

ORIGINAL ARTICLE

Pre-Service Teachers' Process of Developing and Using Content With AI

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ABSTRACT

Artificial intelligence (AI) is a technology that has been used quite effectively in the 21st century and has the potential to directly affect education as well as many other fields. AI is supported in many areas such as developing skills in education, increasing the effectiveness of education and student motivation, contributing to the professional development of teachers, and reducing institutional workload. This study aims to examine the perceptions and usage habits of pre-service teachers (PT) towards chatbots, especially ChatGPT. A case study was conducted for the research, and data were obtained from the individual interviews, Bot Usability Scale and the Individual Innovativeness Scale. The participants of the study were PT studying at a state university. The findings of the study show that the PT mostly used chatbots for educational, informational and unethical purposes. In addition, it was found that the PT individual innovativeness levels and their attitudes towards AI were related.

1 | Introduction

Artificial intelligence (AI) has emerged as one of the most transformative technologies of the 21st century, influencing a wide range of fields, including education. AI refers to a broad array of technologies and methods, such as machine learning, natural language processing (NLP) and neural networks, that enable machines to perform tasks traditionally requiring human intelligence (Goksel and Bozkurt 2019; Zawacki-Richter et al. 2019). Among these technologies, Large Language Models (LLMs) are particularly noteworthy due to their extraordinary capabilities in NLP, which enable a variety of applications ranging from business solutions to education (Brown et al. 2020; OpenAI 2024).

LLMs are equipped with extensive datasets and large-scale neural networks. They are used for diverse purposes, including content creation, chatbot development and machine translation (Chen et al. 2024). Their ability to mimic human language comprehension has led to significant advancements in communication technologies. Tools like ChatGPT demonstrate how AI can generate coherent responses, code and other data strings based

on user inputs, known as prompts (Floridi and Chiriatti 2020). Prompt engineering, the process of formulating precise inputs to guide AI systems, has become an essential skill for maximising the effectiveness of such tools (Lee et al. 2023).

Chatbots, a practical application of NLP-based AI, are digital systems designed to interact with users and process their queries in natural language (Huang et al. 2022; Wollny et al. 2021). These tools integrate AI with NLP to simulate human-like interactions through text or voice, providing a bridge between technology and user engagement (Cain 2023b; Pérez et al. 2020).

In the educational context, AI offers significant potential to revolutionise traditional teaching and learning methods. By personalising learning experiences, providing instant feedback and tailoring content to individual needs, AI has the capacity to make education more effective and engaging (Cain 2023a; Harry and Sayudin 2023; Wu and Yu 2024). Personalised learning experiences, powered by AI, adapt materials and activities to suit individual learning speeds and styles (Kuhail et al. 2023), empowering students to take a more active role in their

education (Holmes et al. 2022; Rajendran 2023; Zhai et al. 2021). This shift from passive reception to active participation fosters critical thinking, creativity and deeper engagement with learning materials (Korzynski et al. 2023).

AI's role extends beyond personalisation; it enhances the learning process through tools like chatbots that offer round-the-clock feedback and support (Holmes and Tuomi 2022). Additionally, AI-based simulations and game-based environments make abstract concepts more tangible by providing interactive and engaging experiences, especially in complex or technical subjects (Holmes and Tuomi 2022). For educators, AI alleviates workload pressures by assisting with lesson planning, grading and tracking student performance, allowing more time to focus on individual student needs (Liu et al. 2023; Rajendran 2023).

AI also plays a critical role in educational analytics. By analysing student behaviour and interactions, AI-powered tools can predict performance, identify trends and reveal patterns, contributing to data-driven decision-making in educational settings (Antonenko and Abramowitz 2023). These tools help reduce human bias in evaluations and support resource allocation, ensuring better outcomes for students (Chiu et al. 2023; Holmes and Tuomi 2022).

Moreover, AI has shown promise in language learning by providing personalised feedback and practice opportunities, making the process more effective and engaging (Alshumaimeri and Alshememry 2023). This highlights the broad scope of AI applications in education, from supporting teachers to enhancing student experiences.

Chatbots are tools that utilise natural language processing and related technologies to engage in text- or voice-based interactions with humans to a certain extent (Pérez et al. 2020). ChatGPT, one of the most well-known examples of AI-based chatbots, reached many users after its launch in November 2022. The AI-based chatbot ChatGPT communicates with users by responding to queries and acknowledging errors (OpenAI 2024). The growing interest in the educational applications of chatbots has led to a rapid increase in the number of studies conducted in this field. For a better understanding of the effects of ChatGPT in education, more research focusing on the use of ChatGPT in education is needed (Wu and Yu 2024).

1.1 | Theoretical Framework

The usability of AI-based chatbots is a key consideration in understanding their effectiveness. Borsci et al. (2022) propose five dimensions of chatbot usability: accessibility, functionality, conversational quality, privacy and security and response time. These dimensions evaluate whether chatbots meet user expectations and facilitate meaningful interactions. Accessibility ensures that users can easily find and use the chatbot, while functionality assesses the clarity and relevance of the chatbot's features (Baz Aktas et al. 2023). Conversational quality pertains to the chatbot's ability to provide accurate and concise information, whereas privacy and security involve the system's

capability to safeguard user data and alert users to potential breaches (Borsci et al. 2022). Response time is also crucial, as delays can diminish user satisfaction.

Individual innovativeness, a well-established concept in technology adoption studies, is critical for understanding AI integration in education. Kilicer and Odabaşı (2010) define individual innovativeness through dimensions such as resistance to change, openness to experience, risk-taking and opinion leadership. These dimensions influence educators' willingness to adopt new technologies, including AI-supported tools, in their teaching practices (Wu et al. 2015). Individuals with high levels of innovativeness are more likely to embrace and effectively use AI tools, facilitating the integration of innovative practices in education (Uzumcu and Acilmis 2024).

Research has shown that individual innovativeness positively affects attitudes towards AI. For example, PTs with higher innovativeness levels are more likely to use AI interactively in their lessons (Kilci Erciyas et al. 2023; Uzumcu and Acilmis 2024). Understanding the interplay between innovativeness and AI adoption is crucial for developing strategies to enhance the acceptance and effective use of AI technologies in education (Jensen et al. 2025; Kim et al. 2024; Rapp et al. 2021). Moreover, studies emphasise that educators' innovativeness contributes to the effective application of technologies like AI in classroom settings (Akgün 2017; Mazman Akar 2019; Yilmaz and Bayraktar 2014).

Metaphors provide valuable insights into perceptions of abstract concepts like AI. They simplify complex ideas and help researchers understand how individuals conceptualise AI (Erdoğan and Bozkurt 2023). Research on metaphorical perceptions of AI reveals that common metaphors include 'human', 'robot' and 'brain', reflecting its human-like capabilities (Tartuk 2023; Balıkcı et al. 2024). Negative metaphors, such as 'threat' or 'monster', also appear, highlighting concerns about AI's potential risks (Savaşkan and Özer 2024).

Studies focusing on students' and teachers' perceptions show that metaphors vary across groups. For instance, students often associate AI with terms like 'chameleon' or 'universe', while educators commonly use metaphors such as 'assistant' or 'machine' (Erdoğan and Bozkurt 2023; Lim 2024). These findings underscore the diverse ways AI is understood and experienced in educational contexts.

AI technologies offer immense potential to transform education by personalising learning experiences, enhancing engagement and reducing teacher workload. However, realising this potential requires addressing ethical, social and pedagogical challenges to ensure responsible and effective implementation (Chiu et al. 2023).

This research investigates the transformative role of AI in education, focusing on PTs' use of AI-based tools, particularly chatbots, in developing and delivering course content. By examining practices like prompt engineering, the study aims to provide insights into how innovative approaches can reshape educational processes and perceptions. Key research questions explore the impact of AI on teaching practices, its

role in fostering individual innovativeness, and the perceptions of PTs regarding AI integration in their professional development.

- **RQ 1.** What is the status of the PTs' use of AI-based chatbots before the instructional technologies course?
- **RQ 2.** Does PTs' prompt engineering in AI-based chatbots change after taking the instructional technologies course?
- **RQ 3.** What are the opinions of the PTs regarding AI-based chatbots?
- **RQ 4.** What are the PTs' metaphorical perceptions of AI?
- **RQ 5.** How is the innovativeness level of the PTs after the instructional technology course?
- **RQ 6.** What are the opinions of the PTs in regard to their use of AI-based chatbots in their future lives?

2 | Method

2.1 | Research Model

In this research, a case study was used to get an idea regarding PT's use of chatbots in their courses. The use of chatbots in education is seen as a case that needs to be investigated and understood. Although this study adopted a predominantly qualitative research method in order to gain an in-depth understanding of a current issue (chatbots), in the methodology of this study, quantitative data collection was used to support and extend the qualitative approach. Case studies mainly rely on qualitative data collection and analysis, but they can also include surveys or other quantitative methods (Mardis et al. 2014). The focus of a qualitative study can be on a specific topic, and a situation (or situations) can be used to explain this topic. Some researchers define the 'case' as the purpose of the research (Stake 1995). Others see the 'case' as a research method (Merriam 2009). A case study is an in-depth investigation of a limited system based on extensive data collection (Chmiliar 2010; Creswell 2007). In this context, the method used in this study is the instrumental case study defined by Stake (2005), one of the case study types (Figure 1).

Instrumental case studies serve the purpose of illuminating a specific topic. Instrumental case studies also overlap with the exploratory and explanatory case study types mentioned by Yin (1984).

2.2 | Participants

In this case study research, the participants were selected using a non-probability purposive sampling method. Data were collected from PTs taking the Instructional Technologies course. The participants of the study consisted of 89 PTs studying in the Departments of English Language Teaching (ELT) and Mathematics Education who took the instructional technology course in the 2023–2024 academic year. While 70.8% (63) of the participants were female, 29.2% (26) were male. In terms of department-based distribution, 57.3% (51) of the participants

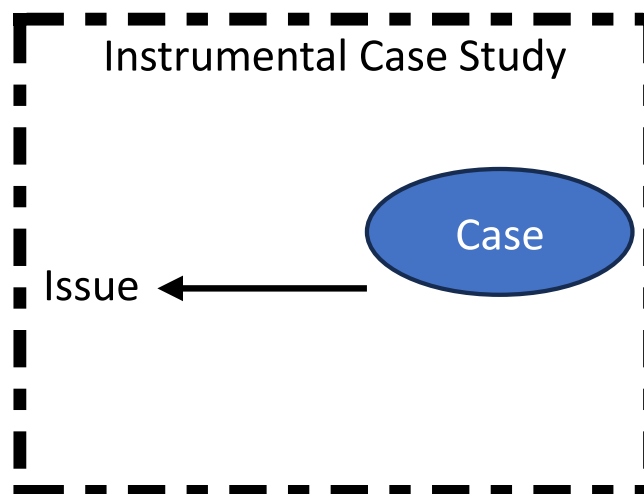


FIGURE 1 | Instrumental case study (Stake 2005).

were in the Department of ELT, while 42.7% (38) were in the Department of Mathematics Education.

2.3 | Research Process

This study was conducted within the scope of the Instructional Technologies course conducted at the Faculty of Education, and the process is as shown in Table 1.

The PTs of the Departments of ELT and Mathematics Education who took the Instructional Technologies course prepared five assignments as shown in Table 1. The selection of the homework topics was based on the curricula published by the Ministry of National Education. The PTs determined the topics of their assignments by selecting the learning outcomes from these curricula on the basis of the department they were studying in. In the remaining time of the course, the theoretical parts of the course were continued.

Before starting the homework process, the PTs' opinions regarding AI and Chatbots were taken. In line with the opinions received, it was determined that the PTs did not know or use AI-based content development environments. Therefore, the assignments given in Table 1 were not started. In the process, the path in Figure 2 was followed for the use of AI environments.

As can be seen in Figure 2, Chat GPT 3.5 and Google Bard environments were introduced to the PTs before the assignment process. PTs were informed regarding how to log in to these environments and the interfaces of these environments. After this, information on how to make a prompt was given and questions were asked to the AI interactively with the PTs and answers were received. The AI environments developed for different purposes were preferred according to the structure of the assignments. Bing Chat environment was preferred for Text2ImageModels. The reason for choosing Bing Chat instead of Midjourney or Stable Diffusion is that Bing Chat integrates with Dall-E and is free of charge. Gamma environment for Text2Presentation and elevenlabs.io environment for Text2Audio were introduced to the PTs during the assignments.

TABLE 1 | The course activities process.

Assignments	Outcome selection	Content development environments	Assignment preparation environment
1. Creating an Interactive Document	Ministry of National Education Curriculum (English and Mathematics Teaching)	Chat GPT	Canva
2. Creating an Infographic		Google Bard	
3. Create a Presentation		Chat GPT Google Bard Bing Chat	
4. Creating a Concept Map		Chat GPT Google Bard Bing Chat	coggle.it
5. Creating a Video		Chat GPT Google Bard Bing Chat Elevenlabs.io	Powtoon



FIGURE 2 | The content development process.

After the development of the contents, a product was developed from the data obtained. AI environments were used to generate content for the assignments to be prepared. Different environments such as Canva, coggle.it and Powtoon were used to prepare the obtained content as homework.

2.4 | Data Collection and Analysis

Creswell (2007) states that in a case study, the situation should be examined in depth with data collection tools that include multiple sources (observations, interviews, audiovisuals, documents and reports). Merriam (1998) suggests six strategies to ensure internal validity in case studies: triangulation; long-term observation; peer examination; having the data checked by the data source (member checks); having the researcher state his/her own views and opinions at the beginning of the study (researcher's biases); and involving the participants in the whole process (participatory or collaborative modes of research). Yin (1984) also mentions six sources of data collection. These are as follows: documents; archival records; interviews; direct observations; participant observation; and physical structures. Qualitative data were collected in multiple forms—information form, documents (assignments), interviews, metaphors—to

achieve triangulation of data. Quantitative data were collected through scales and %, f , \bar{x} were used to analyse the data. In this context, different data collection sources were employed in this study (Figure 3).

Within the scope of the study, the data collection process commenced with the ethical approval obtained from a state university on 6 February 2024, under the approval number 129925. Data were collected with different data collection tools at the beginning, during and at the end of the instructional technology course. In order to determine PTs' AI usage and prior knowledge, a three-question questionnaire was applied at the beginning of the course in addition to gender and department. In this questionnaire, there were three questions regarding whether the PTs had used AI environments before and, if so, for what purpose. In the course process, the PTs produced the content from the AI environments in line with the outcomes they had determined while preparing homework. At this stage, a Google Form was used where the PTs could submit the questions they asked and the answers they received. The PTs added the questions they asked to the chatbots and the answers they received to this form. In addition, they also submitted the visuals and presentations produced through this form. In addition to this data, they also submitted the assignments they prepared in different ways, such as adding links or files. This content

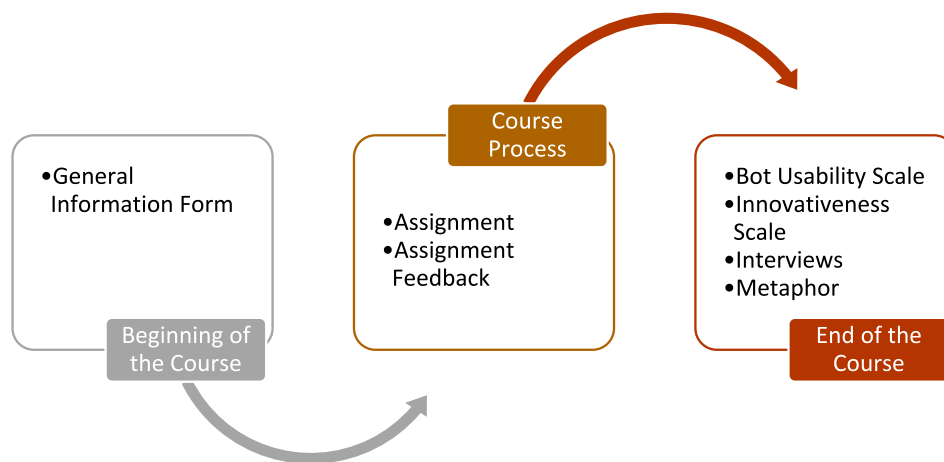


FIGURE 3 | Data collection process.

and the assignments submitted by the PTs were evaluated by the researcher, and feedback was given to the PTs. Google Sheets were used while giving feedback. The feedback on each PT's assignments was written on Google Sheets, and this document was made available for each PT to see. This data collected during the course was handled as documents. At the end of the course, the Bot Usability Scale (BUS), adapted into Turkish by Baz Aktas et al. (2023), and the Individual Innovativeness Scale, adapted into Turkish by Kilicer and Odabaşı (2010), were administered to the PTs. The 11-item Bot Usability Scale is a 5-point Likert scale (5: Strongly Disagree, 1: Strongly Agree). The scale has five factors. These are as follows: perceived accessibility to chatbot functions; perceived quality of chatbot functions; perceived quality of conversation and information providing; perceived privacy and security; and Time Response. It is stated that the items in the scale explain 47.953% of the total variance. The RMSEA value is less than 0.07, and the SRMR value is below 0.08. The Cronbach Alpha internal consistency coefficient for the whole scale is greater than 0.70 and is at an acceptable level.

The 20-item Innovativeness Scale is a 5-point Likert scale (1: Strongly Disagree; 4: Disagree; 3: Moderate; 2: Disagree; 1: Strongly Agree). The scale has four factors: resistance to change, thought leadership, openness to experience and risk-taking. It is stated that the items in the scale explain 52.521% of the total variance. While the Cronbach Alpha internal consistency coefficient for the whole scale is 0.90, the first sub-factor value is 0.808, the second factor is 0.734, the third factor is 0.767 and the fourth factor is 0.615. The innovativeness score is obtained from the scale. In regard to the innovativeness score, those above two standard deviations above the mean were categorised as 'Innovator'; those between two standard deviations and one standard deviation above the mean were categorised as 'Pioneer'; those between one standard deviation and the mean were categorised as 'Questioner'; those between the mean and one standard deviation below the mean were categorised as 'Sceptic'; and finally, those below one standard deviation below the mean were categorised as 'Traditionalist'.

At the end of the course, semi-structured interviews were conducted with four PTs from the Departments of ELT and Mathematics Education. The semi-structured interview form was developed by the researcher and subjected to expert opinion. The form structure consisting of five questions before the expert

opinion input was transformed into a structure consisting of six questions. Written and verbal permission was obtained from the participants before the interview through the consent form.

Finally, in order to determine the metaphorical perceptions of the PTs taking the course regarding AI-based content development environments, data were collected with a Google Form consisting of two questions: 'AI is' and 'because' in addition to the gender and major question.

While content analysis was used to analyse the qualitative data collected in this study in which various data collection tools were used, %, *f*, \bar{x} were used to analyse the quantitative data.

3 | Findings

The findings of this study, aligned with the research questions, explore the experiences of PT with AI-based chatbots and the changes observed in their skills and perceptions throughout the instructional process. The findings are presented sequentially to answer the six research questions.

3.1 | The PT's Use of AI-Based Chatbots Before the Instructional Technologies Course

A pre-course questionnaire revealed varying levels of chatbot familiarity among the 84 PTs. Of the respondents, 68% were female and 32% male, with 60% from the English Language Teaching (ELT) department and 40% from Mathematics Education. A significant contrast in prior chatbot use was noted: while 52% of ELT students had used chatbots, only 18% of Mathematics Education students had.

Chatbot usage among PTs was categorised as follows:

- Educational purposes: Chatbots were used for completing homework, correcting assignments and solving problems. However, unethical use, such as cheating, was also reported:
 - 'We used ChatGPT to share exam questions there sometimes' (P2).

- Information retrieval: PTs searched for curious or daily questions when traditional search engines were insufficient:
 - ‘Sometimes I couldn’t reach the information I didn’t know on Google. I was trying to reach it directly from there’ (P2).
- Commercial purposes: Chatbots facilitated tasks like contacting customer service and managing product returns.

Interviews revealed that some PTs were familiar only with ChatGPT before the course, learning about Bard and Bing during instruction:

- ‘I already knew ChatGPT. I learned Bard this year thanks to you’ (P7).

3.2 | The PT’s Prompt Engineering in AI-Based Chatbots After the Instructional Technologies Course

Practices were carried out before the course in order to improve the PT’s ability to ask questions in chatbot environments. After these practices, when new environments were introduced during the course, examples were given on how to ask questions in these environments. While giving feedback on the assignments during the course process, sample questions and answers/images were shared on the Google Classroom in the area where the lesson was located in order to guide the PTs and to emphasise how to ask questions.

When the feedback given to the assignments was analysed, feedback was given regarding the order of asking the questions, creativity, not asking clear questions and asking the questions of the search engine to the AI. In addition, as in the examples given in the Google Classroom, constructive feedback was given to guide the PTs. This feedback is explained under the headings of order of asking questions, creativity, not being able to ask clear questions, asking the AI the questions to be asked of the search engine, and constructive feedback.

3.2.1 | The Order in Which Questions Are Asked

‘Your questions to AI are good. They have a certain hierarchy. The next question is thought to be related to this question and you continue with how to do it now. Continuing the questions in this way makes it easier to reach the desired goal’.

‘Your achievement is good, but there seems to be a problem in organising your questions. Questions such as what orientation is, how to give directions, what are the basic words for directions to be asked. You have similar questions, but you can think about the order accordingly’.

‘The way you ask the questions gives the feeling that you are getting rid of the search engine, and that’s pleasing. I can see it in your second question, you want an addendum’.

‘Your questions about pi are good. You got detailed information about pi’.

‘It’s good that you ask questions in a flowing way’.

‘The order of the questions is important. You directly asked how to calculate the diameter with the help of a rope. Then you moved on to the compass question. It is unclear whether you are asking how to use a compass to draw a circle’.

‘You reached the content related to your learning outcome with three questions. The questions served the purpose in an orderly manner’.

‘You asked the first question about the volume of the cylinder in the third question’.

‘The questions you ask to get to the content are good and the right structure to get detailed information. However, two questions could be moved. First, you could ask about length in maths and then how to calculate the perimeter’.

‘When I look at the questions about the circle, the order can be organised in some places. For example, what is the radius of a circle can be replaced with the previous question. After the question of what is a circle, questions such as how to determine the center of the circle, how to determine the radius and diameter, and how to calculate them can be asked’.

3.2.2 | Creativity

‘You asked good questions while creating images. You pushed your imagination and created beautiful images’.

‘It’s good that you thought of anime style for your visuals. I wanted you to think differently by sharing Cartoon in Classroom’.

‘The image of 1980s people dancing at a music festival, this problem is different, because you added a difference by saying 1980s people’.

‘You pushed your imagination in the questions you asked to create a visual’.

‘You could have pushed your imagination a little more to create images’.

‘You asked the image creation questions in a good way to create images where prisms are in our world, and the resulting images have a different structure’.

‘You also used your imagination to create the visuals, but at some points the AI couldn’t do it. The important thing is to ask good questions’.

3.2.3 | Inability to Ask Clear Questions

‘There is ambiguity in your questions. For example, what would happen if there was no moon?’

‘What are the activities we do daily? Is this question appropriate for creating a visual? Is it enough? You can ask it in finding content’.

‘You used the word “mysterious” in your visualisation. Mysterious according to whom, according to what. You can describe what mysterious means with your imagination’.

3.2.4 | Asking AI the Questions to Be Asked of the Search Engine

‘You can ask any search engine the questions you ask to create an image’.

‘Research was conducted with phrases that would be used for the kind of searches that would be asked of search engines or the kind of searches that would be made in search engines’.

‘You asked for the words “doctor,” “medicine,” “hospital,” “syringe,” and “patient” that we can find when we type them into a search engine’.

3.2.5 | Constructive Feedback

‘I asked him if he would design an anime of a lion asking for directions and a rabbit giving him directions and I got a nice visual’.

‘Could you design a story about how your emotions change according to the weather? This would be a good question’.

‘There are four different types of quadrilaterals. Instead of asking them one by one, what are the types of quadrilaterals? Can you elaborate on the properties of a rectangle, parallelogram, rhombus and trapezoid? You can reach the content with two questions such as’.

They could have asked questions such as, ‘What are the types of triangles, how can I name triangles according to their properties, or how can I define triangles more easily according to their properties?’

While giving feedback, an attempt was made to give feedback for right and wrong. This was because the individual should know that he/she is doing the right thing and this situation should be reinforced. On the other hand, if there was a mistake, it should be corrected. The feedback given was shared in such a way that all the PTs could see each item of feedback, and the PTs could see both their own feedback and the feedback given to others. In this way, the aim was to show how to do it right or how to correct the mistake. The feedback provided positive development in the PT. This situation was also revealed in the interviews with the PT; P5: ‘For example, did you criticise in that way? I tried to ask directly in a way to include the outcome, why ask with keywords?’ P6: ‘Homework feedback improved our ability to ask a question in different ways’.

In addition to the feedback, after the semi-structured interview conducted with the PTs at the end of the lesson process, it was determined that there was a change in the PTs’ question-asking skills; P8: ‘I definitely felt that my question asking quality has really improved, you know? Maybe this will

sound very simple to you, but really’. PTs followed a different path from the searches they had made on search engines; P6: ‘When we type a question or something on a search engine, we usually ask a straight question, short or more, we can’t elaborate much anyway’. P8: ‘It was usually keywords. Now I realise that I can ask better comprehensive questions, I feel good’. They continued the search by continuing the conversation as if there was a person in front of them; P1: ‘For example, as if they are talking’; P2: ‘We direct questions to them as if there is a person in front of them’; P3: ‘For me, I talk like a friend. Can you design this for me? Can you summarise it for me?’; P4: ‘You know, now I’m tiring you a little bit with the chat, but I’m tiring you a little bit. An emotional thing inevitably comes, just like that’; P5: ‘I talk as if there is someone in front of me. Can you add this or take out that or, for example, in the story, I said that, can you take out these parts that I don’t like?’; and asking questions in detail, P7: ‘I try to make my questions more descriptive because I realise that he doesn’t understand or he gives me different examples’.

3.3 | The PT’s Views on AI-Based Chatbots

In order to determine the PT’s views on AI-based chatbots, a BUS was applied and semi-structured interviews were conducted. The BUS included perceived accessibility to chatbot functions (PACF), perceived quality of chatbot functions (PQCF), perceived quality of conversation and information providing (PQCIP), perceived privacy and security (PPS) and time response factors. Eighty-nine participants responded to the BUS, and it was determined that the PT did not differ in terms of gender or department regarding the usability of the AI-based chatbots. Differentiation emerges when the departments are considered separately in the context of gender (Table 2).

It can be determined that the genders have different interpretations regarding the usability of chatbots according to the department. In other words, while the averages of females in English language education are higher than those in mathematics education, the situation is the opposite for men. The averages of males studying in mathematics education are higher than those in English language education.

The PT’s views on chatbots were also discussed in the interviews conducted at the end of the course when the PT evaluated chatbots positively and negatively.

Positive features:

- Accessed Content
 - P4: ‘You know, when we search on Google, it can give us more than that’.
- Pathfinder
 - P5: ‘It gives us an idea or creates a basic outline in our minds when we are doing research’.
- Saving time
 - P1: ‘In the past, for example, to find the answer to a question, I used to scan ten or fifteen websites, I used to look at

TABLE 2 | PT's views on the usefulness of the AI-based chatbots.

Gender	Department	Factors	N	\bar{x}	SD	
Female	Mathematics Education	PACF	89	2.96	0.776	
		PQCF		2.92	0.812	
		PQCIP		3.13	0.722	
	ELT	PPS		3.00	1.080	
		TR		2.96	0.978	
		PACF		89	3.63	1.004
		PQCF		3.64	1.147	
		PQCIP		3.30	0.992	
		PPS		3.18	1.270	
Male	Mathematics Education	PACF	89	3.38	0.916	
		PQCF		3.20	1.004	
		PQCIP		3.13	0.573	
	English Language Education	PPS		2.84	1.143	
		TR		3.15	1.068	
		PACF		89	2.96	1.030
		PQCF		3.02	1.040	
		PQCIP		3.30	0.842	
		PPS		2.84	1.405	
	TR	3.15	1.143			

all of them, I used to examine them, but now when I write to Bard, it brings up four or five drafts; I just look at the four or five drafts and move on'.

P5: 'So at least it speeds up the process'.

Negative features:

- Laziness

P1: 'In a way, I can say that it makes us a bit lazy because now everything is at our fingertips'.

- Incomplete search

P2: 'Sometimes I didn't get exactly what we wanted. As I said before, it doesn't give the exact equivalent. Maybe it has something to do with the language. You know, because we write in Turkish, so it doesn't fully meet. Sometimes the answers can be too long. I mean, sometimes I say, not as much as I want, but more than I want. That part can also be fixed'.

- Ethical issues

P3: 'There are also applications with the copy and paste method in online exams and online assessments'.

P4: 'When one of the children asks for homework, it would be a problem for them to produce a product without any effort, in the sense that they can do it directly from media and cut and paste it'.

P6: 'You give homework. No due diligence, I'll just ask in Chat and be done with it'.

P8: 'I mean Gamma, for example, you asked a question and they immediately created a presentation for you'.

- Updating content

P7: 'For example, I wonder if your Bard is being updated. Or... I don't know exactly how those things work. I mean, if it stays the same, it's a problem, but if it's constantly updated, it makes it easier for everyone'.

- Creativity will decline

P7: 'I think that in the future, ideas may become fixed and creativity may decrease'.

- Adherence to AI

P3: 'We can find our educational life dependent on this, because you have a question, we have a topic. We only depend on AI. We act as if whatever he says is what he says'.

as the most important factor in the development of the country's economy.

3.4 | The PT's Metaphorical Perceptions of AI

In order to determine the metaphorical perceptions of PT about AI, forty-one PTs responded to the statement, 'AI is' and 'Because'. Of the responding PTs, 17 (41%) were male and 24 (59%) were female. While 25 (61%) of the responding PTs were students in the Department of ELT, 16 (39%) were students in the Department of Mathematics Education. When the metaphorical perceptions of the PT regarding AI were examined, it was determined that they likened AI to living or non-living beings. The metaphors are as follows: 'Thinking human, revolution, life savior, robot, magical intelligence, man-made brain, woman's bag, auxiliary brain, sea, ship, friend, black hole, double-edged sword, mirror, living knowledge, our right arm, earth and Thanos'. When the prominent and different metaphors are analysed, their explanations are as follows:

- It is magical intelligence, because AI is like a digital wizard, capable of learning by magically understanding data.
- It's a woman's bag, because everything can be found.
- It is the sea, because AI is a kind of wave-owning tool that can respond back the requested information according to the transmission strength of the question. It is also the thing that holds this information and has a certain flow of information.
- It is a ship, because it sails in the ocean of information and reaches knowledge by using data like the wind.
- It's a black hole, because it attracts everything.
- It is the soil, because in order for it to give something, you have to make an effort, you have to work well, you have to ask the right questions, you have to give the necessary explanations so that what you are talking about is well understood.
- It's Thanos, because he brings the end, just like in Marvel.

3.5 | The PTs' Innovativeness Levels After the Instructional Technology Course

After the instructional technology course, the Individual Innovativeness Scale was applied to the PTs. When the individual innovativeness of the PT was analysed, it was determined that almost half of the PT (41.6%) were questioners. The questioners were followed by pioneers (31.5%) and the pioneers were followed by sceptics (18%). While the rate of innovators was determined as 6.7%, the rate of traditionalists was 2.2%. At the beginning of the process, the PTs were asked about their use of AI-based Chatbots, and it was determined that the rate of use by pre-service mathematics education teachers was low. A similar situation was reflected in their individual innovativeness at the end of the process. Only almost a quarter of the pre-service mathematics education teachers (26.3%) were at the pioneering and innovative level, while almost half of the pre-service English language teachers (47.1%) were at the pioneering and innovative level. While 31.6% of the pre-service mathematics education teachers were sceptical, 7.8% of the pre-service English language teachers were sceptical.

It was further examined as to whether the individual innovativeness of the PT varied according to gender or department and, as a result of the analysis of variance, it was determined that gender and department did not show a significant difference.

3.6 | The PT's Use of AI-Based Chatbots in Their Future Lives

The PT wanted to use chatbots during their student teaching and later when they became teachers. However, they also stated that they should not be completely dependent; P3: 'They really help us, our lives. I don't want to be completely dependent on them, but I will definitely get help from them when the issue I am stuck on is more of a creativity issue or when I am really indecisive'. While using these environments, they also saw them as a place where they could ask questions regarding activities to access content and gain teaching experience in the first years of their teaching. While all the PTs wanted to use these environments when they became teachers, they stated that they should be cautious in regard to their students' use of these environments. It is stated that the point to be considered here is the age of the students or the level of education; P4: 'Well, of course, it depends on the age and level of the students'; P7: 'Depending on the level of the student, you know, now that I am an elementary and middle school English teacher, we enter every level, but if I am in elementary and middle schools, I don't think I would want it too much'.

4 | Discussion

This study explores PTs' perceptions of chatbots, particularly ChatGPT and their usage habits. The findings align with existing literature, highlighting both the potential benefits and challenges of using AI tools in education.

With the first research question, the use of AI-based chatbots by prospective teachers before the instructional technology course was investigated. PTs primarily used chatbots for educational, informational, and, in some cases, unethical purposes. These findings are consistent with (Chauncey and McKenna 2023), who emphasise the importance of ethical and responsible AI use. AI-supported learning can enhance student engagement, critical thinking and creativity but raises concerns about information reliability and bias (Wu and Yu 2024). Researchers (Aguilera-Hermida 2024; Williams 2024) underscore the need for awareness regarding ethical issues like plagiarism and the accuracy of chatbot outputs. While PTs displayed enthusiasm for adopting chatbots, echoing Zhang and Aslan's (2021) findings on the growing optimism for AI in education, the results reinforce the need for professional development to enable effective and ethical use of these tools (Labadze et al. 2023; Luckin and Cukurova 2019).

The study examined PTs' development of prompt engineering skills through pre-course practices, in-class activities and constructive feedback with the second research question. Knoth et al. (2024) emphasised the necessity of prompt engineering skills for the use of generative AI-based environments. Findings show that such interventions significantly improved their questioning skills, consistent with studies by Alshumaimeri and Alshememry (2023). AI-based chatbots proved to be effective tools for fostering these skills, supporting prior research on the potential of AI to enhance learning processes (Korzynski et al. 2023). Feedback focused on refining questioning techniques, improving creativity and reducing reliance on search-engine-style queries. PTs demonstrated growth in crafting detailed, logical and imaginative prompts, reflecting the value of targeted feedback in improving their interactions with chatbots. This finding aligns with research indicating that interacting with AI-based chatbots enhances PTs' inquiry skills (Lee et al. 2025).

Using the BUS-11 scale and the interviews, the study assessed PTs' opinions on AI-based chatbots with the third research question. As a result of the research, differences in chatbot usability between male and female pre-service teachers were determined. It is stated that chatbot usability is not related to variables such as gender, age and previous chatbot use (Balderas et al. 2023). In another study, it's reported that female participants were more likely to report experiencing feelings of annoyance during their interactions with the chatbot (Thunström et al. 2024). The interviews which encompassed positive and negative aspects:

- Positive features: Chatbots were praised for content richness, guidance and time-saving capabilities. PTs noted that chatbots provided more comprehensive and customised information than traditional search engines and facilitated faster research processes. This is consistent with the studies of Cain (2023a) and Lee (2024), where PTs emphasised the positive features of chatbots. One other study (Lee et al. 2025) showed that AI-based chatbots can provide PTs with an effective, low-risk, authentic and individualised learning experience.

- Negative features: Concerns included encouraging laziness, ethical issues like plagiarism, outdated content and over-reliance on AI. These drawbacks reflect broader concerns in the literature (Jurenka et al. 2024; Nguyen et al. 2024) about the potential for AI to undermine critical thinking and creativity.

Additionally, ethical issues such as data privacy and algorithmic bias remain pressing challenges, as noted by Okonkwo and Ade-Ibijola (2021). For example, biases in AI systems can perpetuate stereotypes, as Lim (2024) highlights, with AI tools sometimes misclassifying individuals based on race or gender due to biased training data (Kaplan and Haenlein 2019). Educators and policymakers are responsible for taking precautions against ethical problems. There is a lack of literature exploring how education providers should handle big data like learner information and analytics (Williams 2024).

To answer the fourth research question, PTs' metaphorical perceptions of AI were used. PTs produced both positive and negative metaphors for AI, reflecting its dual potential:

- Positive metaphors: Examples like 'thinking person' and 'life saver' emphasise the benefits of AI (Luckin and Cukurova 2019) in enhancing learning and supporting education.
- Negative metaphors: Descriptions like 'black hole' and 'double-edged sword' highlight ethical concerns, potential risks and fears of AI (Holmes et al. 2022) overshadowing the human element (Gündüz Hoşgör et al. 2023) in education.

These metaphors align with similar findings in previous studies, demonstrating consistent perceptions of AI across different groups (Balıkçı et al. 2024; Demir and Güraksın 2022).

The fifth research question aimed to determine the level of innovation among teacher candidates after taking an instructional technology course. The study found that PTs with higher levels of individual innovativeness—categorised as 'pioneers' and 'innovators'—displayed a more positive and open approach to AI. This supports Uzumcu and Acilmis (2024), who observed that innovative teachers integrate AI tools more effectively into their teaching. Although no significant differences in innovativeness were found based on gender or department, the results highlight the importance of AI education in shaping positive attitudes and effective use of these tools (Luckin and Cukurova 2019).

The sixth research question sought to identify whether PTs intend to incorporate AI-based chatbots into their future pedagogical practices. PTs expressed intentions to use chatbots in their future professional lives, particularly for enhancing engagement and providing personalised learning experiences, as reported in the literature (Huang and Zou 2024). However, they emphasised the need to avoid over-dependence (Selwyn 2024), consistent with the view that AI should serve as a tool rather than an end in education (Baker and Smith 2019).

The study emphasises the need for strategic integration of AI into education (Zawacki-Richter et al. 2019), considering ethical, pedagogical and psychological dimensions. Recommendations include:

- Professional development: It is a fact that the use of AI-based chatbots is becoming widespread at all levels of education. In order to evaluate the potential of these tools and ensure their effective use, it is recommended that professional development training be provided on their potential use. It is imperative that professional development activities encompass the ethical considerations arising from the integration of AI.
- Ethical guidelines: A significant number of studies in the relevant literature underscore the importance of ethical utilisation of AI. Not all individuals have equal access to AI-based chatbots underscores the digital divide. It is critical to ensure that all individuals have the opportunity to benefit from the advancements in AI on an equal basis. In an ethical framework, the protection of student data shared with AI systems is a key consideration. Other ethical considerations include ensuring the accuracy and transparency of data. Teachers' knowledge of ethical concerns is an important part of their professional responsibilities. Additionally, addressing issues such as protecting students' personal data, responsibly using data accessed through chatbots, and ensuring equal access to AI-based chatbots is a noteworthy approach. The language educators adopt during their conversations with the chatbot also shapes algorithmic biases. In this context, it is recommended that teachers take individual differences into account in the use of AI in education and adopt an inclusive language.
- Critical thinking: The accuracy of information accessed through AI should be checked. Critical thinking skills are the basis for checking the accuracy of information. PTs should be encouraged to critically evaluate the accessed data and transform it into knowledge.
- Longitudinal studies: The use of AI-based chatbots has only been around for a few years. The rapid increase in their use provides insight into the future. Additionally, studies on this topic in education are scarce. Longitudinal studies, in particular, will contribute to our understanding of the impact of AI on teaching and learning.

By addressing these areas, educators and institutions can maximise the benefits of AI while mitigating potential risks, fostering an environment where AI tools enhance rather than hinder learning outcomes.

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Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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