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Artificial intelligence for higher education: benefits and challenges for pre-service teachers

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Introduction: The study investigates the integration of artificial intelligence (AI) in higher education (HE) and its impact on pre-service teachers at the University of Latvia (UL) by exploring pre-service teachers' perceptions of the benefits and challenges of AI in both their academic learning and their future professional roles as educators, particularly regarding the promotion of inclusive education.

Methods: Data was collected via an online survey of 240 pre-service teachers across various disciplines at the UL. The survey included demographic details, AI usage patterns, and perceived benefits and challenges. Responses were analyzed using descriptive statistics, Kruskal-Wallis H tests, Spearman's correlation, and thematic analysis.

Results: Less than half of the participants used AI in their studies, with many expressing ambivalence or opposition toward AI. Benefits included language assistance and accessibility to global knowledge, while challenges involved reduced critical thinking and concerns over plagiarism. Despite recognizing AI's potential to promote inclusivity, most pre-service teachers have not applied it in practice. No significant differences in AI perceptions were found based on age, gender, or study level.

Discussion: The findings highlight a low adoption rate of AI among pre-service teachers and a gap between theoretical recognition of AI's potential and its practical application, particularly for inclusion. The study emphasizes the need for HE institutions to enhance AI literacy and readiness among future teachers.

Conclusion: AI is underutilized by pre-service teachers in both HE learning and teaching environments, which has implications for teacher preparation programs that better integrate AI literacy and inclusive practices.

1 Introduction

Although artificial intelligence (AI) has been known and used for some time, its best possible use in higher education (HE) is yet to be found. There is increasing interest in the impact of AI on education research (Chen X. et al., 2020) and AI's application in HE has not yet been consolidated (Hinojo-Lucena et al., 2019) or sufficiently evaluated to find its true benefits (Kairu, 2020). The use of AI in HE is connected to controversies, unclear methodological questions, and ethical issues. Critical reflections on the challenges and risks of AI in education are also still missing (Zawacki-Richter et al., 2019). However, information accessibility and free access to AI tools increase the opportunities to use them in the education process—for both teaching and learning.

The potential of AI in education is widely recognized and highlighted internationally by educational organizations (Brown et al., 2020). Popenici and Kerr (2017, p. 1) define AI as "computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and use of data for complex processing tasks." AI includes various technologies such as learning analytics, semantic analysis, etc., and various tools have been developed, such as ChatGPT, Gemini, Eduaide, Cognii Virtual Learning Assistant, and others. In scientific literature, AI's promise in education has been associated with a revolution to address some of the challenges in education, educational transformation, and paradigm shift for education to become more student-centered, diverse, personalized, of higher quality, and equitable for everyone (Bhutoria, 2022; Chen L. et al., 2020; Kumar, 2023; Wang et al., 2021; Holmes and Miao, 2023).

Like any recent technology, AI is changing the process of teaching and learning in many ways. However, the use of AI does not always come with fundamental transformations in pedagogy, nor does it happen as often and as fast as intended. As several researchers have concluded, despite the increasing use of AI in teaching and learning, there have just been a few cases where AI was truly used to transform pedagogy (Chen X. et al., 2020; Crompton et al., 2022; Hwang and Tu, 2021). AI can be used in many ways in education—to assess students (Benotti et al., 2018; Chen L. et al., 2020) for diagnostics purposes (Crompton et al., 2022), to provide feedback to both students and lecturers and to grade and evaluate students (Chen L. et al., 2020; Fahimirad and Kotamjani, 2018; Yang et al., 2019) thus to provide ongoing formative assessment (Baidoo-Anu and Ansah, 2023). It can be used for personalized intelligent teaching (Wang et al., 2021; Akinwalere and Ivanov, 2022), for learning analytics (Chen L. et al., 2020; Salas-Pilco et al., 2022a), for gaming and active learning, specifically in writing and language acquisition (Crompton et al., 2022), for more personalized support and assistance (Hwang and Tu, 2021; Chan and Zary, 2019), for students with special educational needs (Hopcan et al., 2022), and international students overcome challenges and promote their inclusion in other educational cultural environments (Wang T. et al., 2023). AI can be used across educational fields and disciplines so that students can engage more deeply with learning, do so with enjoyment, feel more satisfied, and be more included in the learning process.

As early as 1999, Brown announced that AI and virtual reality would bring about changes in teacher education (Brown, 1999). The latest research suggests that teacher education is gradually adopting recent technologies, and that AI can be successfully used in teacher education (Salas-Pilco et al., 2022a). For example, it can prepare future teachers for dealing with various issues, such as classroom management aspects (Attwood et al., 2020). However, AI's adoption rate in education is still slow compared to other fields (Salas-Pilco et al., 2022a).

While there is a rapidly growing body of research about AI in HE (Zawacki-Richter et al., 2019), general education (Chen L. et al., 2020), and AI's usage in HE, specifically in teacher education (Salas-Pilco et al., 2022a), there is still a lack of research into AI's use in teacher education (Celik et al., 2022) in both local (Latvian) and global contexts. This lack of critical evaluations of the benefits and opportunities of AI in HE was the primary motive

for this research. The second reason was that because pre-service teachers in Latvia often combine the study process and working at school as teachers, it is reasonable to consider whether pre-service teachers are transferring their learning experience in HE to their professional teaching experience in general education by adopting the use of AI in teaching.

This research will therefore try to reduce the gap in the knowledge about how AI has been adopted and used in education, specifically by pre-service teachers in HE in the context of studying at the university and then transferring their usage of AI to their professional working experiences in general education to promote an inclusive and more diverse learning environment for all. The research aims to answer several questions:

- RQ1: Are pre-service teachers using AI in their learning?
- RQ2: What do pre-service teachers perceive to be the main opportunities and challenges with the use of AI in HE?
- RQ3: Are there any differences in perceptions of AI regarding age, gender, and level of study?
- RQ4: Do pre-service teachers, already working as practicing teachers, use the possibilities of AI to build an inclusive environment in their classes?
- RQ5: Are there any correlations between future teachers using AI in the study process and using AI in their professional lives as novice teachers?

2 Literature review

2.1 Pre-service teachers use of AI

Research suggests that university students from different fields (medicine, business, education, art, etc.) and countries and continents are informed about what AI is (Abdelwahab et al., 2023; Almaraz-López et al., 2023; Bisdas et al., 2021). Although the majority of studies reveal that students have a positive attitude toward AI and positively perceive the possibilities provided by AI (Bonsu and Baffour-Koduah, 2023; Chan and Hu, 2023; Hussain, 2020; Jeffrey, 2020; Leoste et al., 2021; Limna et al., 2023; Lukić et al., 2023; Moldt et al., 2023; Mousavi Baigi et al., 2023; Pauwels and Del Rey, 2021; Swed et al., 2022; Terblanche et al., 2023), there are some exceptions (Haseski, 2019; Keleş and Suleyman, 2021). In one case, pre-service teachers even had negative emotions toward AI (Haseski, 2019).

At the same time, it seems that while students believe that AI will be important in their professional field in the future (Al Saad et al., 2022), they are concerned about the rapid development of AI and how it will affect humankind (Jeffrey, 2020), some do not want to live in a world ruled by AI (Haseski, 2019). From the very beginning, there were questions about whether and how AI would affect teachers. Would it be a threat or bring some desirable changes (Romiszowski, 1987)? Some argue that AI tools might replace lecturers in some subjects in the future (Fahimirad and Kotamjani, 2018), but others propose that AI will reduce teacher burden (Andersen et al., 2022). The majority, however, agree that teaching will not be possible without a teacher. Using AI to enhance human thinking and augment the educational process is the most important task, not to reduce it to a set of procedures for content

delivery, control, and assessment (Popenici and Kerr, 2017). AI should be used to support teaching, not to replace it (Akinwalere and Ivanov, 2022). Thus, stress is placed on changing the teacher's role and pedagogies used in the teaching process.

Although students are willing to integrate AI tools into their future careers (Chan and Hu, 2023), they do not always feel fully prepared by HE to do it (Abdelwahab et al., 2023). They have limited knowledge and skills in working with AI (Almaraz-López et al., 2023; Mousavi Baigi et al., 2023). Technology readiness has a significant influence on technology adoption (Damerji and Salimi, 2021). It is most probably because of insufficient knowledge that students have doubts related to AI's use in their professions, for example, how to solve data protection issues and the risk of being constantly monitored at work (Moldt et al., 2023). Consequently, the need for further training of students has been articulated (Almaraz-López et al., 2023).

Like other students, future professionals and pre-service teachers are aware of the implications of AI tools in their lives and society (Karahan, 2023). However, to use AI in the classroom, teachers need to be prepared and informed about what and how AI can be used in teaching and learning (Antonenko and Abramowitz, 2023). The usage of AI in the classroom can also be impacted by teachers' beliefs (constructivist vs. transmissive) about teaching (Choi et al., 2023).

Research on AI literacy in early childhood education underlines two vital aspects for researchers and educators to work on: educators must constantly improve their competence in using AI, and child-friendly, safe AI tools and curricula must be developed. At present, since teachers lack the methodological skills to use AI meaningfully, it is common for teachers to work with children using AI tools that are not suitable for their age or abilities or to leave them to their own devices without the teacher's guidance (Su et al., 2023). Studies indicate that teachers are one of the key stakeholders in implementing AI-enhanced education. Yet, little attention is paid to the needs and challenges teachers face in successfully implementing AI in the teaching-learning process. Thus, the interrelationships of the several dimensions of teacher readiness should be studied in the context of the educational use of AI: cognition, ability, vision, and ethics (Lameras and Arnab, 2022; Wang X. et al., 2023).

2.2 Opportunities and challenges of using AI

Both the opportunities and challenges of using AI have been identified in the research. There is growing research specifically about the benefits and challenges of using AI by teachers (both in-service and pre-service) (Salas-Pilco et al., 2022a).

There are many benefits for teachers using AI: improving planning to address children's individual needs better, implementing a curriculum through immediate feedback and teachers' interventions, and improving assessment (Celik et al., 2022). AI can assist teachers in different activities to reduce their workload, for example, by providing automatic grading and adaptive learning that identifies specific areas of improvement to ensure more focused learning experiences for students (Salas-Pilco

et al., 2022a). Using AI helps to provide more in-depth learning (Sharma et al., 2019). It is already acknowledged that AI can be immensely helpful for students to reach learning goals faster and have higher learning achievements, such as when learning languages (Rad et al., 2023) or music, specifically piano (Li and Wang, 2023). When teaching languages, it is possible to use AI tools for generating personalized learning materials, using machine translation tools, involving AI writing assistants, conversing with chatbots, applying AI-powered language learning software, relying on intelligent tutoring systems, and using intelligent virtual reality (Pokrivčáková, 2019).

Researchers have discussed the numerous benefits that AI has on the students' learning experiences (Rus et al., 2013). For instance, AI enables tracking of the learning progress, increasing the quality of the learning process (Kahraman et al., 2010), and helps international students reduce language barriers and cultural differences by providing necessary support for their academic success (Wang T. et al., 2023). AI can facilitate students' learning achievement, technology acceptance, learning attitude and motivation, self-efficacy, satisfaction, and performance (Chiu et al., 2023). Research into generative AI has stressed the possibility of receiving personalized and immediate learning support, writing and brainstorming support, research and analysis support, visual and multimedia support, and administrative support (Chan and Hu, 2023). ChatGPT can facilitate adaptive learning, provide personalized feedback, support research and data analysis, offer automated administrative services, and aid in developing innovative assessments (Rasul et al., 2023). AI tools may change how students learn and assist them in developing essential skills (Fahimirad and Kotamjani, 2018). AI also makes access to education easier for more challenged students, thus promoting inclusion (Pisica et al., 2023) and can be used to support inclusive education for minority groups (Salas-Pilco et al., 2022b).

At the same time, however, using AI in learning has become a rather controversial issue due to certain new educational challenges and risks (Holmes and Miao, 2023). Many challenges may be encountered, such as a lack of teacher knowledge or limited technical infrastructure at school (Celik et al., 2022). These include cost-effectiveness, cultural clashes (Fahimirad and Kotamjani, 2018), data protection and security (Pisica et al., 2023), and even AI getting out of control and ruling humans (Haseski, 2019). Although university students today have an opportunity to learn in an interactive and personalized environment enabled by AI solutions, the challenges in HE, especially in middle-income countries, are related to the fact that universities try to be innovative on the one hand but, on the other, often lack financial and other resources. In some cases, such need has served as an incentive to create and develop low-cost technologies capable of providing personalized support and services to students (Kuleto et al., 2021). Currently, there are many discussions about the ethical aspects of using AI in HE (Crowe et al., 2017; Pisica et al., 2023). For example, Crowe et al. (2017) observed that AI may encourage dishonesty and jeopardize academic integrity.

There is also a growing body of research arguing that ChatGPT can be misused in dishonest ways. Ethical considerations should also be considered so that AI does not threaten the preservation of human individuality (Kuleto et al., 2021). Rasul et al. (2023) identified several challenges when using ChatGPT: ethical and

equity considerations, academic integrity concerns, reliability issues, the inability to evaluate and reinforce graduate skill sets, limitations in assessing learning outcomes, and potential biases and falsified information in information processing. In order to overcome such problems in task assignments, it is suggested that AI should not be banned; instead, the tasks offered to HE students should be changed. Instead of asking them to reproduce knowledge, there should be tasks with deeper learning, where students engage in personally meaningful tasks, such as class-specific, guided self-reflections for assessing their own work, achievable only by humans (Overono and Ditta, 2023). Thus, AI can be a valuable tool in higher education if it is used responsibly.

2.3 Using AI in the classroom by pre-service teachers

Although there have been some developments in AI's use in teacher education, its adoption rate is still slow compared to other fields (Salas-Pilco et al., 2022a). The report Emerging Technologies and the Teaching Profession (Vuorikari et al., 2020), which provoked discussion about how digitalization and automation can impact the teaching profession, emphasizes that teachers' competence to apply technologies is insufficient to their current needs in the profession. However, educators clearly need knowledge, skills, and the right attitude to apply technologies in their teaching practice. The development of various AI processes, practices, applications, and tools in education means that teachers must develop specific ethical capabilities, pedagogical, digital, and technical competencies, and data literacy, as well as change their understanding of their role as teachers. For example, use personalized learning to provide students with different learning materials that are based on their individual learning needs (Akgun and Greenhow, 2022). The use of AI in education can update teaching and learning practices and how learning is organized and assessed in educational institutions. Researchers indicate that in the educational process, teachers should develop the competence of teaching using AI in pedagogically rich, ethical, and challenging ways, which means they should encourage an understanding of the characteristics of AI tools to be able to select, use and evaluate AI tools in the educational process. The essential aspect of a teacher being able to interpret data provided by AI tools to promote student learning with data-based feedback should be added to their research skill set. The ethical competence of teachers in the AI context relates to the requirement for teamwork and leadership skills in building relationships with AI assistants that complement but do not replace humans (Lameras and Arnab, 2022; Salas-Pilco et al., 2022b).

It should be noted that there are several types of solutions when using AI in education (pedagogical, technological, and sociocultural solutions), which reveals the potential of AI and recent technologies and the importance of quality education to promoting inclusive education in an inclusive society and world (Chiu et al., 2023). Promoting teachers' awareness of using AI systematically, including AI in teacher education and continuing education programs, and providing continually updated guidelines for using AI in teachers' work is important. Teacher education should have a strong interdisciplinarity dimension to learn about

and use AI in a targeted way. The more inclusive education for a sustainable future should offer more of a STEM+Arts (STEAM) approach to education, which allows for more successful development and meaningful use of AI solutions and ensures the inclusion of diverse student minority groups (Skowronek et al., 2022). Finally, a study about the acceptance of AI from science teachers' perspectives (Al Darayseh, 2023) draws attention to the fact that the adoption and use of AI may differ in the practices of teachers from different fields, and cultural differences should also be considered. Differences in age, study level, and gender should be further examined, as well as knowledge implementation in the practice.

3 Materials and methods

3.1 Instrument

For this study, a mixed-methods approach was applied. Qualitative and quantitative approach was used in parallel (Flick, 2018) to identify more outcomes (Bryman, 2008). The instrument used was a self-administered questionnaire on QuestionPro, which was available online from April 5 to May 15, 2023. The questionnaire items (N = 37) were developed and adapted based on the literature review. The questionnaire consisted of four sections: section one related to demographic details (including gender, age, student status, name and type of institution, and program of study), section two consisted of 15 questions related to the use of AI, and sections three and four included questions about other HE issues. The current paper analyzes only part of the questionnaire related to the research questions (20 items from sections one and two).

Three field experts from UL reviewed the original questionnaire to ensure its content reliability. Based on their recommendations, slight modifications were made. Next, a pilot survey was conducted by asking three students to complete the questionnaire. Based on their feedback, further modifications were made to ensure that the questions were appropriate for collecting valid and reliable data. Some questions required respondents to answer using a 4-point Likert scale, others were simple yes/no questions, and there were also open-response questions.

3.2 Participants

Initially, we asked all UL students to complete the questionnaire; 1,273 completed it. As it is explained above in this particular study, we are more interested in preservice teachers' experiences adopting AL both in their learning and working at school. It relates to the necessity to explore deeper the phenomenon that in Latvia, often pre-service teachers combine the study process and working at school as novice teachers even from the first study year. We separated students from pre-service teacher programs from the pool for our current study's analyses. Three hundred and seventy three students from various pre-service teacher programs (representing different curriculum subjects) were identified. Subsequently, 240 respondents were selected for further analysis as they answered the question, "Have you used any AI tool for learning purposes?"

In terms of the participants' demographics, their ages ranged from 19 to 60; 94% (226) were women; 50% studied college-level programs (ISCED 5), 37% bachelor-level (ISCED 6), 10% master's-level (ISCED 7), and 3% doctoral-level (ISCED 8); 29% were full-time students, while 71% were part-time students; and while 33% of respondents lived in the countryside, the rest lived in the capital Riga or another city.

3.3 Data gathering and analyses

The participants were recruited through an email targeted at all UL students. The UL Academic Department distributed the email in April 2023 with a request to participate in the study and an explanation of its purpose. Participants were required to fill in an informed consent form before completing the survey. A convenience sampling method was employed to select respondents based on their availability and willingness to participate.

The data obtained were analyzed to consider their internal consistency and correlation. Cronbach's α was 0.947, which is above the minimum value of 0.7. This result indicated a satisfactory level of construct validity and internal consistency of the Likert scales in the questionnaire and confirmed that they were fit for the purpose set in the research objectives. Descriptive statistics were used to analyze the survey data, and a Kruskal-Wallis H test was conducted to test the differences. Spearman's correlation coefficient was calculated to find correlations. Finally, thematic analysis (Braun and Clarke, 2006) was used to analyze the participants' answers to the open-response questions.

4 Results

4.1 RQ1: Are pre-service teachers using AI in their learning?

When asked, "Have you used any AI tool for learning purposes?" 43% of the respondents gave a positive answer, 37% said they had not, and 20% did not know whether they had ever used AI tools. Only 23% of the respondents had used ChatGPT: 3% use it very often (several times a week), 5% use it often (several times per month), and 9% use it once per month.

Of the 22.5% (54) of respondents who answered the question, "Evaluate the benefits of using ChatGPT" (see Figure 1), most gave positive answers about such benefits: "It helped me find the information I needed to complete the work" (69%), "It helped me understand a subject I had very little or no prior knowledge of" (61%), "It helped me save time in completing the task," and "I use it to have a friendly chat about all kinds of issues that interest me" (both 57%).

We used thematic analysis to analyze responses to the open question, "What are the other benefits of using ChatGPT?" Two additional themes emerged from the answers: learning foreign languages and analyzing the quality of one's work.

Students were asked to evaluate how often they used different AI tools. The answers they provided about using AI tools in their studies (see Figure 2) revealed that they used mainly AI tools to deal with information in a foreign language (Google Translate,

Grammarly, Microsoft Translator) and to apply Latvian grammar rules as correctly as possible (Tildes Birojs). They also used them to search for information to solve learning challenges (ChatGPT, Excel Formula Bot) and everyday life challenges (chatbots from government organization homepages). Respondents could indicate other AI tools they use that are not listed in the question. Although we conclude that less than half of preservice teachers use AI in their learning, the AI tools listed show that students mainly use them for searching for information, understanding texts in foreign languages, and creating grammatically correct texts.

4.2 RQ2: What do pre-service teachers perceive to be the main opportunities and challenges involved with AI in HEI?

When answering the question, "Please rate how much you agree with these opportunities created by artificial intelligence in higher education," respondents were asked to evaluate various benefits and opportunities using a 4-point Likert scale. "Rather agree" and "Fully agree" were combined as positive answers.

Students were offered 16 benefits for evaluation. The most valuable benefit (as agreed by 75% of respondents) was that AI tools help students with language barriers to learn, and 70% agreed that they make global knowledge more accessible. The fact that AI tools help students with disabilities to learn was noted as the third most valuable benefit (65%) (see Figure 3).

We also usedthematic analysis to identify more outcomes and to analyze responses to the open question, "What are the other benefits of using AI tools?" Three additional themes emerged from the answers:

- Provides useful tools to help create assignments and tests.
- Helps to evaluate/check the quality of information.
- Develops text editing and correction skills.

When answering the question, "To what extent do you agree with these challenges and risks created by artificial intelligence in higher education," students could evaluate eight challenges when using AI tools on a 4-point Likert scale (see Figure 4). "Rather agree" and "Fully agree" were combined as positive answers.

Most of the respondents agreed that using AI tools reduces the need to exert oneself, increases laziness, and reduces students' interest in doing their research and coming to their conclusions or solutions (both 66%). 59% agreed that using AI tools causes plagiarism, and 58% agreed that effortlessly generated information negatively affects students' critical thinking and problem-solving skills. At the same time, when evaluating the benefits of AI, 55% agreed that using AI tools helps develop critical thinking skills, and 49% agreed that it helps develop problem-solving skills.

We used thematic analysis to analyze responses to the open question, "What are the other challenges of using AI?" Four additional themes emerged from the answers:

- Can promote the usage of false information by relying on false information generated by AI tools.
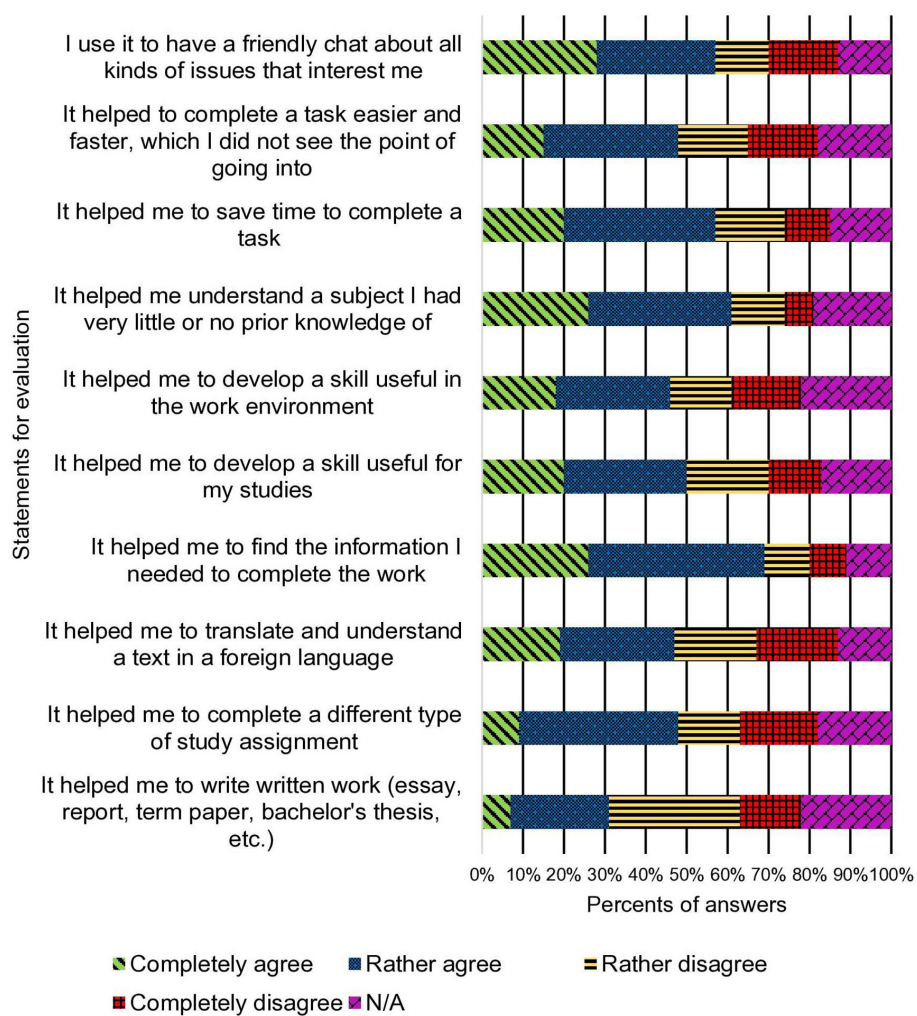- Logical, structured speech and language-formation skills are reduced.

FIGURE 1
Summary of answers to the question "Evaluate the benefits of using ChatGPT."

- The fullness of an individualized personality may be lost because, over time, students may start to think alike, solve problems similarly, and act uniformly.
- Children and students may lose motivation to learn as everything is told to them upfront.

With this context about the benefits and challenges of AI in HE, 40% of students gave a positive answer ("Partly agree" or "Strongly agree") to the statement, "I am excited about the possibilities created by the use of artificial intelligence." However, 35% gave a positive answer to the statement that "Artificial intelligence should be banned in the study process." Less than half had a positive attitude toward AI. Thus, we can conclude that students have rather controversial attitudes toward using AI in the teaching and learning process, they perceive both opportunities and benefits.

4.3 RQ3: Are there any differences in perceptions of AI regarding age, gender, and level of study?

The Kruskal-Wallis H test showed no differences between age groups, study levels, or genders regarding their perceptions of using AI ($p > 0.005$), with one exception. In answer to the question "Have you used ChatGPT?" a Kruskal-Wallis H test showed that there was a statistically significant difference between genders [$\chi^2_{(2)} = 13.334$, $p = 0.001$, with a mean rank pain score of 69.17 for man, 122.98 for woman, and 148.5 for others] While 66% of men have used it, only 20% of women have. However, it should be noted that there were only 12 men among the respondents (5% of all respondents).

FIGURE 2
Summary of answers to the question "Evaluate how often you are using different AI tools."
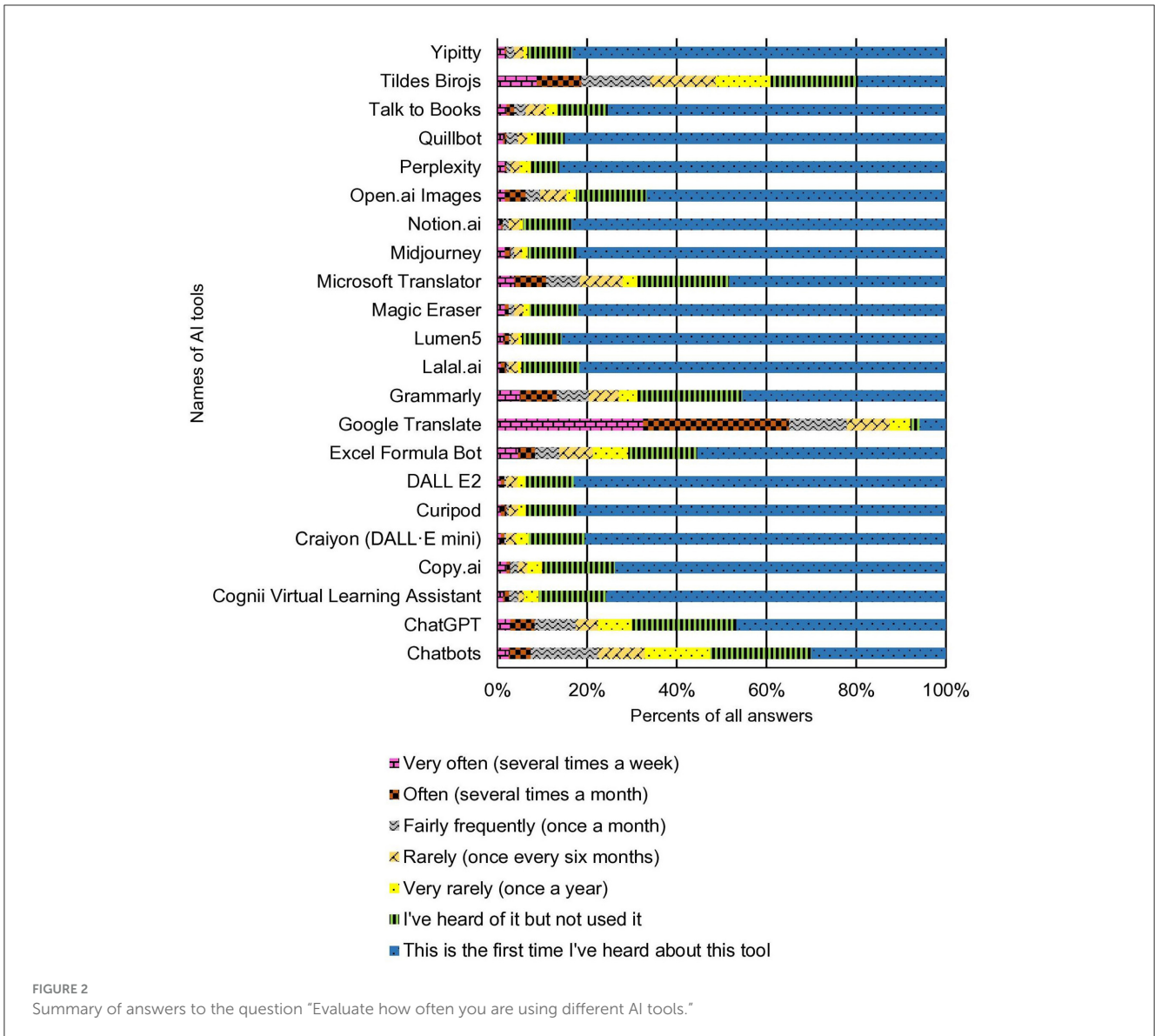
4.4 RQ4: Do pre-service teachers use the possibilities of AI to build an inclusive environment in their classes?

Respondents were asked to what extent they agreed with various statements about the use of AI in teachers' work using a 4-point Likert scale (see Figure 5). "Rather agree" and "Fully agree" were combined as positive answers. The answers considered for this RQ were provided by 147 participants who already had teaching experience. 61% of them agreed that using AI in teachers' work makes it possible to include students with different learning needs, and 55% agreed that it makes it possible to include students with special needs. The results show that most teachers (69%) use AI to find the content information they need.

The respondents were also asked how often they use AI in teaching. The results show that 57% of respondents never used AI to include students with special needs, and 55% never used it to include students with different learning needs (see Figure 6).

We used thematic analysis to analyze responses to the open question, "What other ways are there of using AI in teachers' work?" One additional theme that emerged from the answers was the creation of performance-level descriptors. Some students were more inclined to explain how they used AI to help students with disabilities or diverse needs in the classroom, such as to train spelling and other writing skills.

Although students acknowledge (60%) that they can use AI to address needs relating to diversity, more than half have not used it in practice (55%). Consequently, the results reveal a contradiction, and it is quite possible to explain this by the students' lack of
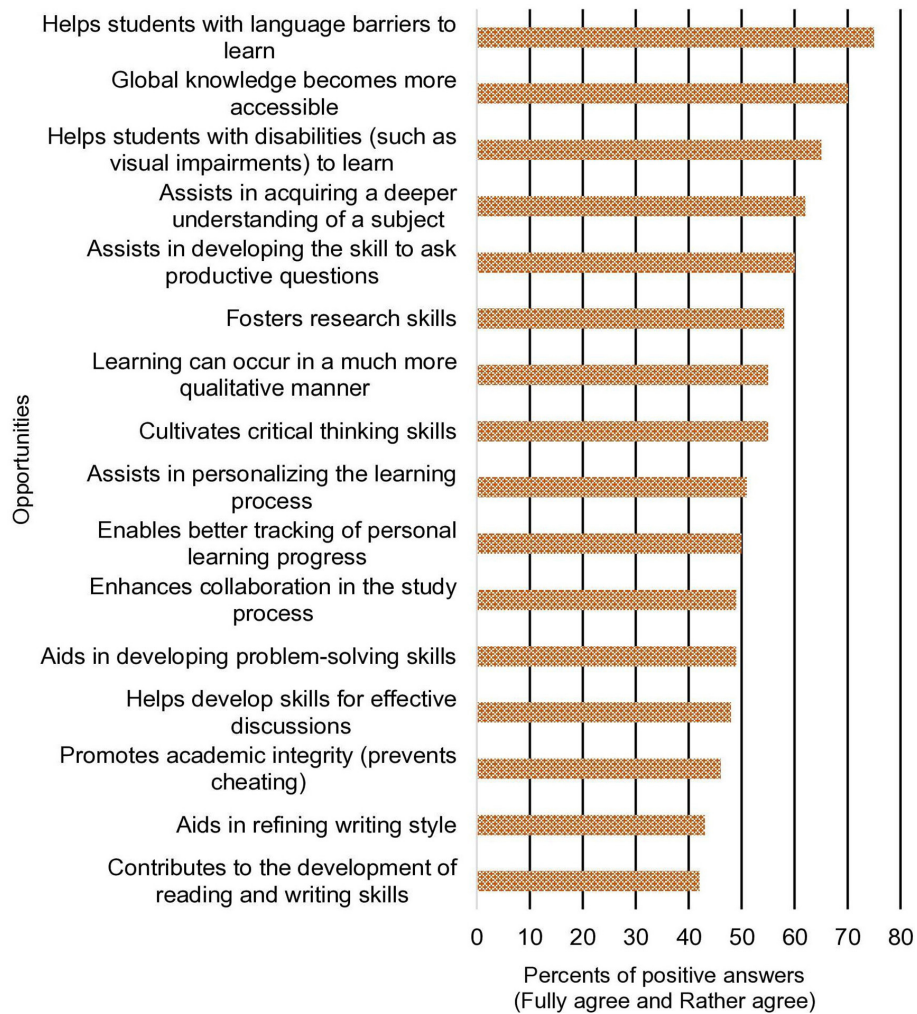
FIGURE 3
Summary of answers to the question "Please rate how much you agree with these opportunities created by artificial intelligence in higher education."

experience in using AI for learning and teaching. Even fewer students admitted (55%) that they could use AI to provide better support for students with special needs and, accordingly, have not used it in practice (57%). Therefore, we can conclude that in the study process, it is necessary to introduce examples of good practice in the use of AI tools for the inclusion of students with special needs.

4.5 RQ5: Are there any correlations between future teachers using AI in the study process and using AI in their professional lives as novice teachers?

For this RQ, we selected answers from the 147 respondents who indicated that they are currently working as teachers to analyze the correlations between the questions "Have you used any tool based on artificial intelligence for learning?" and "Mark

to what extent you agree with these statements about the use of artificial intelligence in teachers' work." A Spearman's rank-order correlation was run to determine the relationship between the answers. Negligible or low positive correlations were found (see Table 1), meaning that students who do not use or are not sure about using AI tools are more likely to disagree with statements about the implications of using AI in their work as educators. At the same time, no correlation was found between the use of AI in the study process and the question, "How often do you use these opportunities provided by artificial intelligence in your work as a teacher?": find the necessary content information [$r_{s(145)}$ = 0.221, p = 0.007], create questions and tasks for assessment [$r_{s(145)}$ = 0.194, p = 0.019], develop lesson plans [$r_{s(145)}$ = 0.049, p = 0.558], include students with special needs [$r_{s(145)}$ = 0.097, p = 0.244], include students with diverse learning needs [$r_{s(145)}$ = 0.100, p = 0.230]. This means that the use of AI tools in the study process is not related to the frequency of use by students in their work as teachers. The absence of a correlation between AI use in the study process and the frequency of AI use in their
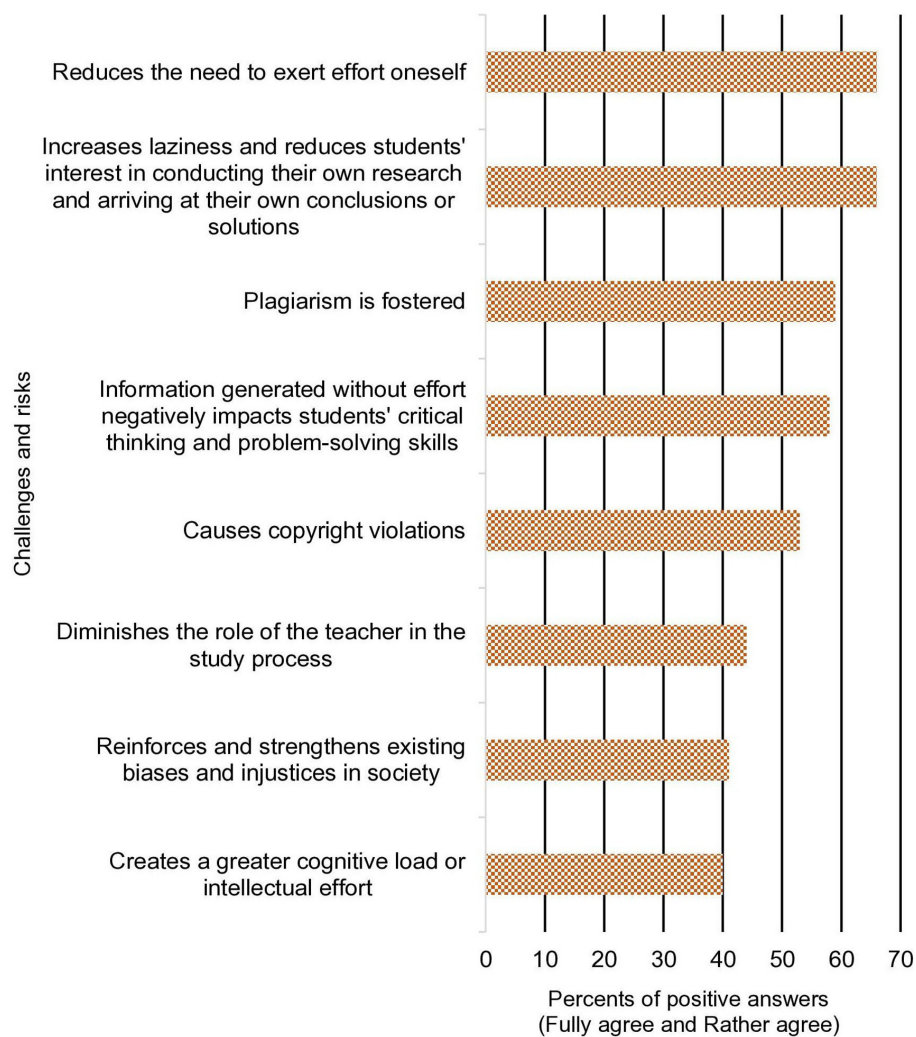
FIGURE 4
Summary of answers to the question "To what extent do you agree with these challenges and risks created by artificial intelligence in higher education."

professional teaching work implies that students' experience with AI during their studies does not significantly translate to their confidence or likelihood to use AI tools in teaching roles. This could reflect a disconnect between AI exposure in academic settings and practical applications in real-world teaching or perhaps a need for more explicit training in AI tools tailored specifically for teaching applications.

5 Discussion

Overall, this study shows that less than half of pre-service teachers within our sample use AI tools in their learning, and less than half of them were positive about it. Almost a third of them thought that AI tools should be banned in the study process. Moreover, a considerable portion of the respondents, almost a quarter did not even know whether they were using it or not, so most probably they were not familiar with AI. It could be explained

that AI—as a newly arrived technology—is not widely used by our sample or lack awareness of it, or there is a lack of education about it. The question still remains, how quickly educators typically take up technologies; where ChatGPT, for example, was only released in November 2022, and our survey was done in April-May 2023, so teachers only had a period of 6 months or so to learn how to use it, how it could be used, whether it should be used (i.e., whether it was ethical, trustworthy, reliable, etc.), and how to incorporate it into their learning practices. AI tools are used most probably by pre-service teachers in their practice, however, awareness of doing so is still very low. Lack of knowledge and experience could impact perceptions, leading to not using AI's full potential in learning and in profession, thus slowing progress of AI transformation in education by reshaping how educators teach and how students learn. Thus, there is a need to further investigate pre-service teachers' beliefs about AI and moreover about teachers' beliefs about teaching-and-learning theory and methods related to AI education (Lim, 2023), which can be an
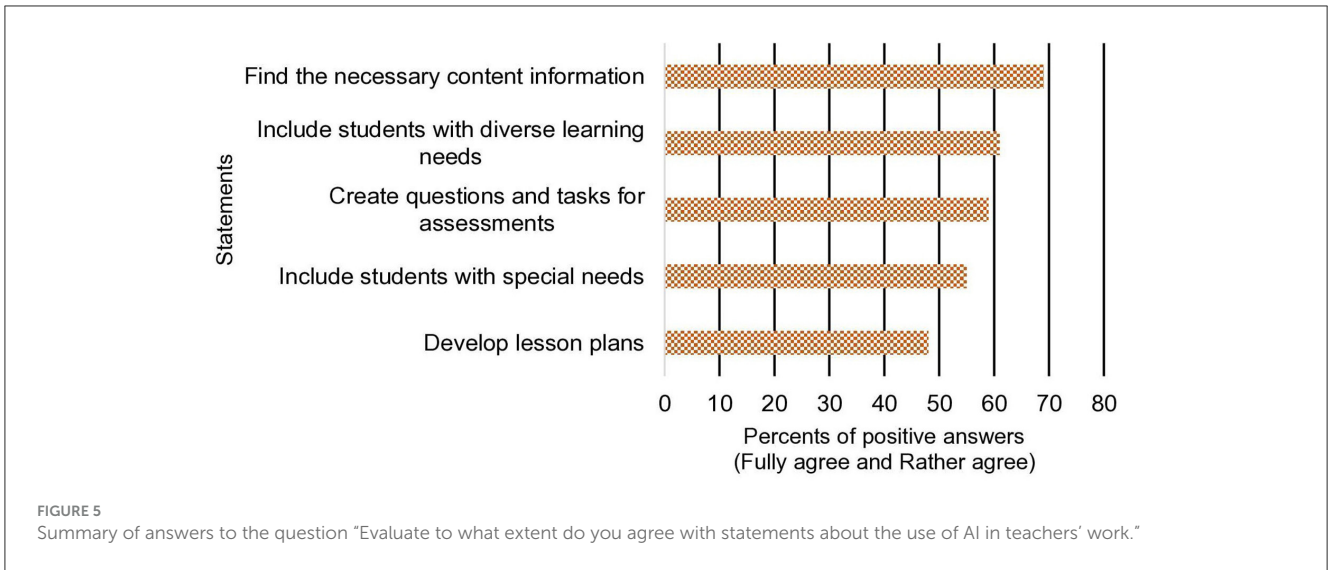
FIGURE 5
Summary of answers to the question "Evaluate to what extent do you agree with statements about the use of AI in teachers' work."
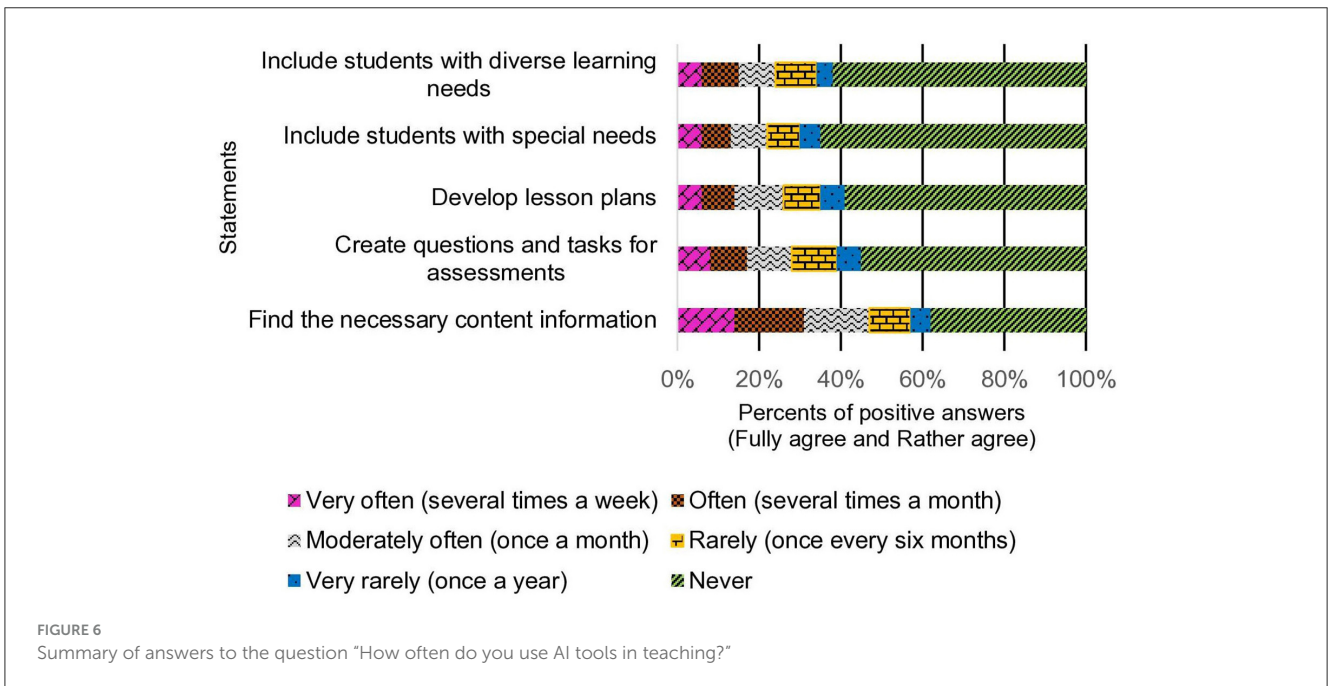

FIGURE 6
Summary of answers to the question "How often do you use AI tools in teaching?"

TABLE 1 Correlations between future teachers using AI in the study process and using AI in their work as teachers.

		Find the necessary content information	Create questions and tasks for assessment	Develop lesson plans	Include students with special needs	Include students with diverse learning needs
Have you used any tool based on artificial intelligence for learning and cognitive purposes?	Correlation coefficient	0.311**	0.260**	0.227**	0.257**	0.283**
	Sig. (2-tailed)	0.000	0.001	0.006	0.002	0.001
	N	147	147	147	147	147

**Correlation is significant at the 0.01 level (2-tailed).

important indicator of what thoughts and attitudes teachers will have when they use AI in their practice. Such findings could help identify the teachers' professional development needs more clearly (Chiu et al., 2023) and to define more clearly how AI should be integrated in the pre-service teachers' study processes. In the future, it would be important to reduce existing contradiction between the demands by society to prepare young people to use technologies and become responsible "digital citizens," where teachers can play a

leading role (Hwang et al., 2020), and the current state, where pre-service teachers are not well prepared to deal with such issues. The awareness of AI in education (can teachers employ AI in teaching) is still extremely low (AlKanaan, 2022; Galindo-Domínguez et al., 2024). Our results reflect previous findings that students still have limited knowledge and skills in working with AI (Almaraz-López et al., 2023; Mousavi Baigi et al., 2023). To change this, pre-service teachers should acquire AI literacy (Long and Magerko, 2020), which refers to the skills and knowledge required for individuals to communicate, work, and interact effectively with other people and machines in a future dominated by AI. Thus, (pre-service) teachers require the knowledge, skills, and attitudes to do so (Seufert et al., 2020). Beyond gaining knowledge and skills in prompt formulation and practical AI application, ethical considerations and the responsible use of these tools are especially critical. This is particularly important given that teachers work with children, where the authenticity of the teaching-learning experience holds substantial significance (Sperling et al., 2024; Galindo-Domínguez et al., 2024; Zhang and Zhang, 2024).

However, AI-related skills have not yet been sufficiently defined, and we are still trying to understand the full potential of using AI in education.

Several recent studies indicate that AI will undeniably have a transformative effect on education, and we are currently at the beginning of this transformation, which is growing exponentially. AI tools are used in teachers' work and are associated with personalized, adaptive education provision. Therefore, AI will not replace teachers, but changes their role in education, in the classroom (Galindo-Domínguez et al., 2024). It is noted that research in educational sciences, particularly on teachers' practical skills and ethical perceptions, is essential for advancing the integration of AI tools in teacher education and the teaching profession (Sperling et al., 2024).

Regarding the question of what pre-service teachers perceive to be the main opportunities of using AI in HE, our findings are somewhat like those of previous studies. For example, they show that AI can reduce language barriers by providing students with the necessary support for their academic success (Wang T. et al., 2023). Pre-service teachers also predominantly see AI as a tool to assist in overcoming language problems (for example, for translations) (Pokrivčáková, 2019). AI makes global knowledge more accessible, thus assisting in acquiring a deeper understanding of the subject, to provide higher-quality learning (Chen L. et al., 2020). AI also helps to implement inclusive principles by aiding those with disabilities (Pisica et al., 2023; Salas-Pilco et al., 2022b). In our study, pre-service teachers mentioned some additional benefits, for example, that it helps them to evaluate/check the quality of information. Thus, thanks to AI, teachers can work more effectively and efficiently (Chiu et al., 2023).

Concerning what pre-service teachers perceive to be the main challenges of using AI in HE, our findings partially support results from previous studies. Students agree that the challenges are related to the ethical aspects of AI's use, particularly with the unfair use of AI in the study process, false information (Crowe et al., 2017; Pisica et al., 2023), and the reduction of the role of the teacher in the learning process (Andersen et al., 2022). Pre-service teachers also perceive the challenges of using AI as its potential to reduce the need to exert oneself, increase laziness, and reduce students' interest in doing their research and coming to

their conclusions or solutions. Such answers are most probably related to misconceptions about the challenges connected with AI or superficial ideas about AI in learning in HE. AI should be seen as a powerful tool that can help teachers and students in many ways. However, we must examine such challenges to provide the necessary education to overcome those challenges and misconceptions (Crompton et al., 2022).

It should be noted that AI education can promote students' understanding of the benefits and challenges of innovative technologies. Moreover, it can help them use "computational thinking" to solve different problems, be creative, generate innovative ideas, and be ethically responsible AI users (Ali et al., 2019). Considering this, including AI in the pre-service teacher curriculum would be a key step. Different forms and methods could be implemented to assist pre-service teachers in using AI. Such changes are promoted both by society and responsible institutions. For example, the updated regulations of the Latvian Cabinet of Ministers on the state standards of professional higher education require professional higher education study programs of all study cycles to ensure that graduates can responsibly and safely choose and use information technologies for the performance of work duties, research, and lifelong learning, as well as for the acquisition and creation of digital content and sharing (Ministru kabineta noteikumi Nr. 305., 2023).

Regarding whether there were any differences in perceptions of AI regarding age, gender, and level of study, our results support other findings (Galindo-Domínguez et al., 2024; Al Darayseh, 2023; Kaya et al., 2022; Lukić et al., 2023; Wang et al., 2021) in that there are no such differences. However, in one question about using ChatGPT, there seemed to be a statistically significant difference between genders as more men than women used ChatGPT. However, a bigger sample is required to form a firmer conclusion due to the small number of male respondents ($N = 12$). Nevertheless, considering the proportion of men in schools and teacher training programs in HE, this number of male respondents is typical.

Regarding whether pre-service teachers use AI to build an inclusive environment in their classes, we found that they perceive it possible to use AI to include children with different learning needs and special needs. However, only some do it in practice, more than half admitted that they have never done so. This echoes other research concluding that AI readiness is still in its initial stages (Wang X. et al., 2023): students are still not fully prepared to use AI in practice (Abdelwahab et al., 2023) and have limited knowledge and skills in working with AI (Almaraz-López et al., 2023; Mousavi Baigi et al., 2023). Furthermore, the use of AI in inclusive and special education is a new phenomenon; however, there are some examples of using AI in the classroom to support children with special needs (Hopcan et al., 2022). Another explanation could be that student teachers have not had any experience with children with special needs, even though there are children with various educational needs in every class nowadays in Latvia. Another explanation is that the pre-service teachers know theoretically that it is possible to use AI to promote a more inclusive environment and help students with diverse needs but do not know how to apply it, and it is not promoted in the study process.

Research on the competencies of future teachers in Latvia (Kalke et al., 2022) concluded that there is a close relationship between the teacher's present and the learner's competence in the

future. It is especially important to consider this in the context of Latvia, where teachers are legally allowed to start working in the classroom as soon as they enter studies. Discussions on the use of AI can also be deepened by the fact found in this study that pre-service teachers devote more time to assessing children's growth, paying more attention to formative assessment, investigating and analyzing learning data, communicating with parents, adapting learning content to the needs of learners, and systematically evaluating and using digital learning materials and technologies to create a more inclusive learning process. Therefore, further research is still necessary to study which factors affect how teachers apply knowledge and understanding in their professional activities.

Regarding the last research question, we found that pre-service teachers who do not use or are unsure about using AI tools are more likely to disagree with statements about the implications of using AI in educators' work. At the same time, no correlations were found between using AI tools when learning in HE and their frequency of use during students' work as teachers, which partially contradicts previous research (Damerji and Salimi, 2021).

The findings identify some relevant requirements for integrating AI into the future teacher curriculum. To enable pre-service teachers to start using AI in their teaching, especially to promote inclusive environments and support diversity in the classroom, it is necessary to build their awareness of AI, promote their readiness to use AI tools and integrate such tools into their learning processes.

Our paper has some important implications for pre-service teacher preparation regarding AI and using AI tools. Universities should prepare students for this shift as AI tools are increasingly used in the workplace. As indicated by previous research, as teachers have more knowledge to interact with AI-based tools, they will have a better understanding of the pedagogical contributions of AI (Celik, 2023) and start using it in practice. Studies on AI education policy in HE that examine the perceptions and implications of text-generative AI tools emphasize that preparing students for an AI-driven workplace must teach them how to use AI responsibly, ethically, and effectively, how to use AI for deepening the education process Universities should implement pedagogical activities while simultaneously considering the growing importance of AI in various industries, ensuring that students acquire the skills and knowledge to fit into workplaces that will constantly change. Integrating learning analytics tools into adaptive learning platforms can significantly aid in identifying learner needs, personalizing the curriculum, and providing teachers with information about each learner's performance, thereby facilitating timely intervention (Zhang and Zhang, 2024). Students should understand their role in the professional environment, how to integrate AI into their workflows, and how to evaluate responsibly the effectiveness of AI tools (Chan, 2023). In the future, the diversity of AI tools will certainly become more prominent within the teaching professions, extending beyond generative AI tools, which are currently the primary focus (Galindo-Domínguez et al., 2024).

6 Limitations

Self-reported data that comes from participants' perceptions is very useful for understanding the subjective experiences of pre-service teachers using AI both in their study process and professional work. It also has several limitations and biases. Firstly, we collected data from voluntary respondents, which may not represent the entire pre-service teacher population in UL. Although our sample reflects the diversity within the target group (age, level of study program, part-time, full-time studies, live in city, and countryside), we had disproportionate numbers of male and female (94%) in our sample. As we know from statistics, it reflects the reality in the education setting in Latvia. To address bias, we ensured anonymity for participants and used neutral wording as much as possible. In future research, we suggest using mixed-mode data collection. Thus, we suggest organizing a focus group interview to reach a broader sample and to have more profound interpretations of pre-service teachers' attitudes toward AI. In the future, other university students could also be involved in the study to answer the survey questions and increase the sample size. Finally, it is important to note one more limitation of the research. AI is developing rapidly, and new AI tools have already emerged during the development and implementation of the survey. Accordingly, they were not included in the survey. This study illustrates the situation when AI intensively entered higher education, the inclusion of it in the education of pre-service teachers, which thus forms an essential basis for further research.

7 Conclusions

This research provides insight into the pre-service teachers' existing use (or not) of AI in the learning process in HE and their teaching roles at school. Although pre-service teachers perceive that using AI in learning can be beneficial, our research shows that using AI in learning in HE is still low. The same applies to pre-service teachers using AI in their teaching roles at school. Pre-service teachers have the necessary awareness that AI can help build a more inclusive environment in their classes and that it should enhance the possibility of including children with different learning needs and special needs in their classrooms. However, only some do it in practice, and more than half admit that they have never done so. Our research shows no correlations between using AI tools when learning in HE and their frequency of use during students' work as a teacher. It shows that students' experience with AI during their studies does not significantly transform their use of AI tools in teaching.

In future research, it would be beneficial to investigate pre-service teachers' beliefs about AI in the learning and teaching process and follow up on their development using AI in HE and in teaching at school. This would also involve a more significant number of pre-service teachers from different Latvia's HE institutions. Further research must study which factors affect how teachers apply knowledge and understanding in their professional activity.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

DK: Writing – original draft. DN: Writing – original draft. SB: Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1501819/full#supplementary-material

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