Are They AI-Competent? Future Teachers' Readiness to Use Conversational Agents as Learning Assistants

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***Abstract*—This study examines the perceptions of student teachers regarding artificial intelligence technologies particularly their knowledge, their willingness to use them, any concerns and perceived benefits and challenges in relation to the Digital Competence Framework for Citizens (DigComp) 2.2 digital competence framework. Our mixed-methods research, involving 372 undergraduate student teachers, revealed correlations among these aspects, indicating that frequent AI users have a stronger intention to use AI, while infrequent users express greater concerns about it. Student teachers acknowledge AI's time-saving benefits as well as the convenience and academic enhancement it provides, but also voice concerns about its misuse and reliability and the potential impact on skill development and learning. These concerns are in agreement with digital competence areas of information literacy and safe technology use. Reflecting on these perceptions, it is essential to maximise the educational benefits of effective and responsible AI integration into higher education and foster the digital competencies of future teachers.**

***Keywords*—Artificial Intelligence (AI) in education, chatbots, Digital Competence Framework for Citizens (DigComp), pre-service teachers, teacher education**

I. Introduction

This research focuses on integrating generative Artificial Intelligence (AI) into education and, more specifically, the potential use of chatbots in the learning process within higher education. The rapid advancements in AI, characterised by the emergence of increasingly sophisticated tools, have drawn significant interest from the scientific community. It is notable that the advent of the advanced AI model and chatbot "ChatGPT" has given rise to substantial global discussions regarding its transformative potential and challenges, having already had a major impact on daily life.

AI has become ubiquitous in today's society, being applied to various industries and aspects of everyday life. AI refers to the development of intelligent computing systems that emulate human behaviour [1]. Similarly, generative AI does not only mimic human intelligence but also generates original content [2]. One aspect of generative AI that has attracted considerable attention refers to chatbots or conversational agents. From the creation of "Eliza" [3] to the emergence of "ChatGPT" [4], it is evident that chatbots are ever-evolving, while numerous related applications are also being developed.

In addition to the above-mentioned, it can be stated that generative artificial intelligence has had a significant impact on teaching and learning across the entire education sector, from preschool to higher education. It is therefore important to understand how future educators engage with these technologies, as they are to face soon this new reality as teachers. This study explores the knowledge, willingness to use and concerns about AI-driven conversational agents expressed by pre-service teachers, drawing on the European Commission's Digital Competence Framework for Citizens (DigComp) 2.2 digital competence framework as a conceptual lens. DigComp's 2.2 competence areas offer a structured perspective for interpreting AI-related readiness in teacher education.

A mixed-methods design was employed, involving 372 student teachers in Greece. The quantitative findings revealed moderate AI knowledge and high willingness to use ChatGPT particularly among more advanced and frequent users. It is imperative to note that greater knowledge was associated with heightened concerns, indicating a more nuanced awareness of ethical and pedagogical risks. The qualitative responses also highlighted these views, since participants acknowledged AI's time-saving benefits as well as the convenience and academic enhancement it offers, but they expressed concerns about AI's misuse and reliability along with the potential impact on skill development and learning.

This study offers a policy-relevant interpretation of future teachers' AI-related readiness, addressing a gap in current educational research regarding digital competence frameworks and emerging technologies. The implications of this study highlight the need to embed AI-specific digital competencies, especially in information evaluation, ethical awareness and safe classroom integration, within teacher education programmes. It is expected that these findings will be of value to researchers, curriculum developers and policymakers as they seek to prepare educators for responsible and effective AI use in 21st-century learning environments.

II. Literature Review

Chatbots are trained on extensive knowledge bases [5], enabling human-computer interaction by interpreting user inputs in natural language and providing relevant responses [6]. By using machine learning and statistical weighting factors to select the most appropriate answers, chatbots can adapt to users' needs, improving the quality of interactions. This often makes conversations appear human-like. It is noteworthy that even in the early developmental stages of chatbots, the inventors aimed to create the impression that the user was interacting with a real person [7].

The ability of chatbots to provide interactive experiences at a low cost has increased their popularity, leading to their widespread integration into various aspects of everyday

life [8]. Moreover, there is a strong interest in using chatbots in educational settings [9], as they provide learning assistance for student teachers and educators [10].

Chatbots have the potential to adopt various roles as assistants to both teachers and student teachers [11]. Their versatility in the educational sector is demonstrated through their ability to support a wide range of learning processes. Some of these roles include administrative support [12], online education support, especially following the COVID-19 pandemic [13], assisting with various educational issues [14], supporting collaborative activities [15], providing practice opportunities [16] and assessing courses [17].

Their interactivity makes them more effective than other conventional technological systems, as they allow users to interact continuously [18]. As Keller [19] highlights, exposing learners to interactive activities sparks academic interest, contributing to improved academic performance.

Plenty of research has revealed the advantages of using conversational agents in educational settings. They seem to facilitate the learning of foreign languages [5, 16, 20, 21] and can be supportive and helpful for student teachers with special needs [17]. They have a significantly positive impact on the learning process and individual performance [22, 23]. They enhance interest and motivation for learning [9, 24], increasing student participation [21] and engagement [14, 25, 26]. Additionally, the absence of criticism reduces the fear of failure and feelings of anxiety [20] and pressure [9]. Furthermore, the personalisation and interactivity they offer [5, 27] provides learners with greater autonomy [9], while making learning fun [28] and enjoyable [17]. It is essential to emphasise that this is a conversational environment, which enhances communication and dialogue [15, 26], aiding users in brainstorming [12, 29], research analysis and writing (12, 30, 31]. In general, it constitutes a technology with the potential to include and integrate all types of learners [17, 32].

These advantages can be better understood when considering that chatbot technology is user-friendly, easy to use and beneficial [9, 25, 23], being accessible without any specialised equipment. It serves as a fast communication channel [14] that provides real-time feedback at any time [5, 10, 25]. It appears to offer capabilities that are often limited in traditional teaching methods [9].

Overall, studies examining the perceptions of teachers and student teachers of the use of chatbots in educational contexts have shown a generally positive attitude and willingness to use them [12, 14, 31–33]. However, concerns and challenges regarding any technology are inevitable. Individuals express worries about the future impact of these tools [32, 33] and hesitancy about the appropriate user training for proper utilisation [13]. They are also concerned about the over-reliance on these tools and the reduction of creativity and critical thinking in the educational process [12].

Given the aforementioned, it is crucial to understand how future teachers perceive and approach these tools in order to be integrated in a responsible and pedagogically meaningful manner. Research has begun to explore how pre-service teachers understand and accept the use of AI in education. AI literacy, digital readiness and technological self-efficacy are becoming increasingly important. In this context, willingness to use AI chatbots is based not only upon interest or novelty but also on an individual's digital competence in applying these tools.

In order to conceptualise better what it does for educators mean to be digitally ready in the AI era, we utilised the new version of DigComp framework. This framework highlights five essential competence areas starting from information and data literacy to problem solving and it constitutes one of the most widely-used digital competence frameworks worldwide [34]. The framework as such has not changed but it supports new examples of knowledge, skills and attitudes. DigComp 2.2. focuses on helping individuals use both everyday and new digital technologies, such as AI systems [35].

Thus, as AI continues to be integrated into daily life, it becomes increasingly evident that future teachers will incorporate AI-based tools. The rapid emergence of ChatGPT has highlighted how quickly traditional educational paradigms can be disrupted by technology [36]. Therefore, it is essential to examine the motivations behind the adoption or resistance to the use of chatbots and anticipate the expected benefits and challenges in education, while understanding the level of future teachers in relation to the competences. Higher education holds significant research interest as the pursuit of innovative and effective teaching methods is important, given the greater level of specialisation needed.

While global research on the use of chatbots has underlined their benefits on learning outcomes [5, 9, 14, 16, 20–23, 25, 26, 30, 37], there remains a gap in understanding how future teachers perceive these technologies, particularly in regions where AI integration is still emerging. Greece, where AI in education is still in an early stage of growth, serves as a valuable case study for exploring future teachers' perceptions in a context where digital transformation is ongoing. This perspective contributes to international discussions on the implementation of AI in various educational systems. From a local perspective, there are a limited number of studies in Greece about the use of chatbots in education and most of them focus on perceptions of in-service teachers or student teachers in primary or secondary education, as being analysed in the following paragraphs.

Seiradakis [38] conducted a study in which he interviewed six preschool experts to examine the roles and risks in special education in preschool settings in Greece. The experts identified ChatGPT's potential as an educational aid, a personal assistant for school administrators and a tool for communication with family members. At the same time, they identified possible risks, like hallucinations, inclusion issues and a lack of evidence-based guidelines.

In another study, Athanassopoulos *et al.* [39] evaluated the effectiveness of ChatGPT as a tool for providing feedback to 15-year-old migrant and refugee student teachers, learning Greek as a second language, for improving their writing. They found that student teachers improved their vocabulary and grammar in writing, having been revealed through the increased number of words and more complex sentences they produced.

Finally, Kotsis [40] examined the potential use of ChatGPT in physics teaching at elementary schools, through simulations based on Artificial Intelligence and interactive

activities. He argued that by providing personalised feedback and practical learning tasks, ChatGPT has the potential to foster student teachers' engagement, curiosity and understanding. Nonetheless, it is essential to emphasise the need for the ethical use and continuous assessment of its impact on education.

To the best of our knowledge, only two studies have focused on higher education in Greece. Kostas *et al.* [41] conducted a survey with 515 student participants, collecting their perceptions of AI tools, revealing that, on the one hand, they acknowledge their potential in research and providing personalised learning experiences, while, on the other hand, are concerned about AI tools in terms of ethical issues, reliability and the depreciation of critical thinking skills. Presenting quite similar findings, Tsiani *et al.* [42] explored the knowledge, willingness to use these tools and concerns of 231 future educators by comparing the perceptions of undergraduate and master's level student teachers. Additionally, they found that when student teachers are involved in hands-on experiences, their concerns are being reduced, expressing a more balanced view on the integration of AI into education.

Our study differs from the aforementioned, since it focuses particularly on higher education and examines undergraduate, future teachers' perceptions of ChatGPT under the scope of the DigComp Framework. More specifically, it employs a mixed-methods approach, combining quantitative and qualitative data to explore both the reasons for student teachers' willingness to use ChatGPT for academic purposes and those for their concerns about its use.

In particular, this study examines the perceptions of future educators regarding AI technologies, such as ChatGPT, focusing on their knowledge of AI, their willingness to use such tools and their concerns as well as their perceived benefits and challenges. While focusing on Greece, our findings can also offer insights for other countries where AI in education is still in its early stages of development. As AI continues to shape learning environments worldwide, our study contributes to the ongoing discussion on how future teachers perceive, adopt and engage with these technologies in higher education and how this is in agreement with the competence areas of the latest edition of the DigComp Framework, which has a specific target in AI-related competencies.

III. Materials and Methods

This study aims to evaluate data collected from higher education student teachers/future teachers regarding the integration of chatbots into higher education. The research questions (RQs) are as follows:

RQ1: Is there a correlation among knowledge, willingness to use, perceived concerns, semester and the frequency of AI chatbots usage, such as ChatGPT, among student teachers?

RQ2: Do student teachers' knowledge, willingness to use and concerns about AI chatbots, such as ChatGPT, differ significantly based on their level of usage?

RQ3: What are student teachers' perceptions of the benefits and challenges of using AI chatbots, such as ChatGPT?

As mentioned above, the sample of the study consisted of undergraduate student teachers/future teachers, having enrolled in a pedagogical department of a Greek university. Non-probability, convenience sampling with voluntary participation was used to effectively collect data within the available time and resources. A total of 372 responses were collected.

The research was conducted using a structured questionnaire originally proposed by Chan and Hu [12], which explored university students' perceptions by assessing the knowledge, willingness to use, concerns and the perceived benefits and challenges of AI technologies, such as ChatGPT. The questionnaire consisted of 4 demographic questions, 18 items based on a five-point Likert scale, divided into 3 subscales, to measure participants' agreement or disagreement along with two (2) open-ended questions to gain a deeper understanding of their perceptions. The instrument provided a nuanced understanding of student teachers' views, combining quantitative data with qualitative insights.

The selection of this questionnaire was based on its ability to assess critical aspects of our study. Additionally, the combination of quantitative and qualitative data was considered to be necessary for a comprehensive understanding of the participants' attitudes towards the use of conversational agents in learning. The same questionnaire has been used by a number of researchers in similar contexts (e.g., quite recently by Tsiani *et al.* [42], supporting the effectiveness of the scale in higher education).

The research tool was employed in its original form, except for the incorporation of supplementary questions for demographic details. More specifically, three (3) demographic questions were used to collect data on the participants' gender, semester and frequency of AI usage.

For the frequency of AI usage, we decided to use a dichotomous one from the 5-point scale because we noticed that the majority of responses clustered around two points of the scale. This suggested that student teachers were either frequent users or rarely used AI. This dichotomous scale simplified the interpretation of our data while managing to capture key patterns in usage.

The first subscale of knowledge of AI encompassed six (6) closed-ended items to assess the participants' understanding of AI technologies, rating their agreement regarding the limitations, biases and emotional intelligence of AI tools, such as ChatGPT, on a five-point Likert scale.

The second subscale of willingness to use AI included eight closed-ended items evaluating the participants' intentions and openness to integrate AI tools into their practices. Items were rated on a five-point Likert scale, focusing on perceived usefulness, time-saving benefits and potential for digital competence.

The third subscale of concerns about AI comprised four closed-ended questions aimed at capturing the respondents' concerns about the use of AI technologies. Participants rated their agreement on a five-point Likert scale with statements concerning the potential risks and limitations associated with AI, such as impacts on educational value and social interaction.

The questionnaire included two open questions aimed at exploring the reasons why student teachers were willing to use AI technologies, such as ChatGPT, as well as the reasons

for their concerns or lack of concerns about such technologies.

Data was collected online using a questionnaire form and it was stored on a secure online hard drive, being only accessible to the researchers until the end of the research. After collecting the data, both a statistical analysis of the quantitative data and a thematic analysis of the qualitative data were conducted.

Quantitative data were analysed using the statistical software Jamovi (version 2.3.21). We utilised different statistical approaches, such as descriptive tests by measuring the mean and standard deviation of our sample and scales, correlational tests to see how the scales were associated with each other by using Spearman's correlation coefficient and inferential tests by using t-tests to compare the groups with high and low frequency of AI usage. During the analysis of quantitative data, age groups and enrolled semesters were merged in order to match the distribution of the sample due to minimal or zero observations in some groups.

For the qualitative data analysis, a concept analysis was employed. All responses were reviewed and examined in order to fully understand and identify key ideas or concepts within the data. Initially, the emerging categories were generated by the first author, based on themes identified both through the participants' answers and existing research on similar topics, providing detailed descriptions, definitions and representative quotes. We developed our own categorisation, drawing ideas from the original article and making certain adjustments. In a later stage, the two remaining authors independently categorised 30% of the answers. We opted to include only categories with more than 10 responses in the tables, as they represented the most commonly mentioned themes. Responses with fewer than 10 mentions were characterised as "other low-frequency responses" to ensure that they are acknowledged while concentrating on more prominent categories. In the case of disagreement, all three authors attended a discussion session to resolve the issue and reach a consensus. No issues remained unresolved.

This study employed the triangulation approach by integrating both quantitative and qualitative data to address the research questions. The quantitative analysis provided an overview of trends and correlations among the three subscales, while the qualitative analysis added depth by uncovering the underlying reasons behind student teachers' attitudes.

IV. Mapping the Study Constructs to DigComp 2.2 Competence Areas

To map the DigComp 2.2 framework to our study, we aligned the basic constructs of our research - the knowledge of AI, willingness to use AI and concerns about it – with the five competence areas of the DigComp 2.2 [35].

- Information and Data Literacy: This competence involves finding, evaluating and managing digital information effectively. The knowledge of the Artificial Intelligence construct in our study explores the ability of future teachers to assess the accuracy of content produced by Artificial Intelligence and identify misinformation, which is related to this competence.
- Communication and Collaboration: The willingness to use Artificial Intelligence in our study is linked to this competence. It includes the use of digital tools for interaction, collaboration and participation in the digital society. Concerns about the decline in human communication caused by Artificial Intelligence are also related to this.
- Creating Digital Content: The willingness to use AI and concerns about it in our study are in agreement with this area. The willingness of future teachers to use such tools for creating and editing digital content demonstrates confidence, while worries about plagiarism or content quality reveal ethical challenges.
- Security: This area covers digital security, privacy, cyber security and online well-being. This competence is linked to our research concerns about AI. High concern may indicate gaps in the digital skills of future teachers, while low concern may demonstrate greater awareness of safe and ethical practices.
- Problem Solving: This skill encompasses solving technical problems, adapting to new technologies and utilising digital technologies creatively. This relates to both knowledge about AI and willingness to use it. The willingness of future teachers to adopt and apply AI to teaching indicates strong problem-solving and innovative skills. Reluctance may reflect a lack of confidence in the use of new technologies.

V. Results

A. Quantitative Analysis Results

1) Reliability of questionnaire scales

Table 1 illustrates the reliability check of the questionnaire scales using Cronbach's alpha. Cronbach's alpha values for all our scales have values greater than 0.7. A scale is considered to have acceptable reliability when $\alpha > 0.7$ and good reliability when $\alpha > 0.8$.

Table 1. Reliability of scales

Variables	Cronbach's α
Knowledge of Gen AI agents such as ChatGPT	0.715
Willingness to use Gen AI agents such as ChatGPT	0.828
Concerns about Gen AI agents such as ChatGPT	0.722

2) Correlations between questionnaire scales

Table 2 shows the correlations between scales. The analysis shows that there is a weak positive correlation between AI knowledge and concerns and a weak negative correlation between willingness to use AI and concerns. The correlation between willingness to use AI and frequency of AI usage is moderately positive and statistically significant. There is also a weak positive correlation between willingness to use AI and semester. The correlation between concerns about AI and frequency of AI usage is a weak negative correlation, but statistically significant, and there is also a weak negative correlation between concerns about AI and semester. Finally, the correlation coefficient between the frequency of AI usage and semester is a weak positive correlation, but statistically significant. To summarise, the table shows that higher AI knowledge and usage are associated with greater willingness to use AI, while concerns about AI tend to decrease with increased usage and academic progression.

Table 2. Correlations between scales with Spearman's correlation coefficient

Variables	AI knowledge	Willingness to use AI	Concerns about AI	Frequency of AI usage	Semester
AI knowledge	—				
Willingness to use AI	−0.092	—			
Concerns about AI	0.240***	−0.171***	—		
Frequency of AI usage	0.037	0.315***	−0.108*	—	
Semester	−0.001	0.170***	−0.121*	0.182***	—

Note. * $p < .05$, ** $p < 0.01$, *** $p < 0.001$

1) Demographics

Table 3 reveals that the research sample (N = 372) predominantly consists of undergraduate student teachers (N = 372), women (N = 326), attending their 1st semester of studies (N = 264). A notable variance is observed in the frequency of AI usage among participants, with a significant percentage "never or rarely" (N = 224) using AI technologies, such as ChatGPT, and another percentage of student teachers using "sometimes, often, and always" (N =148) these technologies. This suggests potential differences in how participants use AI and, therefore, further qualitative exploration may define the reasons for different uses.

Table 3. Demographic characteristics

Variable	Category	N	Percentage (%)
Gender	Men	46	12.4
	Women	326	87.6
Semester	1st semester	264	71.0
	2nd semester and above	108	29.0
Frequency of AI usage	Low usage [never, rarely]	224	60.2
	High usage [sometimes, often, always]	148	39.8

2) Knowledge of AI technologies such as ChatGPT

The results in Table 4 reveal that participants generally have a moderately positive attitude towards their knowledge of AI, with ratings close to 3.5 to 4 (range 1 to 5). This suggests a basic understanding of technology, though it may not be comprehensive. Variable 4 stands out (M = 4.01) with a mean score to 4, indicating high knowledge of Gen AI agents' limited capacity for emotional intelligence and therefore insensitive output. The standard deviations are relatively low, mostly just below one, indicating consensus among respondents about their level of knowledge. It is notable that the standard deviation for variable 4 (SD = 1.04) is above one, reflecting greater variability in responses. It would be important to explore the factors that may affect their opinions about AI by conducting qualitative data analysis.

3) Willingness to use AI technologies such as ChatGPT

The findings in Table 5 suggest that participants demonstrate moderately positive intentions towards using AI, with most ratings around 3.5 to 4 (range 1 to 5). This may reflect a cautious yet open attitude towards adopting technology. Variable 4 (M = 4.23) and variable 7 (M = 4.05) stand out with a mean score to 4, indicating a higher intention to use AI due to time-saving benefits and 24/7 availability. Standard deviations are relatively small, all just below one, suggesting consensus among respondents on the intention to use AI. Further qualitative exploration may shed light on their opinions, whether these reflect enthusiasm or practical reasons.

Table 4. Mean scores and standard deviations of knowledge of Gen AI agents such as ChatGPT

Knowledge of Gen AI agents such as ChatGPT	Mean (1 = min / 5 = max)	Standard deviation
1. I understand that Gen AI agents may have limitations in handling complex tasks	3.65	0.832
2. I understand that Gen AI agents can produce factually inaccurate output	3.86	0.777
3. I understand that Gen AI agents can produce out of context or inappropriate output	3.40	0.981
4. I understand that Gen AI agents can exhibit biases and unfairness in their output	3.06	1.04
5. I understand that Gen AI agents may overly depend on statistics, which can restrict their effectiveness in specific contexts	3.69	0.845
6. I understand that Gen AI agents have limited capacity for emotional intelligence and empathy, potentially resulting in insensitive or inappropriate output	4.01	0.993

Table 5. Mean scores and standard deviations of willingness to use Gen AI agents such as ChatGPT

Willingness to use Gen AI agents such as ChatGPT	Mean (1=min / 5=max)	Standard deviation
1. I envision integrating Gen AI agents into my future teaching and learning practices	3.38	0.940
2. Students must learn how to use Gen AI agents well for their careers	3.84	0.945
3. I believe Gen AI agents can improve my digital competence	3.81	0.850
4. I believe Gen AI agents can help me save time	4.23	0.790
5. I believe Gen AI agents can provide me with unique insights and perspectives that I may not have considered on my own	3.90	0.944
6. I believe Gen AI agents can provide me with personalised and immediate feedback and suggestions for my assignments	3.83	0.746
7. I believe Gen AI agents are great tools due to their 24/7 availability	4.05	0.867
8. I believe Gen AI agents are great tools as student support services due to anonymity	3.56	0.922

1) Concerns about AI technologies such as ChatGPT

Table 6. Mean scores and standard deviations of concerns about Gen AI agents such as ChatGPT

Concerns about Gen AI agents such as ChatGPT	Mean (1=min / 5=max)	Standard deviation
1. Using Gen AI agents to complete assignments undermines the value of university education	3.53	1.03
2. Gen AI agents will limit my opportunities to interact with others and socialise while completing coursework	3.21	1.10
3. Gen AI agents will hinder the development of my generic or transferable skills, such as teamwork, problem-solving and leadership skills	3.57	1.07
4. I can become over-reliant on Gen AI agents	3.21	1.26

The results in Table 6 show that respondents generally hold a neutral attitude towards AI concerns, with most ratings closed to 3 and 3.5, indicating a balanced view of potential risks and benefits or some degree of uncertainty. The standard deviations are relatively high, all slightly above one, reflecting a higher variability among the respondents. Further qualitative exploration will be able to examine if these concerns reflect uncertainty or if they stem from different levels of familiarity with technology.

1) Significance test of AI knowledge by frequency of AI usage

All figures from the test results are included. The description focuses on the statistically significant findings.

Fig. 1 and Table 7 present the significance test for the "AI knowledge" scale regarding the demographic characteristics of frequency of AI usage. A Shapiro-Wilk test for normality was conducted with $p < 0.003 < 0.05$. Subsequently, a Mann-Whitney test was performed, yielding p-0.481 > 0.05.

There is no statistically significant result in the significance test of AI knowledge by frequency of AI usage.

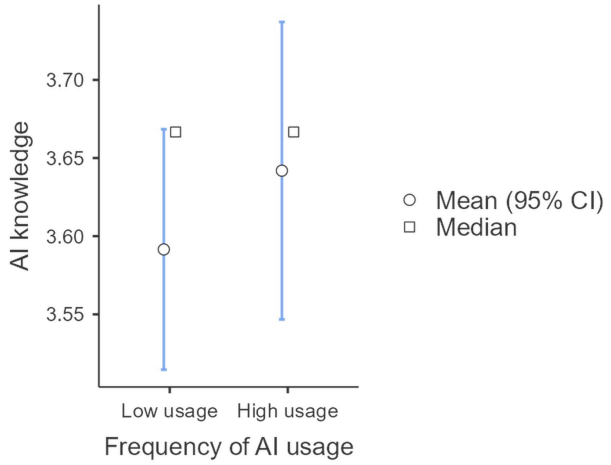

Fig. 1. Visual presentation of AI usage frequencies by levels of AI knowledge.

Table 7. Comparison between frequencies of AI usage across levels of AI knowledge

Independent Samples T-Test	Statistic	*p*
Mann-Whitney U	15863	0.481

Note: $H_a\ \mu_{\text{Low usage}} \neq \mu_{\text{High usage}}$

2) Significance test of willingness to use AI by frequency of AI usage

All figures from the test results are included. The description focuses on the statistically significant findings.

Fig. 2 and Table 8 present the significance test for the "willingness to use AI" scale concerning the demographic characteristics of frequency of AI usage. A Shapiro-Wilk test for normality was conducted with $p < 0.001$. Subsequently, a Mann-Whitney test was performed, yielding p-0.001 < 0.05. This indicates a statistically significant difference in "willingness to use AI" between low usage and high usage participants at a significance level of 0.05.

Table 8. Comparison between frequencies of AI usage across levels of willingness to use AI

Independent Samples T-Test	Statistic	*p*
Mann-Whitney U	10433	< 0.001

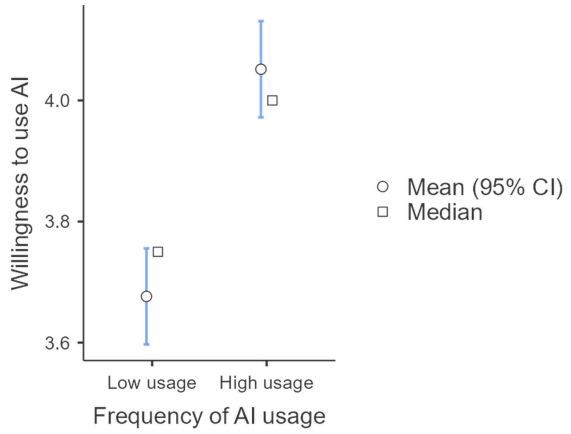

Fig. 2. Visual presentation of AI usage frequencies by levels of willingness to use AI.

3) Significance test of concerns about AI by frequency of AI usage

All figures from the test results are included. The description focuses on the statistically significant findings.

Fig. 3 and Table 9 present the significance test of the "concerns about AI" scale regarding the demographic characteristics of frequency of AI usage. A Shapiro-Wilk test for normality was conducted, where $p = 0.008 < 0.05$. Subsequently, a Mann-Whitney test was performed, yielding $p = 0.037 < 0.05$. This indicates a statistically significant difference in "concerns about AI" between low usage and high usage participants at a significance level of 0.05.

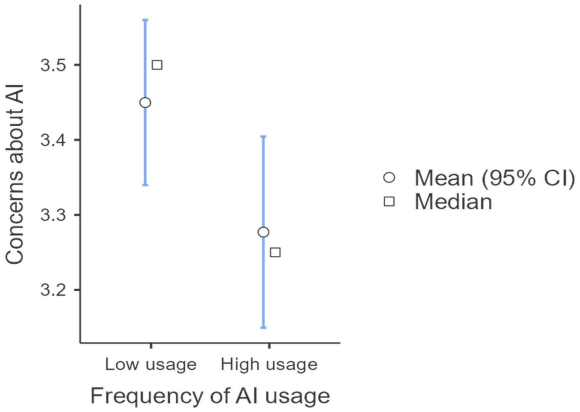

Fig. 3. Visual presentation of AI usage frequencies by levels of concerns about AI.

Table 9. Comparison between frequencies of AI usage across levels of concerns about AI

Independent Samples T-Test	Statistic	*p*
Mann-Whitney U	14470	0.037

Note: $H_a\ \mu_{\text{Low usage}} \neq \mu_{\text{High usage}}$

B. Qualitative Analysis Results

In this section, the themes resulting from the thematic analysis are presented, being divided into subthemes to structure the results based on the qualitative data, as shown in Tables 10–12, which show the structure of themes and subthemes that emerged from the thematic analysis.

1) Reasons for willingness to use Gen AI technologies

The thematic analysis shown in Table 10 identifies several key reasons why student teachers are willing to use Gen AI agents, like ChatGPT, along with perceived benefits.

Table 10. Thematic analysis of the reasons for student teachers' willingness to use Gen AI

Themes	Subthemes	*N*
Time-saving benefits	● Reducing time spent on tasks	131
Academic enhancement and support	● Providing better understanding through clarifications and translations ● Offering notes, ideas and solutions ● Helping students improve their academic performance with diverse resources	120
Easy, accessible and immediate solutions	● Accessibility of AI tools anytime ● Fast and immediate answers to questions	113
Task completion	● Assisting in completing assignments or projects ● Supporting research tasks with organised and relevant information	108
Decreased desire for personal effort	● Reduced need for manual input or critical thinking ● Allowing students to achieve results with minimal effort	59

a) Time-saving benefits

Student teachers frequently refer to the issue of saving time as a primary motivation for using Gen AI technologies. Many note that these tools allow them to complete tasks and get answers in questions quickly with minimal effort which probably saves time. As one student teacher explains, "student teachers often choose artificial intelligence as a tool that may help them save time and effort when completing a task". Another highlights that "I believe they do it to save time from their work […]".

b) Academic enhancement and support

Participants appreciate the role of these technologies in improving their academic work by enhancing their understanding and improving their performance. Many use them as tools that facilitate them when they need help in understanding difficult subjects through clarifications, translations etc. As one of them states "[…] facilitating the complexity of a task or exercise as students focus completely on understanding the material and developing their knowledge […]". They find these tools helpful "due to their usefulness in tasks, ideas, notes and clarifications" resulting in "[…] their learning performance improves due to the contribution of ChatGPT".

c) Easy, accessible and immediate solutions

The accessibility, the easy way to use and speed of these technologies are valued by student teachers. They prefer a tool easily accessible that provides quick and direct answers. One student teacher highlights "Immediate and easy access in information […]" while another describes AI as an "easy, free, accessible source of information". This convenience encourages widespread use by student teachers "because it makes it easier for them".

d) Task completion

Many student teachers use AI primarily "to complete their tasks fast and without effort and research". As they note, "student teachers often turn to generative artificial intelligence technologies to complete their tasks as they look for an easy solution and a good grade for their assignment". Based on the above-mentioned, this technology is attractive to student teachers because it quickly generates well-structured responses, helping them skip time-consuming tasks, like reading long texts, analysing information etc. and providing them with "[…] original ideas".

e) Decreased desire for personal effort

Some student teachers acknowledge that these technologies reduce their personal effort when completing academic tasks. Instead of engaging with critical thinking, research and problem solving, they often resort to AI as a quick and effortless solution. One of them says, "[…] student teachers find it boring to deal with and think for themselves, so they get help from AI technologies". Many express that their boredom has to do with traditional research methods and prefer technology as an easy alternative. As one admits, "they are getting bored when being asked to look for information in books or various online articles and prefer the easy solution".

2) Reasons for concerns about Gen AI technologies

The thematic analysis shown in Table 11 also reveals several reasons for student teachers' concerns about Gen AI agents along with perceived challenges.

Table 11. Thematic analysis of the reasons for student teachers' concerns about Gen AI technologies

Themes	Subthemes	*N*
Accuracy and reliability of information	● Concerns about AI providing answers that are not objective or might be biased ● Worries about whether the information is valid, truthful and up to date ● Scepticism regarding the possibility of incorrect or outdated responses	83
Impact on skill development	● AI may diminish students' ability to put in effort, affecting the development of their essential skills ● Reduced engagement with problem solving, thinking critically and using creativity ● Reduced opportunities for teamwork and collaborative learning	49
Impact on essential learning	● The ease of access to information reduces the quality of the learning process ● Relying on AI for assignments will not encourage students to process information deeply or engage with meaningful learning ● AI-driven assignments might lack originality and personal thought, making learning less authentic	40

a) Accuracy and reliability of information

The main concern among student teachers is the accuracy and reliability of information provided by generative AI technologies. Many worry that their responses may not always be objective and could contain biased or misleading information. Other student teachers express concerns about "insufficient information", "[…] inaccurate or wrong information". There is also scepticism about the possibility of outdated and out of-context responses, leading some student teachers to question their trust in AI content, by saying that "they cannot know how timely they are and whether they are in line with society's frameworks".

b) Impact on skills development

Another concern they have is about the potential impact on

the development of student teachers' skills, such as critical thinking, creativity, problem solving and cooperation. As one notes, about the long-term consequences of this, "future generations won't use their critical thinking to solve problems and they won't learn to cooperate", while another adds "the dependence of research and completion of tasks on artificial intelligence and the alienation of group tasks of communication, emotions expression and socialisation." Student teachers may become reliant on AI for quick solutions which can discourage them from engaging with more challenging aspects, such as assessing information critically, analysing complex ideas, communicating and working in groups etc.

c) Impact on essential learning

Furthermore, the convenience that AI provides can reduce the quality of the learning process because student teachers may not engage with the material. They may often bypass critical steps of analysing, synthesising and processing information, leading to shallow learning. As one notes, student teachers copy the answers "[…] which affects negatively the educational process and true learning", while another says that "[…] information is not always filtered in the right way and this excessive convenience can lead to a lack of methodical search for information". In general, this results in "[…] the absence of authenticity, meaningful effort".

3) Reasons for lack of concerns about Gen AI technologies

The thematic analysis shown in Table 12 also reveals the reasons for student teachers' lack of concerns about Gen AI.

Table 12. Thematic analysis of the reasons for student teachers' lack of concerns about Gen AI technologies

Themes	Subthemes	*N*
Lack of awareness	● Students may not be fully aware of the potential dangers, limitations or long-term consequences of using AI technologies ● A lack of detailed knowledge about AI means that students are less concerned, often viewing the technology in a more positive manner without understanding the full scope of its impact	59
Immediate benefits of technology	● The convenience of AI, especially its ability to save time in completing assignments or tasks ● AI's ability to provide answers or generate content quickly means that students are more likely to use it to facilitate their tasks	58

a) Lack of awareness

One key reason for student teachers' lack of concern about AI is their limited awareness and knowledge about technology and its potential risks and consequences. One student notes that "student teachers' lack of concerns about generative artificial intelligence technologies is likely due to their ignorance of the technology", while many student teachers talk about "lack of information". This can lead them to view technology as a harmless, helpful tool.

b) Immediate benefits of technology

Another reason why student teachers are not concerned about using AI is the immediate benefits it offers them, such as saving time and effort. They are not worried "[…] as it facilitates and saves time" and "since they can finish their tasks". With its ability to generate answers and content, student teachers are more likely to use it as a convenient tool to complete tasks without paying attention to the potential drawbacks "[…] as these technologies serve them".

C. Discussion

1) 1st research question

Firstly, we examined the potential factors influencing the frequency of AI chatbot usage, such as ChatGPT among student teachers/future educators. The findings reveal statistically significant correlations among knowledge, willingness to use, concerns, semester and the frequency of AI usage.

Our results show that a greater knowledge of AI is associated with more concerns about its use. This suggests that increased awareness may raise sensitivity to the risks or limitations of AI technologies. However, it is important to note that increased knowledge does not necessarily result in a decrease of practical usage of AI, as we have found that student teachers with a deeper understanding of AI tend to utilise it more frequently, which is probably an indication that the perceived benefits of AI might be seen as more significant than its potential limitations when users are informed. A deeper understanding of AI leads to more nuanced perceptions of its risks and benefits, which contrasts with the research findings of Chan and Hu [12]. This is confirmed by the framework, which emphasises the need of cultivating users' AI literacy so that they feel confident while engaging with AI. As a result, teacher education programmes should place emphasis on helping teachers understand the data, logic and algorithm of AI tools, such as ChatGPT. Receiving training on artificial intelligence technologies, such as ChatGPT, has the potential to enhance student teachers' willingness to use these technologies, as Chan and Hu [12] suggest, with knowledge of AI technologies being positively correlated to the willingness to use them.

It is therefore important to note that willingness to use AI emerges as a significant factor influencing both concerns and usage. Student teachers who have a stronger intention to use AI may have fewer concerns and engage with it more frequently, highlighting the importance of motivation and perceived utility. This finding appears to contradict the findings by Chan and Hu [12]. It is imperative to refer to the fact that student teachers' willingness indicates a readiness to innovate and address digital challenges posed by new technologies.

This would be beneficial to teacher education, where student teachers, through projects, act as teachers, applying AI tools to overcome classroom challenges. A user's experience with technology is crucial for creating a positive environment and can enhance the willingness to use it [43]. Cultivating a positive attitude towards AI could serve as a balance to perceived risks. Nevertheless, addressing underlying concerns and implementing preventive measures to mitigate the associated risks is also imperative [44]. Chan and Hu [12] have also found a positive correlation between willingness to use AI and frequency of use, which suggests that cultivating positive attitudes and experiences can facilitate the integration of AI tools into educational settings.

This is particularly important when viewed from the perspective of the DigComp framework, since it focuses on the ability to create and adapt digital tools. Student teachers' willingness can be seen as the threshold of exploring new technologies and developing digital problem-solving skills. When student teachers have positive experiences with technology, this increases their intention to use it and leads to more frequent use. This engagement can be viewed as an indicative of their ability to integrate AI tools effectively into their own teaching and learning. Studies suggest that a positive user experience increases an individual's technological self-efficacy in using technology [45]. This finding is particularly useful when planning the integration of AI chatbots into educational settings.

Furthermore, the academic year also plays an important role in student teachers' attitudes and behaviours towards AI. For example, student teachers in later semesters show higher willingness, more frequent usage and fewer concerns. We can attribute this to high confidence in using technology or academic obligations. As suggested by Katsantonis [46] and Almaraz-Lopez *et al.* [47], student teachers' perceptions of AI become more positive as they progress in their studies, highlighting the critical role of academic progress in shaping people's attitudes toward AI.

Thus, it is essential to understand factors like knowledge, willingness to use and concerns regarding artificial intelligence tools, like ChatGPT, in order to foster an effective integration of chatbots into higher education [12]. At the same time, we should emphasise the fact that while artificial intelligence can facilitate pedagogical practices, we should not use it as a substitute for thinking and creativity, but as a valuable support tool [48].

2) 2nd research question

Moreover, research was conducted in order to define the differences in student teachers' knowledge, willingness to use and concerns about AI chatbots, such as ChatGPT across high and low levels of usage. The results show significant variations in both the willingness to use AI and concerns about it based on their frequency of use.

These findings underscore how the engagement that future teachers have with these technologies might shape their attitudes towards AI. More specifically, participants with a higher frequency of AI use show a higher willingness to use AI, whereas those with a lower frequency have more concerns about it. Therefore, it can be stated that student teachers with a broader technological experience show lower uncertainty about AI, while emphasising the potential benefits. Other research findings reveal a positive correlation among familiarity with AI chatbots, higher levels of trust and willingness to use [49]. This underlines the importance of engagement with AI tools in shaping student teachers' willingness to use them.

3) 3rd research question

In addition, we have explored future teachers' perceptions of the benefits and challenges posed by the use of AI chatbots. Our findings highlight a variety of perceptions of technology's advantages and challenges.

Quantitative analysis revealed that participants identify many benefits of AI technologies, such as ChatGPT, which justifies their willingness to use such tools. This finding is in agreement with the study conducted by [50], which suggests a link between perceived benefits and increased acceptance of such technologies. The primary benefit that future teachers referred to for using AI chatbots, such as ChatGPT, is the fact that they are time-saving. Many of them stated that these technologies assist them in completing their tasks faster and with minimal effort. These tools are frequently considered to be convenient. Another benefit mentioned is the academic facilitation provided by AI, with student teachers noting that they understand complex subjects better. These tools are also valued for their ease of access and response time. Furthermore, respondents stated that they use AI to complete tasks, assignments and for research. Such usage indicates how AI can be used to create digital content corresponding to DigComp 2.2. framework.

These findings are in agreement with those of other global studies [12, 50–53]. We think that they contribute to the global conversation by identifying these benefits in a country which is still in the early stages of AI adoption.

However, student teachers also expressed several concerns regarding AI technologies, such as ChatGPT, which may be based on their limited experience with such tools, according to the quantitative analysis. Their primary concern was the accuracy and reliability of information generated by AI as they were worrying about biased or outdated information. This concern is associated with the technical robustness and safety of AI [54], underscoring the necessity for these tools to be reliable. Furthermore, there were concerns about reliance on AI which may lead to decreased development of critical thinking, creativity and problem-solving skills, which are essential for future success. Therefore, concerns have been raised that frequent use of AI may hinder intellectual growth. This reflects concerns related to societal wellbeing [54], highlighting AI's impact on people's cognitive and collaborative abilities. Additionally, respondents highlighted that overreliance on AI could impact the quality of learning as originality and authentic thought decline. This finding emphasises the significance of human agency and oversight in preserving authentic education. This notion resonates with the European Commission's [54] call for preserving human agency and oversight in educational settings.

We believe that these concerns are valid and expected from responsible pre-service teachers, but they must be addressed through proper training. Agreeing with the competence's framework, it is important to emphasise the need of receiving training in AI ethics, data privacy and digital well-being.

It is noteworthy that some pre-service teachers expressed no concerns regarding the use of AI. They attributed that to their lack of awareness of the associated risks and consequences. Also, respondents acknowledged that they are not adequately informed about AI's limitations which led them to focus more on the advantages of AI, while the potential disadvantages were less taken into account. Thus, the immediate benefits of technology, such as the convenience of completing tasks and getting answers, outweighed any concerns they might had.

This finding is also in line with other global studies (e.g., [12, 50, 52, 55, 56]), thereby contributing to the international discussion by exploring concerns in an educational system where AI adoption is ongoing.

Therefore, it is concluded that AI technologies, such as

ChatGPT, offer capabilities that are not being included in traditional teaching methods [9] as their transformative capacity can potentially enhance the learning process and outcomes in several ways [21]. However, associated concerns should be addressed. A main problem is the academic dishonesty when integrating AI tools into educational settings. Thus, taking measures is imperative, since peoples' behaviour while using these tools might probably trigger plagiarism and cheating. Consequently, exploring new assessment approaches that can preserve academic integrity, being crucial in the educational framework [56] is essential [50].

In addition, we have to consider that continuous improvement of AI tools, including regular updates and refinement of the underlying data, is also crucial [44]. It is important that users know that these systems are not infallible. In fact, despite its huge database, ChatGPT acknowledges that there is a likelihood of errors and encourages users to verify critical information. Therefore, it is entirely our responsibility to get trained and ensure the accuracy and quality of the content provided [57]. If we emphasise the pedagogical value of AI tools while implementing preventive measures, we can mitigate the challenges associated with their integration into the learning process [58].

VI. Conclusion

This paper presents an analysis of the perceptions of undergraduate student teachers/future educators, regarding artificial intelligence technologies, with a particular focus on chatbots, such as ChatGPT. The study integrates findings from a mixed-method investigation, emphasising the correlations among the following: knowledge and concerns, willingness to use and concerns as well as willingness to use, semester and frequency of use. The study indicates that frequent AI users have a stronger intention to use AI, while participants who never or rarely use AI have more concerns about it.

Additionally, key themes are identified, including benefits related to effectiveness and improved learning which can justify participants' openness and willingness to use these tools, alongside with concerns about reliability, skill development and essential learning that may lead to low frequency usage of AI and, furthermore, lack of concerns, which multiplies the reasons why student teachers are willing to use this technology.

The integration of advanced technologies, such as generative artificial intelligence and chatbots like ChatGPT, in educational environments presents both opportunities and challenges. It is crucial to confirm that educational technology can serve as an enhancement rather than a substitute [7]. In this context, understanding the perceptions of higher education student teachers, who need to acquire the skills required for the job market in the era of artificial intelligence, is essential for comprehending both the expected benefits and drawbacks associated with these technologies [12].

Participants' opinions are based on their experiences as students and on how these tools affect their academic progress. The fact that participants are future educators makes their perspectives particularly interesting, as their attitudes are likely to influence their future students. This adds a second dimension to their views, as they have the potential to shape their students' educational experiences based on what they believe and perceive.

While this study focuses on Greece, its findings will contribute to the broader international discussion on AI in education. Understanding student teachers' perceptions in different contexts contributes to forming global strategies for AI enhanced learning. The perceived benefits underscore the transformative potential of chatbots, such as ChatGPT, in education. On the contrary, the perceived challenges can guide policymakers and other stakeholders in developing ethical guidelines and programmes to overcome obstacles and foster pedagogical practices for their effective integration. Thus, this study's findings have implications for teacher education as DigComp 2.2. framework allows for a more structured interpretation of what digital readiness means in the AI era. Teacher education programmes can use these findings and ensure that all five competence areas are addressed. Such alignment does not only benefit teachers but also fosters broader EU policy goals, such as the European Commission's 2030 target for high digital skills among citizens.

This study has certain limitations that can be addressed in future studies. One limitation refers to the lack of insight into the participants' epistemological beliefs about education and teaching, which may influence the effectiveness of AI utilisation for academic purposes. Therefore, it is suggested that future research incorporate questionnaires that assess students' epistemological perspectives on education and learning theories. This approach would enable a more comprehensive understanding of the factors that affect perceptions and the adoption of AI technologies in educational settings. Moreover, the limited familiarisation of most participants with AI tools may impact the reliability and validity of their opinion regarding these technologies.

Another limitation of this study is that the majority of participants were then attending their first semester of their teacher education and thus their preparedness on using AI could not be evaluated because such practices are not yet developed at this stage of the teaching programme. This can justify the lower familiarisation with AI in this study. Future studies can focus on later stages of teacher education programmes to examine how their readiness evolves over time.

Given the fact that most of the participants state that they never or rarely use AI, this research lays the ground for future work, like a follow-up study comprising an intervention focusing on the recorded advantages and concerns and a post-experimental phase. Such a study can evaluate changes in proficiency across DigComp 2.2. competencies, providing information on how guided use affects pedagogical readiness and AI literacy.

Ethical Approval and Information Consent

This research was approved by the Committee for Research Ethics of the University of Macedonia (Doc. No 60/27-07-2024). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

All participants gave their consent and agreed to participate after having been fully informed about the study's purpose, procedures and potential risks and benefits.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

SK: Conceptualisation (equal), Investigation (lead), Methodology (supporting), Formal Analysis (lead), Writing—Original Draft Preparation (lead), Writing—Review & Editing (equal); IL: Conceptualisation (equal), Investigation (supporting), Supervision (lead), Methodology (lead), Formal Analysis (supporting), Resources (lead), Writing – Original Draft Preparation (supporting), Writing—Review & Editing (equal); NF: Investigation (supporting), Writing—Review & Editing (equal). All authors have approved this paper's final version.

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