

AI'S (RE)PLACE IN PRE-SERVICE TEACHER TRAINING. A CASE STUDY ON TEACHING AND LEARNING FOREIGN LANGUAGES

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Abstract: Due to the rapid advances in technology, the integration of artificial intelligence (AI) tools in educational settings presents a transformative opportunity to promote personalized learning experiences. However, at the same time, it also raises significant ethical concerns. Educators are called upon to redefine their teaching roles in the triad represented by sound subject matter knowledge, pedagogical knowledge and digital competence. Furthermore, they must develop procedural knowledge to critically explore, from a didactic perspective, the multifaceted opportunities and challenges associated with incorporating AI tools into formal educational environments. This study investigates pre-service teachers' perspectives on the use of AI in learning and teaching a foreign language. Undergraduate students enrolled in vocational teacher training represent a new generation of educators who navigate the ethical dilemmas connected to AI-generated content. These would-be teachers are expected to facilitate the knowledge acquisition process for Alpha Generation students, who require that new communication technologies be part of their daily routine. Thus, the stakes for the teaching profession are high as pre-service teachers' professional development undergoes significant transformations shaped by technological advancements. The study included 52 participants and employed two research instruments: a survey and a semi-structured interview. Data collected through the questionnaire were analysed qualitatively and quantitatively through descriptive statistics using Google Forms' built-in tools, Jamovi 2.6.26 and Voyant Tools for content analysis. Data from the semi-structured interview were also analyzed with Voyant Tools. The study contributes to the existing literature on understanding pre-service teachers' opinions on integrating AI in teaching foreign languages, thereby broadening the educational landscape shaped by AI.

***Keywords**:* Artificial Intelligence (AI), foreign language teaching, pre-service teacher training, Padlet, TalkPal AI

How to cite the article :
Raluca, P., & Anamaria, M . (2025). AI's (Re)Place in Pre-Service Teacher Training. A Case Study on Teaching and Learning Foreign Languages. *Journal of Studies in Language, Culture, and Society (JSLCS), 8*(1), 67-78.

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1. Introduction

The use of artificial intelligence (AI) tools to support students' learning has gained significant attention across various educational levels from kindergarten to tertiary education (Holmes, Bialik, & Fadel, 2023; Luckin George & Cukurova, 2022; Touretzky, Gardner-McCune & Seehorn, 2023; Wegerif & Major, 2023). However, the educational value of AI-powered tools must be continuously explored, researched and better understood as their integration challenges the evolving role of the educator and proposes a turning point in terms of interaction patterns, collaboration and correction strategies.

To adapt educational systems and teaching practices to these new technological challenges, it is essential to engage all stakeholders. The leverage brought in education by AI triggers a chain reaction as salient changes that occur at the macro level (e.g., laws, regulations, policy frameworks), shape in their turn the micro level (e.g., classroom routines, the expectations of parties involved, instructional strategies).

Recent studies highlight that educators often lack readiness to incorporate AI into their teaching (Yue et al., 2024; Chiu & Sanusi, 2024) and emphasize the need for understanding the development of AI literacy as an ongoing process (Lin et al., 2022) that has to address the significant challenges, limitations, and ethical considerations of using such tools (Ayanwale et al., 2024). Given the increasingly fast pace and demand for teachers to acquire AI-related competencies (Cheng & Yim, 2024), providing training on age-appropriate and engaging manners to use AI (Yang, 2022) for differentiation practices and inclusive education is crucial. It is salient, according to Yim & Wegerif (2024,p. 322), "to understand teachers' perceptions of AI literacy and what drives their acceptance of AI". If their readiness level and willingness are understood and researched, teachers will receive the support they need to use AI educational tools effectively. The demand for professional development extends to pre-service teachers as they are the "future architects of educational systems" (Ayanwale et al., 2024,p. 3221). With this perspective in mind, this current study aimed to investigate pre-service teachers' readiness level. In this newly created learning environment, teachers must demonstrate content knowledge, pedagogical expertise and strong technological literacy (Mishra & Koehler, 2006).

This paper widens the discussion about pre-service teachers' attitudes and their readiness and willingness to integrate AI into foreign language teaching. Additionally, it provides an opportunity to reflect on pre-service teachers' hands-on experience with AI tools such as Padlet and TalkPalAI in a formal educational environment. The paper explores educational implications and directions for further research.

2. Literature Review

It is essential to address the evolving role of educators in adapting their teaching practices to the technological challenges posed by AI. As AI will not vanish overnight, even if there is resistance to the changes it brings, it is salient to reflect on the practical aspects of using AI-infused learning environments in foreign language teaching. The discussion on integrating AI into teaching is just in its early stages, given the vast array of available tools and diverse ways these can be incorporated into teaching. Therefore, the educational value of AI tools needs to be considered in connection with the substantial changes they bring.

It is also important to acknowledge that the dynamics existing in the formal educational environment are influenced by what our students experience outside the classroom when they interact with technology. The target group examined in this research is probably going to teach learners for whom the Internet, digital apps, and even AI tools would be an integral part of their daily lives. A new term, *the Alpha Generation,* has been coined to

describe individuals born from approximately 2010 to the mid-2020s. The Alpha generation is immersed in technology from a young age and constantly interacts with various digital tools. Hartnett, Brown & Anderson (2014) argue that the rise of digital technology has led to changes in the ways students perceive, process, and use information. They must develop digital literacy in addition to literacy and numeracy. Alpha generation students have specific learning characteristics: preference for visual and interactive learning materials such as videos, infographics and game-based content, shorter attention span, preference for fast-paced and engaging activities, multitasking, preference for collaborative tasks, problem-solving and project-based activities, need immediate gratification and feedback (Cimene et al. 2024; Höfrová, Balidemaj & Small 2024; Kowalczyk-Kroenke 2024; Swargiary 2024).

To effectively accommodate these learning preferences, teaching must be flexible. In the same line of thought, educational resources should be diverse as "this generation is more responsive to interactive and collaboration-based learning methods emphasizing group work and active student engagement" (Pasinggi et al. 2024, p. 1). However, the constant use of technology can decrease the opportunities for social-emotional development and increase mental health problems (Höfrová et al. 2024, p. 394). To address these challenges, policymakers should create guidelines and develop strategies to support the transition towards this transformed instructional pedagogy, but not at the expense of students' social and emotional development.

Various studies have investigated pre-service teachers' familiarity with AI and interest in incorporating AI in their teaching. Findings indicate moderate familiarity and high interest in incorporating AI (Lamanauskas & Makarskaitė-Petkevičienė 2025). It is also relevant to indicate that gender differences exist in the acceptance of AI (Zhang *et al. 2023*) and STEM pre-service teachers have more positive attitudes toward AI and less anxiety level compared to non-STEM pre-service teachers (Aktulun, Kasapoğlu & Aydoğdu 2024). In this paper, we provided pre-service teachers with a context infused with AI to allow them to reflect on the strengths and drawbacks of each learning tool used. By conducting a survey and a semi-structured interview, we investigated their knowledge of and willingness to use AI tools. This path for inquiry paves the way for the research questions addressed in the study: pre-service teachers' attitudes towards integrating AI in learning and teaching a foreign language, their views on the strengths and weaknesses of incorporating AI in their teaching and their prospects for the future of education.

3. Methodology

3.1. Purpose of the Study

Because the educational system undergoes rapid changes, pre-service teachers need to be aware and prepared to integrate AI tools in teaching a foreign language. In addition to in-service teachers, they represent important stakeholders in shaping tomorrow's educational system.

The study aims to identify pre-service teachers' attitudes towards the benefits and challenges of using AI tools in language learning and teaching. In addition, it intends to investigate pre-service teachers' opinions on the prospects of an AI-infused learning environment.

3.2 Research Design

The research was conducted in October 2024 at the Faculty of Letters at Babes-Bolyai University of Cluj-Napoca, Romania. A mixed-method approach was employed, combining qualitative and quantitative data collection to provide a wider perspective on respondents' views. The Google Forms questionnaire was sent via MS Teams to undergraduate students

enrolled in the French and English Didactics course in the 2024-2025 academic year. Given the small number of respondents, the findings cannot be generalised. Still, the research is valuable for the qualitative analysis of the respondents' views about the benefits and challenges of integrating AI in the teaching and learning of a foreign language. As representativity is regarded, the participants study either English or French didactics or both, allowing for a broader perspective on understanding the scope of AI in foreign language teaching.

3.3 Participants and Procedure

The target group comprised undergraduate students in their third year of study. All of them were enrolled in an elective teacher training programme. A total of 52 respondents provided valid answers to the survey based on convenience sampling. Responses were anonymous. Table 1 indicates respondents' profiles:

Table 1.

Participant's Profile

Participants	N	%
Age		
20	11	21.2%
21	23	44.2%
22	3	5.8%
23	11	21.2%
24	4	7.7%
Total	52	100%
Gender		
Female	48	92.3%
Male	4	7.7%
Total	52	100%
Mother tongue		
Romanian	48	92.3%
Hungarian	4	7.7%
Total	52	100%
Digital competence		
Expert level	16	30.8%
Advanced level	16	30.8%
Intermediate level	13	25%
Low level	7	13.5%
Total	52	100%

Most respondents are between 20 and 23 years old and have Romanian as their mother tongue (92.3%). They have an advanced (30%) or an expert level (30%) in digital competence. As regards gender distribution, this is not equal (female 92.3%, male 7.7%) because in Romania, females are more numerous in the field of language teaching and are more likely to enrol in teacher training undergraduate studies. Respondents gave their consent to participate in this research. As they are adults and according to the existing laws in Romania, no other approval was necessary. Participant confidentiality was strictly maintained.

All respondents are multilingual and can speak various languages, such as English (100%), French (34.6%), German (34.6%), Norwegian (15.4%), Spanish (15.4%), Italian (15.4%), Japanese (5.8%), Swedish (5.8%), and Korean (1.9%). Respondents' answers were gathered through a checkbox item, and therefore, they exceed 100%.

3.4. Research Instruments

Two research instruments were used: a survey and a semi-structured interview. The questionnaire comprises 30 items with a mix of close-ended (multiple choice, checkboxes or Likert scale) and open-ended questions organized into five main sections: Section 1 - Demographic details and respondents' profile (age, gender, linguistic competence, digital skills, learning apps used); Section 2 - General understanding of AI in Education (familiarity with the concept of AI in education, use of AI, AI tools, contexts of using AI); Section 3 - Perceived Benefits of AI in Language Learning (effectiveness of AI, AI for students, AI for teachers, learning outcomes); Section 4 - Challenges and Misuse of AI in Language Learning (limitations of AI, motivation, confidence in AI); Section 5 – AI tools (TalkPal, Padlet).

The quantitative data obtained were analysed through descriptive statistics using Google Forms' built-in tools and Jamovi® software, version 2.3.21. The qualitative data were processed using content analysis provided by Voyant Tools (www.voyant.org). The questionnaire was formulated in English and gathered 52 valid answers. The statistics for the Likert scale data (ranging from 1 - strongly disagree to 5 - strongly agree) determined that Cronbach's Alpha =.76, which indicates that the survey has an internal consistency of 0.76. Considering the value of Cronbach's Alpha, our study instrument is reliable and has an acceptable internal consistency.

The other research instrument used was the semi-structured interview, which was guided by the three main research questions indicated in the current study. The interview had four main sections: Section 1- General use of AI (difficulties encountered, way of using AI in their studies, degree of familiarity with using AI); Section 2 – AI in education (impact of AI in teacher training, impact of AI in foreign language teaching, language anxiety); Section 3 – Case-study on TalkPal (strengths, weaknesses, skills developed); Section 4 – Case-study on Padlet (strengths, weaknesses, usefulness for teachers). The semi-structured interview represents a valuable research tool to tap into interviewees' attitudes, emotions and opinions (Longhurst 2009, 508) about using AI tools. Qualitative data underwent content analysis, and coding was performed by Voyant Tools (www.voyant.org). The semi-structured interview was conducted in English with six respondents who voluntarily offered to participate from the cohort of 52 respondents.

3.5 Research Questions

The study aims to answer the following research questions:

1. What are pre-service teachers' attitudes on integrating AI in learning and teaching a foreign language?
2. What are pre-service teachers' opinions on the strengths and drawbacks of incorporating AI tools in learning and teaching a foreign language?
3. What are pre-service teachers' opinions on the prospects of an AI-infused learning environment?

4. Results

4.1 Quantitative Data

Results indicate that 84.6% of the respondents use various learning apps to improve their language skills. The learning apps used refer to Duolingo (40 instances), Babbel (3 instances) and other language learning apps that scored fewer instances: DuoCards, DuChinese, ELSA Speak, Speakly, Udemy, Lingua, Mondly, Beelinguapp, and Lingopie.

As familiarity with the concept of AI in education is regarded, 21.2% of the respondents are very familiar and 30.8% are familiar with it. Still, quite a significant number of the respondents (44.2%) were uncertain (i.e. neither agreed or disagreed) about this concept,

while 3.8% were unaware of it. This uncertainty also impacts the frequency of AI use. Thus, results conclude that only 5.8% of the respondents use AI tools daily, while 26.9% often use these tools weekly. In addition, 25% of the respondents use AI tools only once a week, 34.6% use them seldom (once a month), and 7.7% never use them.

The context for using AI tools is relevant because it offers a perspective on how pre-service teachers relate to using AI in different educational contexts. Thus, 63.5% of the respondents use AI to search for information, 57% to accomplish different school projects, 32.7% to be more creative, 15.5% to have fun, 13.5% in work-related contexts, 15.4% to test their knowledge, or 1.9% to analyze various data and interpret them. Few respondents (9.6%) do not use AI tools at all. This percentage is correlated to the low frequency use of AI (i.e., 7.7% of the respondents never use AI tools) or the high level of uncertainty regarding general knowledge of AI tools in education (44.2%). Respondents' answers were gathered through a checkbox item. Therefore, the total exceeds 100%.

The majority of the respondents (69.23%) use ChatGPT, while others use Microsoft Copilot (17.3%), Padlet (9.6%) or TalkPal (3.8%).

Below are indicated the results for three items included in the section – Perceived benefits of AI in language learning. This section aimed to address pre-service teachers' preference for using AI tools.

Table 2.

Pre-service Teachers' Preference for Using AI Tools

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Mean	SD	N
Do you enjoy using AI tools?		75%	13.5%		11.5%	2.48	0.97	52
Can AI support a student in learning a foreign language?	13.5%	38.5%	26.9%	15.4%	5.8%	2.61	1.07	52
Can AI support a teacher in teaching a foreign language?	19.2%	34.6%	26.9%	11.5%	7.7%	2.53	1.15	52

A considerable number of the respondents (75%) agreed that they liked AI, while the remaining 25 % disliked AI or had mixed feelings about its use. There is a general tendency toward agreeing that AI can support a student in learning a foreign language (m = 2.61) and that AI can support teachers in teaching a foreign language (m = 2.53). The percentage of those who do not use AI or have mixed feelings about using AI (25%) reflects the strong disagreement of respondents who consider that AI does not support students' and teachers' foreign language learning and teaching. In this section, the respondents' status as would-be teachers was acknowledged. Some respondents (19.2%) are not confident in the support provided by AI in teaching a foreign language. This can be underpinned by the few empirical data available in the field of foreign language learning. More research is needed to help

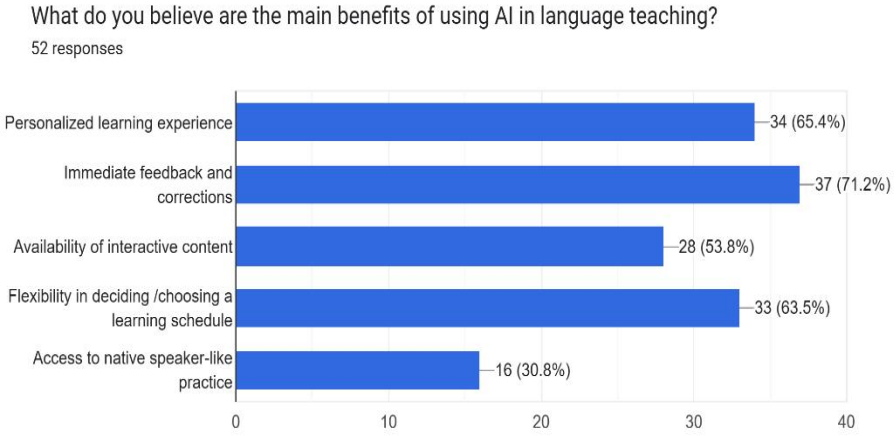
teachers put into practice and obtain similar positive outcomes from incorporating AI in their teaching practice.

Asked to compare traditional teaching methods with AI tools, the same number of respondents agreed they are equally effective (44.2%), while the other 44.2% considered them to be less effective. The boost of confidence comes from 11.5% of the respondents who consider AI tools to be more effective.

Respondents have identified various benefits of using AI in language teaching, and answers were gathered through a checkbox item. Therefore, it exceeds 100%. Most respondents (71.2%) indicate that AI is useful because it provides immediate feedback, a personalized learning experience (65.4%) that is flexible in terms of planning (63.5%). Respondents' answers were gathered through a checkbox item. Therefore, the total exceeds 100%. Figure 1 provides a visual representation of the data:

Figure 1.

Benefits of Using AI in Language Teaching



Quite often, the discourse revolving around the use of AI in education undermines the status of a teacher and raises issues of anxiety connected to the possibility of being replaced by technology (Reiss, 2021). Therefore, it was imperative to ask respondents about the possible replacement of human teachers by AI tools. A considerable number of respondents (69.2%) think that AI cannot replace the human teacher, while others (28.8%) agree that AI can partially replace a human teacher. Only one respondent (1.9%) takes into consideration the shift.

4.2 Qualtitative Data

The open-ended item ("What strategies are there for AI to empower educators, rather than replace them?") underwent content analysis via Voyant Tools. The corpus created contained a total of 778 words. The most relevant frequent words in the corpus were: AI (22 instances), learning (14 instances), help/helpful (12 instances), personalized (9 instances), creative/creativity (5 instances), collaborative/collaboration (5 instances), organize/organizing (4 instances), feedback (4 instances), administrative (3 instances), lesson plan (2 instances). To showcase some of the respondents' opinions on this topic, we include below five word-for-word answers:

[Personalized learning, boosting engagement, collaborative learning environments.]

[When a teacher feels like they are stuck in a routine and can't come up with creative ideas for class activities AI may provide help in brainstorming]

[administrative relief (automating grading and administrative tasks), lesson planning]

[*I think it can come up with creative ideas, although I think those ideas need to be reshaped by the teacher*]

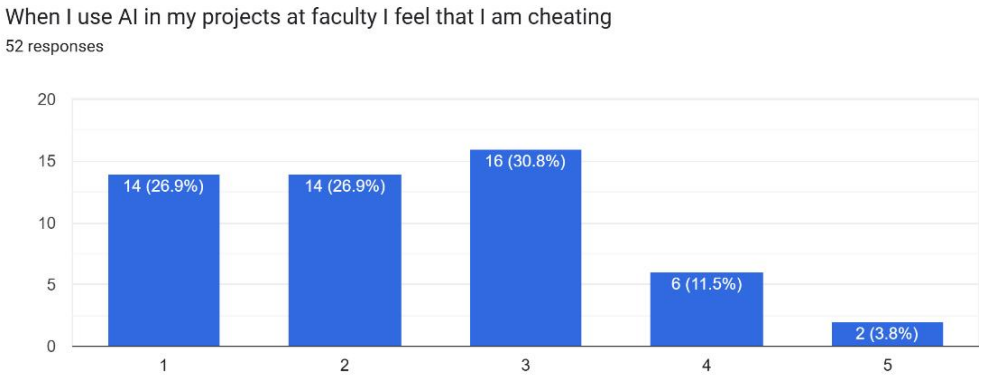
[*Not using it for every task you have to do, not limiting to the ideas ChatGPT offers and trying to think outside the box*]

The bulk of answers provided by respondents and their content analysis indicate that AI can be a helpful companion when creating lesson plans, providing feedback and dealing with administrative tasks. Respondents acknowledged the enhanced collaborative learning spaces and the boost in engagement as an outcome of personalized learning sequences. Still, they are wary to credit AI with total confidence on organizing a lesson, as the input given by AI should be filtered through a lens provided by the teacher (for example [*I think those ideas need to be reshaped by the teacher*]).

Respondents (55.8%) have encountered limitations of AI tools in general. These were linked to mistakes, hallucinations, lack of human interaction, context and cultural misunderstandings, biased information, and the emotional support that is missing. A by-product of the interaction with AI tools might be the sense of cheating, as the input one receives can be easily taken for granted and appropriated. Respondents demonstrated awareness of this issue as more than half agreed (26.9%) and strongly agreed (26.9%) that this can become a problem. The findings are also rendered in Figure 2:

Figure 2.

Ethics and AI



Respondents (76.9%) are aware that AI tools can present incorrect data. Still, the ease of accessing AI and receiving instant information is so alluring that learners could become dependent on AI tools in the context of language learning. Respondents strongly agree (21.2%) and agree (42.3%) that this is a situation likely to occur in the future. On the other hand, some respondents are uncertain (21.2%), disagree (9.6%), or strongly disagree (5.8%) with this perspective.

The qualitative analysis of the data gathered from the semi-structured interview indicates that pre-service students are knowledgeable of the various ways in which AI tools can be helpful both for teachers and students in teaching foreign languages. Data were analyzed with Voyant tools. The benefits of using AI tools by teachers refer to: creating various class activities (6 instances), finding learning materials (4 instances), as tools for time management (5 instances), as sources of useful information (4 instances). Respondents indicated several opportunities for learners to use AI tools: developing learner autonomy (6 instances), enhancing communication skills (5 instances), and engaging in communication with AI (3 instances).

Asked to consider how AI tools can influence the learning a foreign language, the pre-service teachers focused mainly on providing personalized learning experiences, and the ease and rapidity of finding information. The word-for-word transcripts below highlight these two main benefits of AI tools:

[It can offer a customized support, depending on each students' skills. You can develop your communication skills without necessarily having to go through linguistic anxiety.]

[AI can create and obtain learning materials for every learner. It is difficult for the teacher to create learning materials that respond to every child's needs. So the AI can definitely help in this matter.

[AI helps teachers and students obtain various information in a short time.]

[AI can influence the learning process by adapting the activities to every student's linguistic abilities. It can also simulate real conversations. These conversations can help students to develop their speaking skills without fear of being judged.]

[AI can influence the learning process by customizing every student's learning experience: it can provide immediate feedback and by this means it can sustain an autonomous learning process.

Concerning the analysis of TalkPal AI and Padlet, the respondents identified a range of advantages and disadvantages associated with both tools. In the case of the free version of TalkPal AI used in this study, respondents recognized its potential to support the development of writing skills. However, they have pointed out several limitations, including the lack of human emotion, interaction, and spontaneity, as well as repetitive answers, and limited interaction scenarios.

Padlet was perceived as a valuable tool for supporting time management, facilitating collaborative learning, diversifying classroom activities, enhancing digital competence, and generating innovative lesson plans. Nonetheless, respondents emphasized the importance of critically filtering the content provided through Padlet, drawing on their own subject-specific, pedagogical, and procedural knowledge. Taking for granted all the resources offered by Padlet diminishes teachers' active role in the classroom, may undermine their role as decision-makers, and as facilitators for meaningful learning.

5. Discussion

The first research question intended to investigate pre-service teachers' attitudes and readiness to integrate AI in learning and teaching a foreign language. Even if only half of the respondents (52%) are familiar with the integration of AI in education, they are aware of how to benefit from AI: 63.5% of the respondents use AI to search for information, 57% for different school projects, 32.7% to be more creative, 15.5% to have fun, 13.5% in work related contexts, 15.4% to test their knowledge or 1.9% to analyze various data and interpret them. Few respondents (9.6%) do not use any AI tools. Most of the students are using

ChatGPT. In terms of readiness, the majority of the respondents (75%) agreed that they like AI.

The second research question concerned pre-service teachers' opinions regarding the strengths and drawbacks of incorporating AI tools in learning and teaching a foreign language. In this respect, findings indicate that 52 % (13.5% strongly agreed and 38.5% agreed) of the respondents are confident that AI is beneficial and is conducive to learning a foreign language. Some of the benefits of using AI in the foreign language classroom refer to providing immediate feedback (71.2%), offering personalized learning experiences (65.4%), and providing flexibility in terms of planning (63.5%). Respondents demonstrated awareness (55.8%) of the limitations of AI in terms of mistakes, hallucinations, lack of human interaction, context, cultural misunderstandings, biased information, and the lack of emotional support. Respondents' critical thinking skills were put to the test when they were asked to evaluate the sense of cheating connected to using AI. Surprisingly, more than half of the respondents (53.8%) demonstrated awareness of this issue.

The third research question concerned pre-service teachers' opinions on the prospects of an AI-infused learning environment. Findings gathered from the two research instruments indicate that respondents are aware of the possibilities offered by AI in terms of lesson planning, managing administrative tasks, providing personalized learning and engaging students meaningfully in collaborative activities. More than half of the respondents (53.8%) are confident that AI tools can support a teacher in his/her endeavour to teach a foreign language. Nevertheless, a significant proportion of respondents (69.2%) consider that AI cannot replace the human educator in the future.

6. Limitations and further Considerations

The limited sample size in this study restricts the generalizability of the findings. Still, the insights gathered offer valuable implications for policymakers and teacher training programmes, particularly regarding the integration of AI as a pedagogical tool. There is a clear need to develop structured guidelines that define expectations for pre-service teachers in terms of AI literacy, while also raising awareness of the ethical concerns associated with this form of transformative, personalized learning.

The depth and reliability of the study could be enhanced by increasing the number of participants and incorporating a greater diversity of gender and subject specialization. Previous research has indicated that preferences and attitudes toward AI may vary based on gender, as well as the academic discipline being taught.

Furthermore, the study's reliance on self-reported data introduces the risk of social desirability bias. A way to address this issue might be to incorporate more objective assessments, observational methods, and triangulated assessments. Subsequent studies could explore contextual factors that influence the use of AI in education, including institutional support, available teaching methodologies, and curricular constraints.

7. Conclusion

The research adds to the growing body of literature exploring pre-service teachers' willingness and readiness AI tools in foreign language instruction. Consistent with previous studies, the findings indicate that while pre-service teachers generally have a moderate familiarity with AI tools, they demonstrate interest in adopting them in their future teaching practices. The results emphasize the urgent need for teacher education programmes to provide comprehensive training on the functionalities and pedagogical applications of AI. Many would-be teachers lack the formal preparation necessary to use AI-powered resources effectively. In turn, this diminishes their ability to integrate these technologies meaningfully

into the formal educational settings. Focus on the ethical dimension should also be considered when implementing a comprehensive AI literacy curriculum for pre-service teachers. Equipping prospective educators with a critical understanding of the potential benefits and risks of AI use in education will foster responsible implementation and encourage reflective, informed decision-making. This leads to an increased critical awareness surrounding the use and misuse of AI.

References

Aktulun, U, O., Kasapoğlu, K. & Aydoğdu, B. (2024). Comparing Turkish Pre-Service Stem and Non-Stem Teachers' Attitudes and Anxiety Toward Artificial Intelligence. *Journal of Baltic Science Education 23(5):*950-963

Ayanwale, M. A., Adelana, O. P., Molefi, R. R., Adeeko, O., & Ishola, A. M. (2024). Examining artificial intelligence literacy among pre-service teachers for future classrooms. *Computers and Education Open*, (*6*), 100179, https://doi.org/https://doi.org/10.1016/j.caeo.2024.100179.

Chaudhary, A. A., Arif, S., Fontanilla Calimlim, R., Sadia, A. & Khan, Z. (2024). The Impact of AI-Powered Educational Tools on Student Engagement and Learning Outcomes at Higher Education Level. *International Journal of Contemporary Issues in Social Sciences*, vol *3(2):* 2842-2852.

Cheng, M. W., & Yim, I. H. (2024). Examining the use of ChatGPT in public universities in Hong Kong: A case study of restricted access areas. *Discover Education*, *3*(1): 1–10, https://doi.org/10.1007/s44217-023-00081-8

Chiu, T. K., & Sanusi, I. T. (2024). Define, foster, and assess student and teacher AI literacy and competency for all: Current status and future research direction. *Computers and Education Open*, 100182.

Cimene F.T. et al. (2024). Generation Alpha Students' Behavior as Digital Natives and Their Learning Engagement Psychology and Education. A Multidisciplinary Journal: *Psychology And Education*, vol *27(3):* 258-273. Doi: 10.5281/zenodo.14007254.

Hartnett, M., Brown, M. & Anderson, B. (2014). Learning in the digital age: How are the ways in which we learn changing with the use of technologies. In A. St. George, S. Brown, & J. O'Neill (Eds.), Facing the big questions in teaching: Purpose, power and learning (2nd ed., pp. 116-125). Melbourne, Australia: Cengage.

Höfrová A., Balidemaj, V., & Small M.A. (2024). A systematic literature review of education for Generation Alpha. *Discover Education 3(1):* 1-20. Doi: 10.1007/s44217-024-00218-3

Holmes, W., Bialik, M., & Fadel, C. (2023). *Artificial intelligence in education*. *Globethics Publications, 621-653. https://doi.org/10.58863/20.500.12424/4276068*

Kowalczyk-Kroenke, A. (2024). The Generation of the Future. How Can Generation Alpha Change the Labour Market? *Humanitas University's Research Papers Management, 25(3).* Doi: 10.5604/01.3001.0054.7765

Lamanauskas, V. & Makarskaitė-Petkevičienė, R. (2025). Pre-service Preschool and Primary School Teachers' Position on Artificial Intelligence. In Turčáni, M. (eds) 15th International Scientific Conference on Distance Learning in Applied Informatics. DiVAI 2024. EAI/Springer Innovations in Communication and Computing. Springer, Cham. 10.1007/978-3-031-81261-3

Lin, X. F., Chen, L., Chan, K. K., Peng, S., Chen, X., Xie, S., Liu, J., & Hu, Q. (2022). Teachers' perceptions of teaching sustainable artificial intelligence: A design frame perspective. *Sustainability*, *14(13),* 1-20. Doi: https://doi.org/10.3390/su14137811

Longhurst. R. 2009. Interviews: In-Depth, Semi-Structured. *International Encyclopedia of Human Geography*, 580-584. Elsevier. https://doi.org/10.1016/B978-008044910-4.00458-2.

Luckin, R., George, K., & Cukurova, M. (2022). *AI for school teachers*. Boca Raton: CRC Press.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108(6):* 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Pasinggi Y. R., Turken, R. & Krismanto W. (2024). Cooperative Learning for The Alpha Generation: An Assisting Action for Teachers of Madrasah Ibtidaiyah. Conference paper.

Reiss, M. J. (2021). The use of AI in education: Practicalities and ethical considerations. *London Review of Education 19(1*). https://doi.org/10.14324/lre.19.1.05

Swargiary, K. (2024). Teaching the Future Strategies for Educating Generation Alpha and Beta in the Age of AI. Publisher: Lambert Academic Publishing

Touretzky, D., Gardner-McCune, C., & Seehorn, D. (2023). Machine learning and the five big ideas in AI. *International Journal of Artificial Intelligence in Education, 33(2):* 233–266. 10.1007/s40593-022-00314-1

Wegerif, R., & Major, L. (2023). *The theory of educational technology: Towards a dialogic foundation for design*. London: Routledge, https://doi.org/10.4324/9781003198499

Yang, W. (2022). Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation. *Computers and Education: Artificial Intelligence*, *3*, 100061. https://doi.org/10.1016/j.caeai.2022.100061

Yim, I. H.Y. & Wegerif, R. (2024). Teachers' perceptions, attitudes, and acceptance of artificial intelligence (AI) educational learning tools: An exploratory study on AI literacy for young students. *Future in Educational Research, (2):* 318-345. https://doi.org/10.1002/fer3.65

Zhang, C., Schießl, J., Plößl, L. *et al.* (2023). Acceptance of artificial intelligence among pre-service teachers: a multigroup analysis. *International Journal of Education Technology in High Education 20(49):*1-22. https://doi.org/10.1186/s41239-023-00420-7