Journal of Pedagogical Sociology and Psychology
Volume 7, Issue 3, 2025
https://doi.org/10.33902/jpsp.202536762

Research Article

Investigation of preservice secondary school mathematics teachers' views on artificial intelligence

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Received 10 May 2025; Revised 1 August 2025; Accepted 5 August 2025

This qualitative study explores the views of preservice secondary school mathematics teachers regarding Artificial Intelligence, focusing on their experiences with Artificial Intelligence applications in daily life and university courses, frequency of use, and reasons for non-use. In this context, key concepts such as Artificial Intelligence, Artificial Intelligence literacy, and teacher education form the backbone of the research. The study was conducted with five sophomore preservice mathematics teachers (four females, one male) enrolled in a private university in Istanbul. A basic qualitative research design was adopted, and data were collected through semi-structured interviews developed by the researchers based on a review of the relevant literature. The interviews were conducted individually via Zoom, recorded with consent, and analyzed using content analysis. Findings revealed that preservice teachers perceive Artificial Intelligence as a system that imitates human intelligence and continuously updates and evolves through learning. ChatGPT was the most frequently used application in personal and academic contexts, primarily for research, homework assistance, and concept clarification. However, the use of Artificial Intelligence in numeracy-based university courses (e.g., probability, abstract mathematics, linear algebra) was notably limited. Based on the findings, the study suggests the following: Artificial Intelligence literacy among preservice teachers should be systematically developed through curriculum integration; and universities should provide technical infrastructure and professional development opportunities for both faculty and students to foster effective and ethical Artificial Intelligence use in education.

Keywords: Artificial intelligence, mathematics education, preservice mathematics teachers, views on artificial intelligence

1. Introduction

Nowadays, rapid and significant technological developments are expanding the scope of technology in our lives and affecting many different areas. One of the areas shaped by technological developments is education (Raja & Nagasubramani, 2018). The roles of technology in education are "as a part of the curriculum, as an instructional delivery system, as a means of aiding instructions, and also as a tool to enhance the entire learning process" (Raja & Nagasubramani, 2018, p. 34). Although the spectrum of technology use in education is vast, one of the most prominent developments among current technological tools is Artificial Intelligence (AI), which can potentially transform many facets of society (Ayanwale et al., 2024; Haseski, 2019). AI was explained as "the ability of machines to adapt to new and emerging situations, problem-solve, answer questions, create plans, and perform other intelligent functions typically associated with human beings" (Owan et al., 2023). According to Naqvi (2020), AI is the branch of computer science that emphasizes developing computer programs that mimic intelligent behavior and, ideally, improve human-like abilities.

As in many different fields, the use of AI in education and its reflections on education have been an important issue for researchers (Popenici & Kerr, 2017; Roll & Wylie, 2016; Zawacki-Richter et al., 2019). The usages of AI in education include giving instant and individual feedback to students, providing recommendations about enhancing the content of teaching and teaching strategies to teachers, and analyzing students' learning process by examining their behaviors and

perceptions (Hwang et al., 2014; Hwang & Tu, 2021). According to the review study of Saputra et al. (2023), the opportunities for using AI fall into four groups: Delivery of learning materials, learning evaluation, learning management system, and other aspects. Implementing AI in learning provides new ways that make it more practical for teachers to offer learning materials and more effective for students to enhance their understanding (Kong et al., 2021; Timms, 2016). Additionally, it provides personalized learning opportunities for students (Falebita, 2024) and increases the quality of learning. AI-powered personalized learning environments provide opportunities for students regarding their personal needs, abilities, and preferences (Ajani et al., 2025; Hang, 2024). Another advantage that using AI has in education is learning evaluation. Implementing AI in education provides new ways for teachers to assess students' learning products and processes, such as automated assessment systems (Saputra et al., 2023). Educators recognize the role of AI in educational assessment—particularly AI-powered automatic assessment systems for exams and homework—as a significant advancement in teaching and learning practices (Sarıtiken, 2024). AI can also be used to enhance the learning management system in education. AI-powered learning management systems can monitor students' school performance and predict courses in which students are likely to fail. Thus, student learning can be supported with early and personalized interventions (Guan et al., 2020). The last opportunity that AI reveals in education is its effects on educational policies, the development of educational markets, and research trends (Saputra et al., 2023).

Even if the studies that focus on using AI in education generally examine the effects of AI use on students' performance, with the increasing impact of using AI in education, studies on AI have begun to be conducted in the field of teacher education. Recent research has begun to address a significant gap in literature by focusing specifically on preservice teachers' engagement with AI. Karataş and Yüce (2024) conducted a narrative inquiry with 141 preservice teachers who participated in a three-week implementation using ChatGPT via Zoom. Their findings indicated that while AI supported personalized feedback and procedural efficiency, participants also expressed concerns about academic integrity, data privacy, and the need for balanced use. Similarly, Nyaaba et al. (2024) surveyed 167 preservice teachers in Ghana and found that participants generally held positive attitudes toward generative AI, viewing it as both a learning companion and a teaching assistant. Their study identified three core dimensions of preservice teachers' attitudes: teaching, learning, and ethical advocacy. It also revealed that age and year of study were significant predictors of AI use, while gender had no direct effect—although ethical concerns about trust in AI remained prominent. Zhang et al. (2023), in a study conducted with 452 preservice teachers in Germany, examined AI acceptance through the Technology Acceptance Model [TAM]. Their results showed that perceived usefulness and ease of use were the strongest predictors of intention to use AI in educational settings. Additionally, gender differences were observed in variables such as AI anxiety and perceived enjoyment, although gender did not significantly predict behavioral intention to use AI. These studies collectively underscore the educational value of understanding preservice teachers' perceptions, attitudes, and acceptance of AI tools. In this context, the present study aims to contribute to the growing literature by investigating the views of preservice secondary school mathematics teachers in Turkiye regarding AI.

The dispositions and interests of inservice teachers towards the use of AI have also been examined in literature. Studies examining inservice teachers' interest and dispositions toward AI have focused on some affective predictors, such as teachers' readiness, confidence, anxiety, and motivation. According to Ayanwale et al. (2024), understanding teachers' readiness to use AI is essential for the success of AI in education, since teachers' readiness to use and teach AI directly affects the quality of the use of AI in education. Confidence regarding AI is related to some determinants: knowledge about AI, benefits and costs of AI, and precision of AI (Karran et al., 2022). According to Tom et al. (2020), teachers' lack of knowledge about AI is the most decisive factor that affects their confidence in using AI. Additionally, the lack of knowledge regarding AI triggers teachers' anxiety (Wang & Wang, 2022). Lastly, Teachers' motivation significantly affects

their use of AI in education, as educators who perceive AI tools as useful and easy to use are more motivated to integrate them effectively in teaching (Ajani et al., 2025). These studies show that teachers' both cognitive (e.g., knowledge) and affective (e.g., trust, anxiety, motivation) characteristics are decisive in the use of AI. Therefore, similarly, preservice teachers' dispositions and attitudes are also important. Therefore, it is meaningful to examine the ideas and dispositions of preservice teachers, who will play a role in shaping education in the future, towards AI.

As the effect of AI applications in education continues to increase, recent research also highlights the evolving perspectives of next-generation educators on AI, emphasizing the importance of preparing future teachers for AI-integrated learning environments (Samarescu et al., 2024). The studies, which were conducted with preservice teachers, generally emphasized their beliefs and views regarding the use of AI in education. A qualitative study conducted by Çam et al. (2021) aims to reveal preservice teachers' opinions and awareness regarding AI technologies by collecting data with open-ended questions. The data were collected from 34 science and 34 computer and instructional technology education preservice teachers. The study results show that preservice teachers were aware of AI technologies, and they defined AI as a structure created based on human intelligence. Additionally, preservice teachers stated that AI technologies can be used in an educational context to support teachers, enhancing students' learning process by providing individual assessment and feedback. A similar study was conducted by Haseski (2019) with 94 preservice teachers from different departments. The results reveal that preservice teachers gave different definitions for AI. Additionally, they stated that using AI in education has both advantages and disadvantages.

Hwang (2023) conducted a study with 202 preservice teachers to develop a scale regarding preservice teachers' beliefs about integrating AI in mathematics education. Descriptive statistics of the study reveal that mathematics preservice teachers held positive beliefs regarding AI in mathematics education. However, they tended to give lower scores in beliefs regarding teachers' roles in integrating AI into mathematics education. Another study, conducted with 796 preservice teachers, aimed to examine preservice teachers' perceptions and behavioral intentions to learn AI (Sanusi et al., 2024). The study results reveal that preservice teachers' perceptions and behavioral intentions to learn AI were predicted by their anxiety, basic knowledge of AI, subjective norm, self-efficacy, personal relevance, and self-transcendent goals. PSTs' basic knowledge of AI was the most significant predictor of behavioral intention to learn AI.

According to the current literature, there is a need for further studies regarding AI in teacher education (Falebita, 2024). Limited studies regarding AI in teacher education generally conduct professional development programs for teachers to enhance their abilities to use AI in the classroom. However, preservice teachers must be prepared to integrate AI into the classroom context to ensure the integration of AI into K-12 education because, currently, AI is considered an essential ability for the future (Frimpong, 2022; Park et al., 2023). In this context, it is essential to examine and understand the views of primary school mathematics preservice teachers, who will be the future mathematics teachers, on AI, as these opinions have a decisive role in using AI applications in education more effectively and efficiently (Çam et al., 2021). Therefore, this study aims to reveal the perceptions of pre-service teachers about the concept of AI, to determine their use and frequency of AI applications in their daily lives and university courses, to understand their reasons for not using AI applications, and to examine their views on in which courses they would like AI applications to be used. In line with this purpose, the research question was determined as follows:

RQ) What are pre-service teachers' views of artificial intelligence, their use of artificial intelligence applications in daily life and university courses, frequency of use, reasons for not using artificial intelligence applications, and expectations for using them?

2. Method

2.1. Research Model

Regarding the aim of the current study, a basic qualitative research design was conducted to determine the views of secondary school mathematics preservice teachers about using AI in their daily lives and university courses. Basic qualitative research design is conducted to understand "(1) how people interpret their experiences, (2) how they construct their worlds, and (3) what meaning they attribute to their experiences" (Merriam & Tisdell, 2016, p. 24). Therefore, the main goal of a basic qualitative research design is to reveal and make sense of these meanings (Merriam & Tisdell, 2016). Based on this research design, individual semi-structured interviews were conducted with preservice secondary school mathematics teachers.

2.2. Study Context and Participants

The participants included five preservice secondary school mathematics teachers (four female and one male) attending the sophomore of undergraduate education at one of the foundation universities in Istanbul. Sophomore preservice teachers were selected because they had completed courses in basic mathematics as well as information technology and instructional technology. This enabled them to gain an informed perspective on the integration of AI in advanced topics. Since the study aims to gain insight into the opinions of preservice secondary school mathematics teachers about using AI in their daily lives and university courses, a simple random sampling method was used as a sampling method (Merriam & Tisdell, 2016). With a simple random sampling method, five preservice secondary school mathematics teachers participated in the study on a volunteer basis.

2.3. Instruments

In this study, researchers developed a semi-structured interview protocol based on the study's aim. They reviewed the literature to determine the key concepts, and four open-ended questions were written. Then, the interview questions were sent to experts. Based on their feedback, the questions were revised, and the final version of the protocol is given below.

1. How would you define artificial intelligence?
2. What are the artificial intelligence applications that you use or know in your daily life? Please explain.
3. Which artificial intelligence applications do you use in your university courses?
- How and how often do you use artificial intelligence applications in your courses?
- If not, can you explain why not?
4. In which other courses at the university would you like artificial intelligence applications to be used?
- Why do you think it would be helpful for these courses?

2.4. Data Collection and Analysis

Data were collected during the spring semester of 2023- 2024. Before the data collection process, informed consent was presented to volunteer participants, including details about the study's purpose and content, how the data would be used, participant rights, and data privacy. Researchers conducted the data collection process via an online platform (Zoom) due to the end of the semester by carrying out semi-structured interviews with each preservice teacher individually and recorded them within the participants' knowledge and consent

After the data collection process, the data were analyzed using content analysis. Content analysis was defined by Krippendorff (2012) as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 24). As a first step, the recorded semi-structured interviews were transcribed by researchers. Then, open codes were created, and the data was used to create categories and a coding system. In the analysis process, the codes were determined based on the preservice teachers' statements, and the codes'

classifications according to the categories were made. Finally, the researchers made sense of the categories and their characteristics. The researchers conducted the analysis process independently and coded the data independently and then compared their results. The agreement between the coders was determined to be 85%.

In addition, researchers were coded as R and preservice teachers were coded as PST1, PST2, PST3, PST4, and PST5, respectively.

3. Results

In this part of the study, the content analysis results were presented question by question.

3.1. Content Analysis Results for the First Question

Table 1 presents the content analysis results based on preservice teachers' responses to the question, "How would you define artificial intelligence?"

Table 1
Content Analysis Results for the First Question

Categories and Codes	*PST1*	*PST2*	*PST3*	*PST4*	*PST5*
Similarity to Human Intelligence					
Imitation			x		x
Human	x	x	x	x	x
Machine	x	x			
Intelligence	x	x			x
Functional Features					
Updating			x		
Data				x	x
Problem-Solving	x				
Decision-making	x				
Technology					
Development				x	
Software Systems	x				
Updating			x		
Computer				x	
Daily Life					
Applications	x				

According to Table 1, four main categories were created: Similarity to Human Intelligence, Functional Features, Technology, and Daily Life. The codes are marked in Table 1 according to whether they are included in the relevant preservice teacher's response. Codes such as human, machine, intelligence, and imitation reflect the view that AI is similar to human intelligence, while codes such as problem-solving, decision-making, data, and updating emphasize the functional characteristics of AI. While the software systems code under the technology category addresses the technological dimension of AI, the applications code under the daily life category refers to the areas of use of AI in daily life. This analysis shows that preservice teachers' views of AI are multidimensional and that they evaluate AI as a system that both imitates the human mind and is related to technological developments.

The following is the interview recording made with the preservice teacher coded PST3.

> R: How would you define artificial intelligence?
> PST3: In other words, I can define artificial intelligence as machines producing things by imitating human intelligence.
> R: When you think like this, is there anything else you want to add?
> PST3: I mean, I can add that it can update some information or itself, teacher, it constantly repeats and updates itself.

The preservice teacher, coded as PST3, defines AI as "machines producing things by imitating human intelligence" and emphasizes that one of the main functions of AI is to model human intelligence. In addition, by adding that AI "can update information and learn continuously," the PST3 expresses that AI has a dynamic and developing structure. This response shows that preservice teachers see AI as a system that imitates the human mind and as a structure that can learn and improve itself. Moreover, these views reveal that AI is perceived not only as a static source of knowledge but also as a system that changes and renews itself. The preservice teacher's emphasis on "updating" shows that s/he is aware of machine learning and the continuous development process, one of AI's most important features.

Based on the first question, the findings reveal that the definition of AI is shaped at different levels among preservice teachers and that AI is not only an imitation mechanism but also associated with learning and development processes.

3.2. Content Analysis Results for the Second Question

Table 2 presents the content analysis results on the AI applications used by preservice teachers in daily life.

Table 2
Content Analysis Results for the Second Question

Categories and Codes	*PST1*	*PST2*	*PST3*	*PST4*	*PST5*
Area of Use					
Education and Homework Support	x	x	x	x	x
Voice Assistants	x				x
Visual and Presentation Support	x			x	
Health and Technology	x				
Social Media and Current Information Tracking				x	
Artificial Intelligence Applications Used					
ChatGPT	x	x	x	x	x
Siri	x				x
Google Assistant	x				x
Alexa	x				
Math Solver Apps	x	x			
PDF Summarization and Editing Tools	x				
News and Social Media Monitoring Apps				x	
View of Artificial Intelligence					
Trust and Skepticism	x				
Scope and Prevalence		x			
Deficit and the Learning Process				x	

The data shows that preservice teachers use AI primarily for educational and academic support. ChatGPT was the most widely used AI application mentioned by all participants. In addition, voice assistants such as Siri and Google Assistant, PDF summarization, and math solver applications were also frequently mentioned. The usage areas of AI were discussed in various contexts, such as education and homework support, health technologies, social media monitoring, and visual content production.

However, differences were observed in preservice teachers' views of AI. While some participants emphasized that AI has a margin of error and requires verification, others emphasized the potential for future use by considering the scope of AI in a broad framework. These findings reveal that preservice teachers' levels of knowledge about AI vary and that AI is increasingly becoming a part of educational processes.

Below is the answer of the preservice teacher, coded PST1, to the second question.

> R: Well, what is your relationship with artificial intelligence in your daily life? For example, what artificial intelligence applications do you use or know about daily?

PST1: We also learned about natural information processing in the lessons, we said voice assistants such as Siri and Alexa. I use them often, and this Google Assistant is especially available on my phone. I use CHATGPT; it does a lot of recipes and stuff very well. If we give the ingredients, I use them, or if I think about it, there are MRI devices in the health sector, for example, they are video.
R: Are there other areas of use?
PST1: I do not remember the names of the websites, but I use them. It helps me a lot in PDF summarizations and stuff like that. I give articles to artificial intelligence, and it asks me questions about the articles. There are questions that I cannot do in math. They solve them well, step by step. When I ask for different solution methods, it also gives them. I think it is also helpful in stages like this. I use it.

The preservice teacher, coded as PST1, states that s/he actively uses AI in her daily life and that this use has spread to different fields. S/he states that AI-based tools such as voice assistants (Siri, Alexa, Google Assistant) and ChatGPT are important in their daily lives. In particular, s/he emphasizes that s/he uses ChatGPT in various applications, from recipes to academic support. In addition, s/he also mentioned the health sector and evaluated MRI devices as an AI-supported technology, indicating that s/he thinks that AI is not limited to digital tools.

After the researcher's leading question, the PST1 added that s/he also used AI in more academic and functional areas, such as summarizing documents, analyzing articles, and solving mathematical problems. In particular, s/he states that the ability to offer different solutions to mathematics problems makes AI a practical learning tool.

These responses reveal that preservice teachers see AI as a supportive tool in individual daily use and educational and academic processes. In particular, it is seen that functions such as generating alternative solutions, accessing information, and increasing academic productivity are practical in the adoption of AI. However, it was also observed that the preservice teachers had difficulty remembering the exact names of AI applications. This situation reveals that awareness of AI and knowledge of the systematic use of these tools should be developed. In addition, some preservice teachers thought that dynamic mathematics software was also an AI application. Preservice teachers may sometimes overlook the difference between AI applications and other applications.

3.3. Content Analysis Results for the Third Question

Table 3 presents the content analysis results of preservice teachers' use of AI in university courses. Preservice teachers were asked to describe in more detail how they use artificial intelligence in education.

Table 3
Content Analysis Results for the Third Question

Categories and Codes	*PST1*	*PST2*	*PST3*	*PST4*	*PST5*
Artificial Intelligence Applications Used					
ChatGPT	x	x	x	x	x
Canva					x
Gama					x
Strich and Code.org	x				
Instructional Technology Applications (presentation software)				x	
Areas of Use					
Instructional Technologies and Educational Research		x		x	
Research and Information Acquisition	x	x	x	x	
Project and Homework Support				x	
Coding and Programming	x				
Views and Barriers to the Use of Artificial Intelligence					
The Role of Faculty Members		x			
Lack of Information	x	x			
Traditional Education Habits	x				

All participants mentioned ChatGPT as the most widely used AI application. In addition, visual and game-based educational tools such as Canva and Gama, and programming-supported AI applications such as Strich and Code.org were mentioned. In terms of usage areas, students stated that they mostly use AI for research and information gathering, project and homework support, instructional technology courses, and programming and coding. Educational applications are generally referred to by students as Instructional Technology Applications.

When the views of preservice teachers towards AI were examined, some stated that they use AI more frequently with the guidance of their lecturers. However, they rarely use AI since traditional methods are prominent in some courses. Lack of knowledge and awareness are among the main reasons for the limited use of AI. These findings reveal that using AI tools at the university level varies depending on faculty members' guidance and students' knowledge levels.

Below is the preservice teacher's answer to the third question, coded as PST3.

> R: Okay, so do you use artificial intelligence applications in your university courses? If so, which applications are these?
> PST3: We used ChatGPT a few times. We also talked about other applications, but ChatGPT was on our minds more because it was on the agenda, and it was more intense. In terms of doing research, you know, we asked ChatGPT to get more detailed information about it, such as researching some concepts and asking what they are. That's how we got information from him.

The preservice teacher, coded as PST3, states that s/he uses AI applications at a certain level in her university courses. S/he states that ChatGPT is the most frequently used AI application and is more memorable because it is on the agenda. This shows that although preservice teachers actively use AI tools, they may have limited awareness of new and alternative AI applications. The PST3's statement uses AI as a reference source in knowledge acquisition and research processes. The fact that s/he stated that s/he used AI to understand concepts, get explanations, and obtain detailed information reveals that integrating AI tools into educational processes is an important contribution, especially in the context of rapid access to information. However, the response to the question regarding the frequency of use of AI shows that it is used once or twice a week. This suggests that although AI tools are used regularly in lessons, they have not yet become indispensable learning tools. The preservice teachers see AI as a supportive tool, but not yet as an integral part of the teaching process. This finding suggests that the use of AI technologies in university courses varies according to specific courses and needs. Faculty and curricula must take more encouraging steps towards AI integration to increase regular use.

3.4. Content Analysis Results for the Fourth Question

Table 4 presents the opinions of preservice teachers on using AI applications in different courses at the university.

Table 4
Content Analysis Results for the Fourth Question

Categories and Codes	*PST1*	*PST2*	*PST3*	*PST4*	*PST5*
Recommended Artificial Intelligence Use Areas					
Mathematics and Numerical Courses (Probability, Analysis, Linear Algebra)	x	x	x	x	
Computer and Programming Courses					x
Education and Training Courses	x	x	x	x	
Art and Aesthetics Courses		x			
Expected Contributions and Intended Use					
Explaining Difficult Concepts	x	x	x	x	x
Visualization and Simulation	x		x	x	
Sample and Alternative Solution Generation	x	x			
Code Support and Error Detection					x
Views and Barriers to the Use of Artificial Intelligence					
Increasing Motivation to Learn	x	x	x	x	x
Risk of Misinformation					x
Lack of Adequate Knowledge of Use	x				

It was suggested that AI should be used more in mathematics and numeracy courses (probability, analysis, linear algebra), computer and programming courses, and research methods in education. In addition, some preservice students suggested that AI should be integrated into music and visual production processes in courses such as art and aesthetics.

Preservice teachers stated that AI would contribute to explaining complex concepts in these courses, visualizing abstract subjects, and presenting alternative solutions. A better understanding of mathematical concepts, facilitating error detection in code writing processes, and increasing learning motivation are among the most important expectations for using AI. However, some preservice teachers stated that AI risks generating false information and needs more guidance to use these tools effectively. These findings reveal that technological infrastructure and preservice teachers' usage skills must be improved to use AI tools more effectively in university courses.

The answer given by the preservice teacher, coded as PST2, to the fourth question is below.

> R: In which other courses would you like to use artificial intelligence applications at the university? When you think about the process so far, in which courses and why would you like to use artificial intelligence?
>
> PST2: As far as we have seen, I have noticed that we use it mostly in the verbal parts of education and training courses. However, for example, as the mathematics teaching department, I do not think we use it enough in the mathematics part, or that we, as students, can use it. Of course, the program may have deficiencies in this regard. I think this would be more in pure mathematics courses, such as probability, abstract mathematics, or algebra. I would like to use it more widely in solving examples and explaining the course a little more. To understand the questions or to see more examples.

While evaluating the use of AI applications in university courses, the preservice teacher, coded as PST2, states that s/he is used more widely in education and training courses but is not included enough in mathematics courses. As a student of the mathematics teaching department, s/he expresses that s/he wishes that AI tools were used more, especially in pure mathematics courses (probability, abstract mathematics, algebra).

The preservice teacher, coded as PST2, emphasizes that AI can be an important tool for solving examples and explaining the subjects better in mathematics lessons. S/he states that the opportunities provided by AI, especially in terms of understanding the questions better and reinforcing the subjects with different examples, can support the students' learning process. This view reveals that the preservice teachers see AI in terms of accessing information as a tool for better understanding and diversifying the course content.

However, PST2 associates the limited use of AI in mathematics courses with curriculum or program deficiencies. This situation shows that integrating AI technologies into courses at the university level is limited in certain areas and should be made more effective, especially in numerical courses. Preservice teachers' expectations that AI can be used to support learning in educational science courses and mathematics courses that include abstract and complex concepts are noteworthy.

4. Discussion

This study examined preservice secondary school mathematics teachers' views on AI, their levels of daily and academic use, and their experiences regarding the use of this technology in university courses. The findings are largely consistent with the existing literature, although some differences were observed.

The systematic review conducted by Mohamed et al. (2022) suggests that AI tools—such as adaptive learning systems, intelligent tutoring systems, and chatbots—have the potential to enhance engagement, personalization, and effectiveness in mathematics education. However, this study found that preservice mathematics teachers mainly used AI through general-purpose text-based applications such as ChatGPT and did not report using AI specifically in numerically intensive mathematics contexts. This discrepancy may stem from the limited exposure of teacher

candidates to pedagogical uses of AI in their training programs, as well as a lack of structured opportunities to explore AI-integrated instructional strategies in mathematics education.

The findings also revealed that integrating AI into university courses depends on the guidance of faculty members and the familiarity of preservice teachers with this technology. In contrast, the literature highlights the potential of AI to make learning environments more flexible, inclusive, and collaborative (Luckin et al., 2016). Nevertheless, this study identified several barriers to AI use, including lack of technical support (Nascimento & Meirelles, 2021), ethical concerns (Maiti et al., 2025), technical complexity and insufficient professional development opportunities regarding AI tools (Al-Mughairi & Bhaskar, 2024).

Preservice teachers indicated that the use of AI should be increased, particularly in mathematics and numeracy courses. They expressed that AI-supported tools could enrich problem-solving processes in probability, abstract mathematics, and linear algebra courses. However, the current use of AI in these courses is limited. Luckin et al. (2016) emphasize that teachers must understand AI-based learning environments and develop their research and data analysis skills. These findings indicate the need to enhance preservice teachers' competencies in AI. While this study highlights the potential of AI in mathematics education, it also reveals the low levels of preparedness among preservice teachers. The challenges reported by the preservice teachers such as lack of technical knowledge, ethical concerns about misinformation, limited faculty guidance, and inconsistent use of AI in university courses underscore the importance of enhancing AI literacy and providing pedagogical training to support their effective integration of AI tools in future classrooms, as emphasized by Sanusi et al. (2022). These concerns also highlight the need to address ethical issues such as potential bias in AI-generated content and data privacy, aligning with the ethical considerations discussed by Holmes et al. (2021). Moreover, the observed gaps in consistent AI integration suggest a lack of competencies in areas such as data analytics and collaborative problem-solving, supporting the call by Luckin et al. (2016) to embed these skills into teacher education programs.

In conclusion, the positive views of preservice teachers toward AI form a significant foundation for its broader adoption in education. However, lack of knowledge, the risk of misinformation, and technical challenges continue to hinder the integration of AI into teacher education programs. Therefore, efforts to improve AI literacy among preservice teachers should be expanded.

5. Suggestions

To enable more effective use of AI in teacher education, several key recommendations can be implemented. First, AI-supported course curricula should be developed by integrating AI into mathematics and numeracy courses. As highlighted by preservice teachers, AI can also be effectively used in elective courses such as probability, linear algebra, analysis, and art and aesthetics. Additionally, providing professional development opportunities for educators is essential; training programs should be organized to enhance the effective use of AI by both faculty members and preservice teachers. Strengthening technical support and infrastructure in universities is another vital step to ensure efficient utilization of AI tools in education. Furthermore, in light of the potential risks of misinformation generated by AI tools, it is important to establish clear guidelines that encourage ethical and reliable use. Supporting educators and preservice teachers in these areas will greatly facilitate the successful integration of AI into educational processes.

Author contributions: All authors have sufficiently contributed to the study, and agreed with the conclusions.

Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declaration of interest: The authors declare no potential competing interests.

Ethics statement: Ethical approval was granted by 29 Mayıs University Scientific Research and Publication Ethics Committee on 3 June 2024 with the approval code 2024/06. Participants were informed about the study's objectives, procedures, and their rights before taking part. Written informed consent was obtained, ensuring voluntary participation and the right to withdraw at any time.

Funding: No funding was obtained for this study.

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