



ARTIFICIAL INTELLIGENCE AND TEACHER CANDIDATE LEARNING

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Abstract: Artificial intelligence is infiltrating our lives and is also gaining ground in education. Failing to acknowledge its presence in higher education, in particular, would be ostrichism. There is a growing body of research on AI in higher education discussing its modes of use and regulatory aspects (Rajki, Nagy & Dingó, 2024; Horváth, 2024; Bognár, 2024; Wang et al., 2023 etc.). According to Long and Magerko (in Bognár, 2024) AI literacy is a set of skills, competencies, knowledge and attitudes that enable individuals to integrate AI into the learning process. The aim of this presentation is to explore the current state and characteristics of AI literacy and AI application. It seeks to uncover the extent to which teacher candidates use AI, which areas of learning they apply it to, what are the motivating or hindering factors, and what challenges they face. Additionally, it examines the types of support they require to overcome these challenges, as well as the sources and areas of assistance. The survey research employed a self-constructed questionnaire as its main instrument. The study sample consists of students from the *Department of Pedagogy and Applied Didactics at the Faculty of Psychology and Educational Sciences of Babeş-Bolyai University*, including kindergarten and primary school teacher candidates, as well as students enrolled in the Efficient Learning Strategies master's program (N=431). Our findings indicate that, AI is moderately present in the learning activities of the respondents, and they primarily use it for learning support rather than for competing tasks. At the same time, AI users encounter numerous objective and subjective obstacles, and are faced with various challenges when it comes to AI application.

Key words: artificial intelligence, learning, teacher candidates, higher education

1. Introduction

In the context of assessment dilemmas in higher education (and beyond!), it is a recurring question how instructors should approach student assignments where it is evident -or at least suspected—that AI has played a major role in completing the task. In their study, Rajki, Nagy, and Dingó (2024) review the various institutional responses that reflect the stance of multiple universities worldwide regarding AI's growing presence in higher education. Universities are beginning to take a clear stand on defining the boundaries and acceptable uses of AI in academic work. The position of Babeş-Bolyai University in Cluj-Napoca (CS UBB, 2024) aligns with many other institutions in being both regulatory and supportive, encouraging an adaptive approach to AI integration. Nonetheless, there is a high degree of uncertainty as to how university teachers should approach the use of AI in student learning in everyday practice. As part of the ongoing search for answers and best practices, another critical question arises: how do students themselves perceive AI, particularly when it comes to completing academic tasks? Without the intent to advocate for AI use in education, this study aims to explore the areas and characteristics of AI usage among teacher candidates, along with the factors that either support or hinder its use. Understanding these aspects may help university teachers refine their assessment approaches and best practices and may contribute to rethinking education practice by leveraging technology in a reasonable, creative, professional, and adaptive manner.

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2. Theoretical Framework

Artificial intelligence can be defined as a system having human-like intelligence characterized by cognitive abilities, learning, adaptability, and decision-making capabilities (Chen, Chen & Lin, 2020). László Horváth (2023) points out that these systems can adapt by analysing the impact of their responses on the environment. As a result, they can provide increasingly accurate answers to users.

In the literature, we find two main perspectives on the relationship between artificial intelligence and education. There are studies which focus on the regulatory issues and dilemmas surrounding the integration of AI into education (Rajki, Nagy & Dringó, 2024). While other scholarly works explore the transformative impact of AI on education, exploring its advantages and disadvantages as well as its specific applications (Horváth, 2024; Bognár, 2024; Nerantzi et al., 2023; Perry, 2024). Undoubtedly, the effective and appropriate use of AI requires users to possess a certain level of literacy in this area. According to Long and Magerko (in Bognár, 2024) AI literacy is a set of skills, competencies, knowledge and attitudes that enable individuals to integrate AI into the learning process. Ng et al. (2021, p. 2) emphasize that AI literacy is a critical area for development in the 21st century, stating that *“similar to classic literacy which includes reading/writing and mathematical abilities, AI literacy has emerged as a new skill set that everyone should learn in response to this new era of intelligence”*. This perspective must be taken into account in the training of future educators.

The question arises: where should one acquire AI literacy? In addition to introducing AI usage policies, higher education institutions strive to provide guidance to students. For instance, the Career Office at the University of Pécs advises students to use various AI tools during exam periods for learning purposes such as quick and efficient information retrieval, personalized learning experiences, revision and practice, synthesis, time management, language assistance, and even stress management or mental support in order to enhance learning outcomes.

Wang et al. (2023) propose a four-factor model for understanding the willingness to use AI. They argue that cognitive knowledge, mindset, technical proficiency, and ethical considerations play a crucial role in whether teachers perceive AI as a tool for enhancing efficiency or, conversely, as a threat. In this context, Bognár (2024) emphasizes that teacher trainers need to acquire knowledge in all four areas and adapt this knowledge considering the characteristics of student groups and developmental goals. Additionally, they must develop the ability to guide their students in using AI purposefully and safely.

3. Methodology and Data Collection

The research underlying this study aims to examine how kindergarten and primary school teacher candidates use artificial intelligence in relation to their studies by exploring the following areas:

- To what extent and in which learning areas do they use AI?
- What are the factors encouraging or hindering AI application?
- What challenges do they face, and what kind of support do they need to overcome these challenges? Who do they expect support from, and in which areas?

The study involved students from the Department of Pedagogy and Applied Didactics at the Faculty of Psychology and Educational Sciences of Babeş-Bolyai University. The sample consisted of kindergarten and primary school teacher candidates, as well as students enrolled in the Efficient Learning Strategies master's program, totalling 431 participants. This represents 69.6% of the institute's student population. The average age of respondents was 22.8 years, with the youngest participant being a 19-year-old early childhood educator and the oldest respondent being 49 years old. Table 1 provides a summary of the main characteristics of the sample based on additional variables.

Table 1: *Main characteristics of the sample*

Variable	Subdimensions of variables	Individuals	%
Gender	Male	1	0,2
	Female	430	99,8
Study program	BA	390	90,4
	MA	41	9,6
Year of study	1 st	180	41,7
	2 nd	129	29,9
	3 rd	122	28,4

Since we used convenience sampling, the sample cannot be considered fully representative. However, the sample size—nearly three-quarters of the institute’s student population—allows for meaningful observations and conclusions to be drawn regarding the student body within the department under scrutiny.

The study was based on a self-constructed questionnaire consisting of 27 questions (21 closed and 6 open-ended). The first section focused on collecting demographic data. The second section aimed to engage participants through free conceptual and emotional associations. It then addressed the first two research questions by exploring the characteristics of AI integration into respondents’ learning activities, as well as the motivating and inhibiting factors and challenges students face. Understanding these aspects is crucial for two reasons. On the one hand to form an accurate picture of students’ familiarity, attitudes, and needs regarding the latest technological advancements. On the other hand, it is a fundamental principle in higher education pedagogy that understanding students is essential for effective educational development, and as such, a prerequisite for aligning instructors’ and students’ work for successful education. This also includes understanding which learning support tools students are aware of and actively use. The third section examined students’ need for support in effectively using AI as a learning aid, identifying specific areas where assistance is required, the degree of assistance required and the key facilitators in this process. It is crucial to determine the role of higher education institutions in this process through highlighting the extent to which they should consider it their responsibility to assist students in the learning process, in order to ensure that student needs and training provisions align.

4. Artificial Intelligence in Teacher Candidate Learning

Research findings shed light on teacher candidates’ use of artificial intelligence in the learning processes; what they use it for, to what extent, and what goals they want to achieve with it. Results also show student needs in terms of assistance in order to ensure the professional and appropriate use of AI. Descriptive statistics was used to analyse research results, and the discussion on findings is structured based on the research questions.

At the beginning of the survey, to help participants focus on the topic, we asked them to provide conceptual and emotional associations.

Figure 1. shows that, in conceptual terms, the most prominent association is one of the most well-known, freely accessible applications, followed by the terms "robot" and "assistance" at the same rate. The next positions, in terms of frequency, are occupied by the terms "development" and "information (acquisition)". Overall, the conceptual associations point to the most well-known (and likely most widely used) AI application, while both positive (assistance, development, information) and negative (threat, robotized world, unemployment) associations surface. A similar phenomenon can be observed concerning emotional associations (see Figure 2.). We found emotional neutrality, and to a lesser extent, ambivalence. Negative associations, however, are much more frequent (fear, frightening, sad, uncertainty, frustration, anxiety, worry, doubt). Positive associations are represented by terms such as

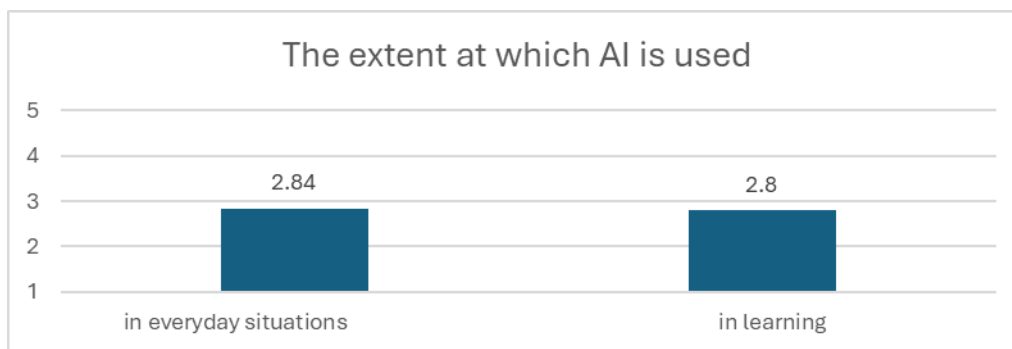


Figure 3. *The extent to which AI is used in everyday situations and in learning – N=431 (own editing)*

Further analysing the features of AI use in the context of learning we found that about one-fifth of the students use AI for understanding concepts (20%), for data collection (21%), and for translation (20%) (see Figure 4.). Significantly fewer students use it to complete specific tasks (less than one-tenth of the sample), such as preparing tasks for teaching practice, taking notes, completing individual or group assignments, and creating worksheets and lesson plans.

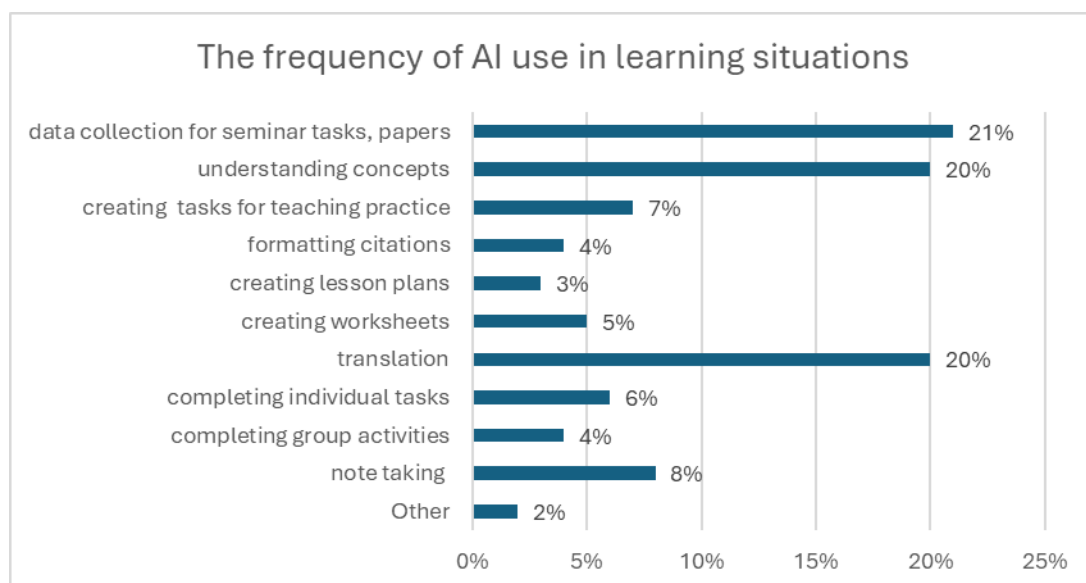


Figure 4. *The frequency of AI use in learning situations – N=431 (own editing)*

Another exciting question to explore is what motivates or discourages students from using AI. Findings are presented in Figure 5. The most motivating factors (with average scores of 3.4 and 3.3) are the general support AI provides in learning, and its ability to assist when students encounter difficulties, as well as its ability to facilitate the learning process. These factors are followed by the aspects of convenience and reducing study time, though with significantly lower values ($t=-8.65727$; $p<.00001$). Other motivating factors, such as trust in AI's problem-solving abilities and a greater sense of efficiency, appear with a halved average value.

The demotivating factors show similar average values to the motivating ones. In this regard, we observe that students associate several risks with AI use (3.3). The idea that using AI to complete tasks is unethical holds a significantly lower value ($t=7.427932$; $p<.00001$), with an average of 2.7. Fear-based avoidance of AI is present to a lower degree among the participants.

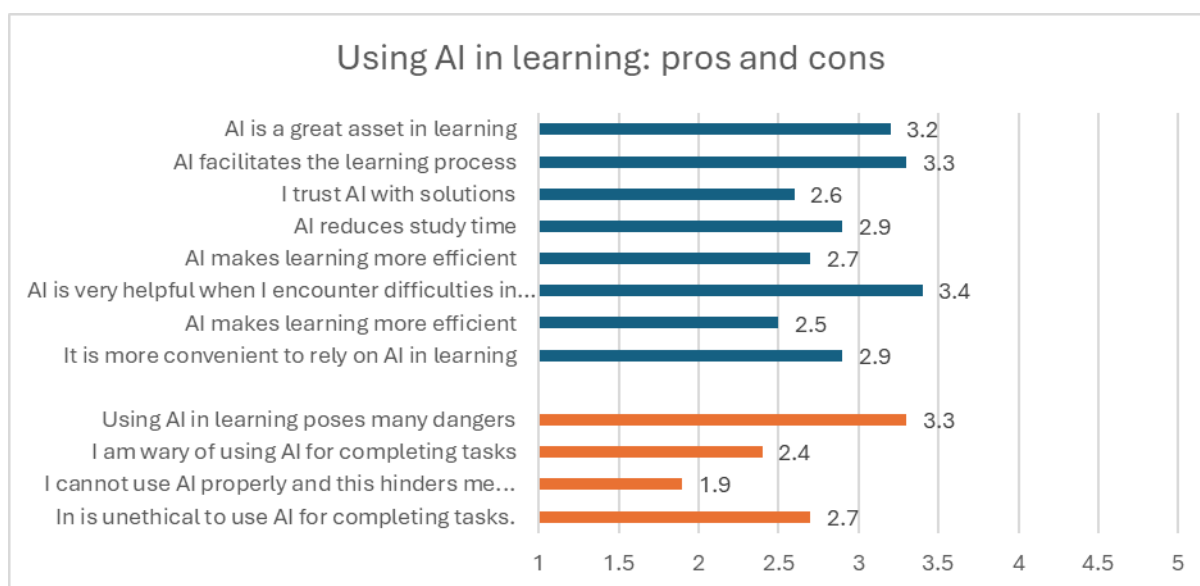


Figure 5. Pros and cons for using AI in learning – N=431 (own editing)

Figure 6 illustrates the challenges students face when using AI. The most significant challenge, with the highest average score (3.4), is to rely on AI only when they are stuck and unable to solve a task through their own efforts. More than half of the sample (51.3%) identified this as a very strong challenge. Critically evaluating the answers provided by AI is considered a significantly smaller challenge ($t=-6.069548$; $p < .00001$), (strongly felt by 30.7%). One-third of the sample (33.7%) often struggles with formulating prompts correctly and purposefully to maximize the relevance and accuracy of AI-generated answers.

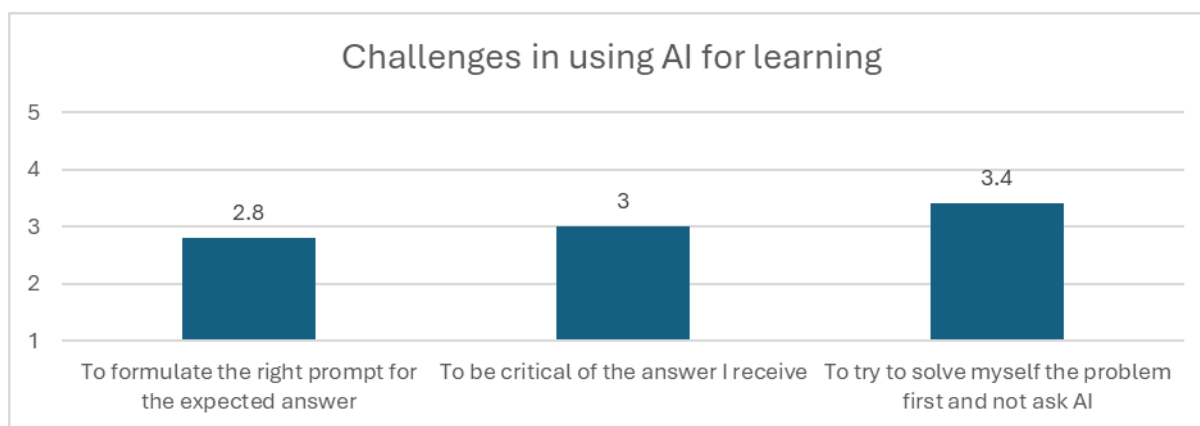


Figure 6. Challenges in using AI for learning – N=431 (own editing)

Among other types of challenges, participants highlighted the superficial, vague, or overly general nature of AI-generated responses, developing a habit of moderate use, and the quick verification of the accuracy of answers received.

The research also explored the *objective hindrances* to integrating AI into the learning process. There are several factors that hinder or make AI application difficult (see fig. 7.), with ethical concerns being the most significant. Strong or very strong ethical reservations were reported by 28% of students. A similarly significant hindrance was the lack of user knowledge necessary for the proper application of AI (27.6% of the sample feeling significantly restricted in AI use due to this issue). Financial and technical constraints were also identified as obstacles, though these were significantly less restrictive than the previously mentioned factors or university regulations ($t=-4.598592$; $p < .00001$). A thought-provoking result is that 11.6% of respondents have never considered using AI for learning, whereas nearly three-quarters (72.4%) have already used it in their studies. For 12.6% of students, financial

constraints pose a strong barrier, while 16.2% face significant technical limitations in integrating AI into their learning. Overall, students identified the very hindrances that the literature (Wang et al., 2023; Bognár, 2024) has highlighted as crucial in relation to educators' AI literacy. In the long run, these findings also raise the question of equal access to learning opportunities considering the disparities in AI accessibility.

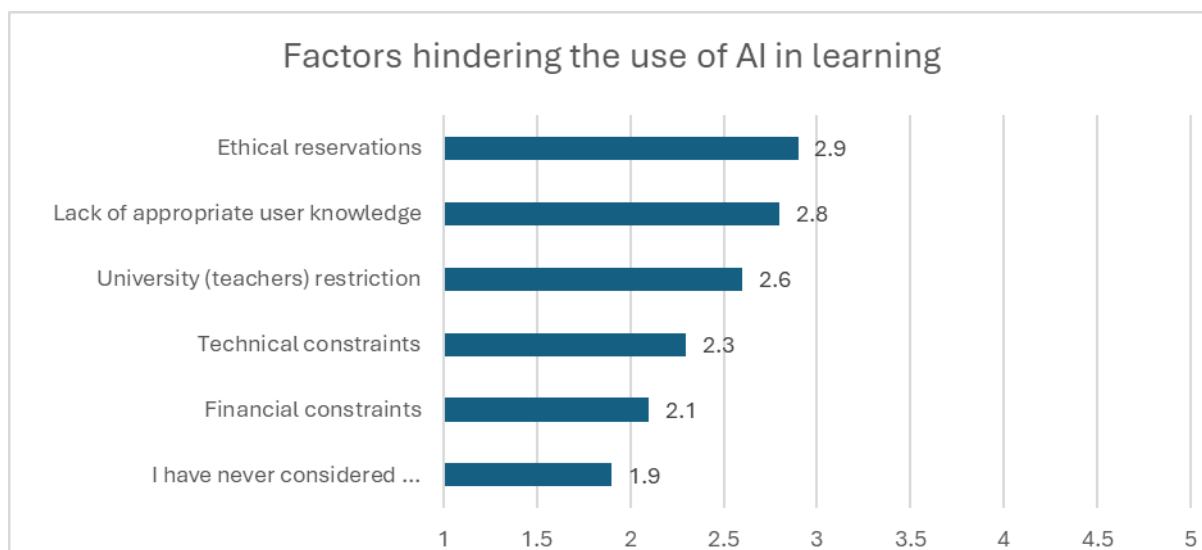


Figure 7. Factors hindering the use of AI in learning – $N=431$ (own editing)

In addition to the objective hindrances to AI use, we also examined *subjective hindrances*, which are primarily related to student perception of AI and its potential disadvantages. These trends are illustrated in Figure 8. A key concern, with a relatively high average score of 3.8, is that reliance on AI may diminish students' learning abilities and individual effort, potentially affecting their long-term academic performance. Furthermore, students highlight that, by using AI, learning outcomes may not accurately reflect their actual knowledge, raising concerns about distorted assessments. This underscores the urgent need to rethink and adapt university evaluation and grading systems to ensure fairness in academic assessments. Another subjective hindrance is a decline in self-confidence and trust in one's abilities, along with fears that AI use may stifle originality and the willingness to present students' own ideas. These subjective inhibiting factors are strongly or very strongly present in nearly two-thirds (60%) of the sample.

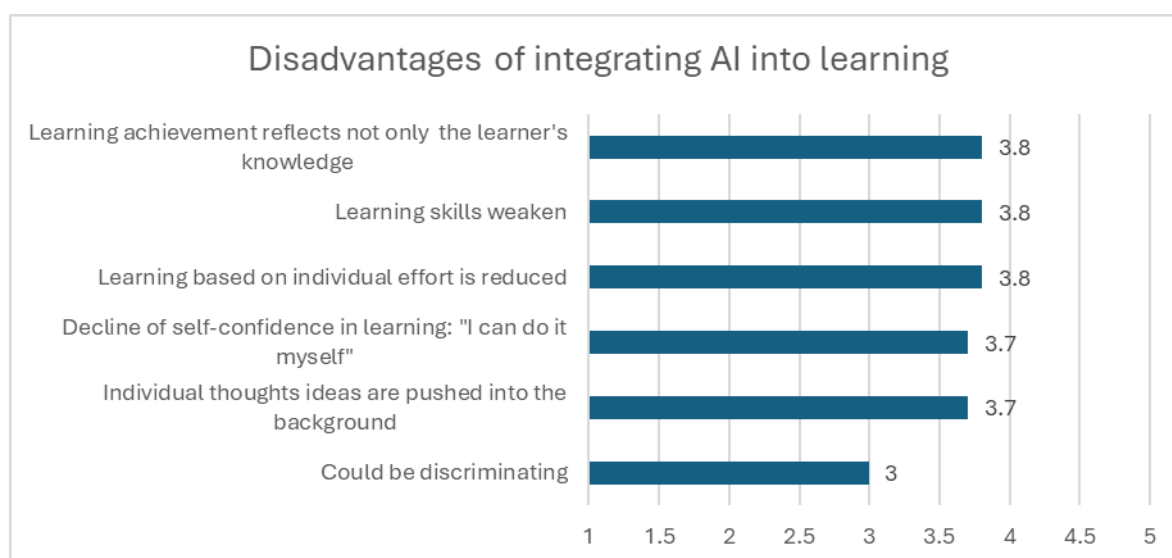


Figure 8. Students' perspective on the disadvantages of AI application in learning – $N=431$ (own editing)

Experiencing the limitations of AI can also be considered a drawback. A quarter of the students (24%) reported that artificial intelligence is not infallible. However, our findings indicate that despite these challenges and the awareness of AI's limitations, students use it to meet university requirements, with an average rating of 3.8. Exactly two-thirds (66.6%) of respondents stated that they rely heavily or fully on AI in their academic studies and in fulfilling university requirements. This suggests that, despite concerns, risks, and obstacles, students are not turning away from AI—fortunately! As this is not an option. In the following section, we present how students perceive the role of AI in their learning in the near future and what kind of support they require to ensure optimal and appropriate use.

4. 2. The future of AI in teacher candidate students learning

The following section summarizes how respondents perceive the future of AI in learning, as well as the challenges that higher education institutions and teachers must face to ensure that students use AI effectively and ethically. One-third (34%) of respondents consider it important or very important to acquire the necessary skills to use AI in learning, recognizing that as it is increasingly becoming an integral part of all aspects of life, learning cannot—or perhaps should not—be excluded from this trend. However, as shown in Figure 9, nearly the same proportion of respondents consider that this issue is slightly significant or not significant at all. Most respondents selected a neutral position, indicating indecisiveness. These results call attention to the prevailing uncertainty and reservations regarding the implementation of AI in learning and also to the fact that this technological advancement is rather controversial in this area.

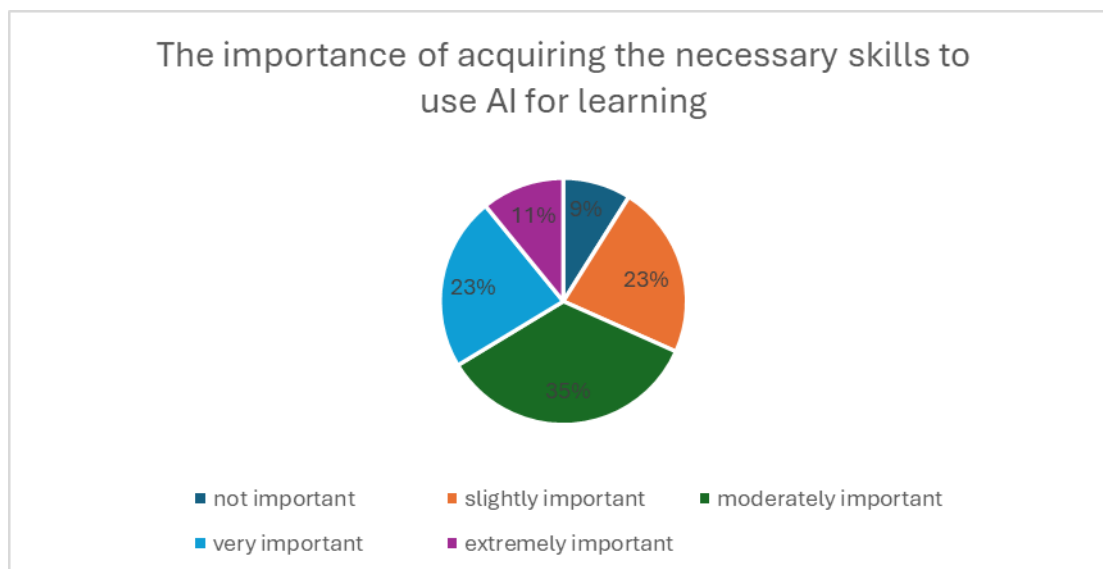


Figure 9. *The importance of using AI in learning – N=431 (own editing)*

Although 54% of respondents believe that teacher candidates will not need (or will only slightly need) to use AI in their learning, the average rating for this question is 3.5. This is significantly higher ($t = -10.223265$, $p < .00001$) than the rating given for the perceived importance of acquiring AI skills (3.0). At the same time, openness to learning AI use is reflected in the fact that 90% of respondents require some level of support (see Figure 10.) to acquire the necessary skills, with an average score of 2.8. This support should address both subjective and objective hindrances.

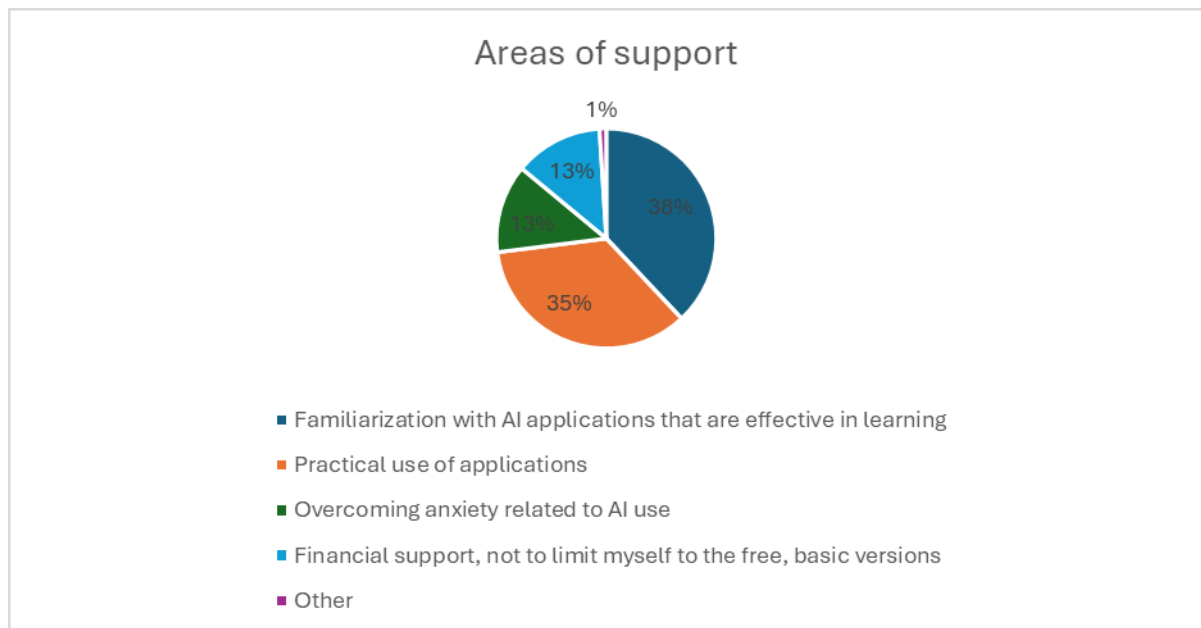


Figure 10. Areas in which assistance was requested for the application of AI in learning – $N=431$ (own editing)

The most common area where assistance is requested is familiarization with AI applications and practical techniques/tricks, tips (see Figure 10). However, some of the respondent need help with overcoming objective hindrances, such as the free use of more complex versions. There are also students who feel anxious about using AI, consequently they need assistance in dealing with their fears.

A nuanced picture emerges when looking at who the respondents expect to receive help from (see Figure 11.).

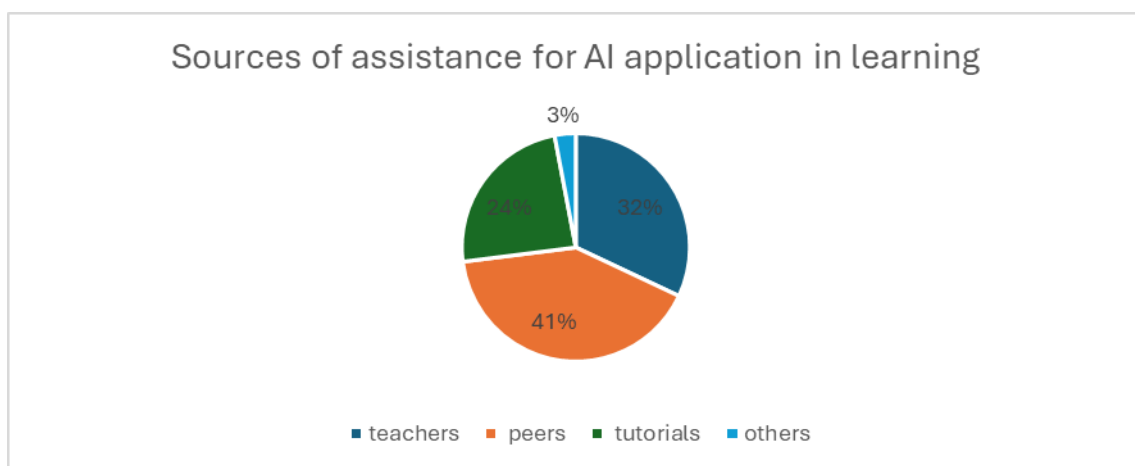


Figure 11. Sources of assistance for AI application in learning– $N=431$ (own editing)

41% of the sample would rather seek help from peers, while 32% trusts their teacher in the role of facilitator. About a quarter of the respondents believe that tutorials can also address their questions related to the use of AI in learning. By implication, this result also illustrates and emphasizes that students have realized by now that the teacher is not the only source of support. In fact, the role of the teacher as facilitator is less significant than that of other sources collectively.

5. Discussion and conclusions

Overall, it was observed that respondent have already started to explore the possibility of using AI in learning. The focus is not so much on transferring task-based learning situations, but rather on cases where support is needed due to a lack of understanding, getting stuck, language related difficulties, lack of information, or challenges in individual progress. At the same time, teacher candidates are largely aware that they will need to face challenges that may currently discourage them from using AI, and to overcome both objective and subjective hindrances.

Considering the challenges of applying AI in education, László Horváth (2023) emphasizes the importance of addressing teachers' competence gaps, lack of interest, and negative attitudes in order for this technology to become an asset in education. Research findings show that the lack of skills and the emergence of negative emotions related to the use of AI are not only common for teachers, but also among teacher candidates. It is of crucial importance to address this issue in the case of teacher candidates and assist them in using AI appropriately. In the process of implementing AI in learning, it is essential for teachers to be aware that students already have experience in using AI in general, or even in the area of education, as our research results emphasize. Therefore, the primary task is to teach 'proper use,' which means adapting their existing knowledge to learning. A constructive learning approach is essential, whether we focus on technical skills or AI literacy, or when shaping attitudes and raising awareness of ethical requirements. In this process, students should not be left on their own (even though only about a third of the respondents explicitly request this kind of help from their instructors). For teacher candidates, it is particularly important to support the goal-directed and ethical use of AI. They are the ones who should assist and guide the future generation in the smart application of smart opportunities (in learning as well). Further research is needed to explore the types of support that teacher candidates expect and the agents they expect it from, as well as what kind of support they expect from institutions and instructors in order to ensure that the help offered meets the need. At the same time, institutions must also play a role in shaping the demand for help, as one cannot ignore the pedagogical aspect when applying AI for learning purposes (Bognár, 2024). This means that while students can learn about tools from other sources, the institution and teachers play a significant role in shaping their attitude and content knowledge (e.g., formulating prompts, critically evaluating responses, ethical requirements, etc.). The pedagogical and didactical aspects must become prominent, which will not only make teacher candidates effective AI consumers (in their own learning process) but also enable them to adapt it to pedagogy. The realization of all this is a very concrete manifestation of the prospective nature of professional development, as today's teacher candidates, as future educators, will certainly not be able to avoid the use of this technology.

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