

The opinions and attitudes of prospective primary school teachers on the use AI applications in education



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Abstract

The growing presence of Artificial Intelligence (AI) in education has drawn attention to its potential to enhance teaching and learning processes. The study examines prospective primary school teachers' perceptions and attitudes toward the adoption of AI applications in education, concerning their readiness, concerns, and expectations. The research was conducted through an online questionnaire distributed among students at the Faculty of Teacher Education, University of Zagreb. The findings provide insights into students' familiarity with AI technologies, perceived benefits, and challenges associated with their use in primary education. The study reveals that while students recognize that AI could be used to customize the learning experience and relieve teachers of some administrative tasks, they also seem to care more about ethical issues, concerning data privacy, etc. Also, critical thinking skills can be placed in danger because of AI. These points will be contributing to the future ongoing discussions in taking the responsibility in which AI is used in education and showing that teacher training on the opportunities and risks of adoption needs further development. Results will have importance not only for policymakers but also for educational institutions in establishing quite meaningful AI education policies in primary schools as per pedagogical plans but also ethical considerations.

Key words:

AI applications, Artificial Intelligence, education, ICT, prospective teachers, teacher perceptions

Introduction

Artificial Intelligence (AI) has recently experienced unprecedented growth in many industries, and education is among the most promising fields for its implementation. Although the potential of AI has been recognized for quite a long time, it is only in the last couple of years that research has shifted more and more towards the effects of AI in the educational field. This increase in interest

has occurred alongside the developments in AI technologies like machine learning and natural language processing, which revolutionize education (UNESCO, 2023; World Economic Forum, 2023). In education, the capability of AI to improve teaching and learning cannot be overemphasized since service delivery has been personalized and made more accessible. In this context, AI refers to systems that can acquire and process large amounts of information, identify learning patterns, and provide individual learning processes. Learners can also progress through their learning curves and at their learning rate, effectively producing results (Alneyadi et al., 2023; HolonIQ, 2023). In addition, ITS, chatbot, and auto-grading solutions can decrease the teachers' workload and make them focus more on the invention and improvement of the creation of meaningful interactions with students and on the development of thinking skills (World Economic Forum, 2023). AI technologies can be used in learning as recommendations in potential development areas and optimization of tasks based on a student's capability. This leads to a situation where even the poor performers and the bright students receive the assistance they require to be productive. Personalized learning platforms have been shown to engage students more effectively, boosting motivation and improving academic outcomes and retention rates (Gningue et al., 2022; Ibrahim et al., 2022). AI can notice that a student requires assistance by analyzing the student's performance profile. Instead of providing general assistance, it assists where the student is most likely to require help (Alarabi & Wardat, 2021). AI systems can analyze student performance data to identify areas that may require special attention. These systems can help detect struggling learners early and provide support before issues get out of hand. For instance, using big data can track the student's activity, attendance, and performance to identify those at risk and suggest the appropriate intervention or change in the learning approach (Niall McNulty, 2023). Moreover, other AI systems, such as Mindspark, assess the students' responses and recommend the right exercises and materials to fill the students' knowledge gaps and provide each learner with the right level of challenge and support (Calibrant, 2023). AI systems in education can also control the speed of learning, thus allowing fast learners to progress faster while slow learners can progress at their own pace. This learning approach makes it possible for the learner to learn at his or her own pace, depending on his or her ability, making the learning process very effective. For instance, a study reveals that AI can use the student's performance data to offer feedback and recommend learning resources suitable for the student (Benzakour et al., 2022).

They also assist educators by pointing out students who may require extra attention and assistance. In this case, AI makes it easier to provide targeted support, guaranteeing that every learner gets the help required to succeed (Kurilovas, 2018). In addition, adaptive learning platforms have been integrated into different educational contexts. They have helped students learn at their own pace and enhanced both the interest and the drop-out rates (Chiu et al., 2023).

Harry & Sayudin (2023) highlight that there is a potential for artificial intelligence to change the educational scenario; however, there are specific barriers that require attention for this to happen. It is beneficial as it can personalize lessons for students, reduce administrative tasks for staff, and provide real-time learning updates during class. Still, they have to calculate the benefits and risks, protect information gleaned from students, and control prejudices from AI systems to make integrative authorities feasible. When this comes together with the limitations, AI could make you more efficient and deliver educational help to all-inclusive students. Integrating AI in education is rewarding with several benefits but presents core concerns that have to be strategically resolved.

The challenges of data privacy, bias in algorithms, and the feasibility of rolling out AI systems have been factors of great concern. Training affected the AI systems, proving adverse as they replicated the biases in the training data and created gaps in areas such as provision for healthcare services and allocation of resources, including special education for various groups of students (Sutaria 2022). With this, privacy concerns come into play when AI categories together and utilize students' information without consent, raising concerns about surveillance and data usage governance in educational settings (GUJJULA et al., 2023; McNulty, 2023).

Other important factors are ethical considerations such as fairness and accessibility of the content. AI should be developed and deployed in a way that does not reinforce prejudices and provides equal opportunities for all learners. This includes explaining how AI algorithms work and use data (UNESCO, 2023). Constant supervision and assessment are needed to ensure the process is fair and does not perpetuate societal educational inequalities. For example, Baker & Hawn (2022) note that caution is needed when implementing AI in education since it can lead to algorithmic bias that is unfavorable to some students. They recommend the use of diverse data in order to reduce bias in the AI models. Likewise, Chaudhuri & Mohanty (2023) also talk about the need for bias-aware algorithms to capture and address biases that might be inherent in historical data patterns. In this way, institutions can ensure that AI systems are trained on a diverse set of data to reflect the diverse student body. Malik (2024) highlighted the importance of continuously using diverse and representative data and monitoring the AI systems' performance to create efficient and ethical AI systems.

Furthermore, the UK's Information Commissioner's Office (ICO) also notes that fairness in AI is not only a technical concept that refers to algorithmic fairness. It needs a more extensive and context-based approach that takes into account the social and legal consequences of data processing, so that AI does not enhance the existing unfair distribution of resources (ICO, 2023). By implementing these principles, AI systems can be more explainable, non-discriminatory, and inclusive to all students with equal opportunities to access educational materials. There is a great deal of interest and controversy regarding the use of AI in education, as the presence of AI in the educational process increases. Since AI technologies like intelligent learning platforms, automated grading tools, and intelligent tutoring systems are being incorporated into classes, teachers' perceptions of such technologies give insight into the future adoption of AI technologies in education. These perspectives influence the integration and application of AI tools and raise the question of the role of technology in learning contexts.

The aim of this paper is to identify the perception of students from the Faculty of Teacher Education at the University of Zagreb towards the application of Artificial Intelligence (AI) in learning. The research aims to identify the positive and negative attitudes students have towards AI, which subject they think should be supported by AI, and which AI applications are most beneficial for teachers and students. The study, conducted through an online questionnaire, aims to identify prospective primary school teachers' attitudes toward the benefits and possible drawbacks of AI in the context of teaching practices, as well as their preferences regarding the use of AI tools and technologies in the process of learning and teaching. This study provides a systematic discussion of the possibilities and concerns of AI in the learning environment, and its purpose is to inform the future directions for teacher preparation and policies in integrating AI into primary education responsibly.

AI's integration into education has brought together a range of feelings and opinions from educators, which span from optimism to caution. Teachers broadly believe in the benefits of AI, primarily in augmenting personalized learning while, at the same time, lightening administrative work. For example, AI can provide services that relieve teachers of the burden by automatically providing feedback and monitoring students' progress and automating tasks such as grading, thereby giving the teacher ample time to teach and offer more personalized services. This, according to Kim (2023) and Wang et al. (2023), can go a long way in minimizing teacher burdens. Moreover, a lot of educators believe that AI has the potential to create customized learning experiences for students, allow for differences in learning speed, and even promote emotional well-being through the use of AI-powered chatbots (Kim, 2023; Pejnović, 2024). In addition, AI enhances the possibility of real-time monitoring and analysis of student performance, thus enabling the teacher to intervene on time when some students struggle (Kostrić, 2021). For example, intelligent tutoring systems make individual feedback available through student performance analysis and help students in their weak areas without waiting for conventional testing periods. Most educators believe that with differentiated instruction, AI will significantly help close achievement gaps and ensure that all students reach their full potential. Some subjects, like mathematics, science, and language learning, were found more effective with ITSs, which give domain-specific feedback in detail (Kurni et al., 2023; AIWS, 2023). As AI continues to evolve, the integration of natural language processing and emotional recognition in ITSs promises to further enhance personalized learning by responding not only to cognitive but also affective states of learners (Fernández-Herrero, 2023).

However, there are quite a few fears among teachers concerning the potential problems of artificial intelligence. One of the most severe concerns are the data privacy issue and the ethical implications of using AI in schools. Many teachers fear that the extensive data collection for AI-enabled personalization can be problematic for student privacy, especially if sensitive information is not handled properly (Felix, 2020; Beović, 2023). Furthermore, concerns have been raised regarding the potential loss of teacher autonomy and the humanizing of educational processes due to artificial intelligence. According to educators, AI should not replace the vital human aspects of teaching, such as emotional support and the development of critical thinking skills, which are crucial for student development (Beović, 2023; Guilherme, 2017; Wang et al., 2023). Teachers seem indifferent regarding their preparedness for the implementation of AI in schools. While some teachers believe that they can use AI with ease, others observe that this cannot be achieved without deeper training that will equip them with the relevant skills in applying AI (Kim 2023). Conversely, other studies have established that preparation to use AI differs depending on prior use and resource experience (Wang et al. 2023). Teachers advocate for specialized training initiatives that encompass both the technological components of artificial intelligence and the associated ethical implications, thereby guaranteeing their preparedness to utilize AI responsibly within the educational setting (Felix, 2020; Alharbi, 2024).

One major factor affecting teachers' attitudes towards AI is their readiness to integrate AI into their teaching practices. However, surveys and studies show that most teachers feel unprepared and ill-equipped for the integration of AI tools—often due to a lack of training or resources required for use in classrooms (Beović, 2023; Wang et al., 2023). Teachers who feel unconfident about using AI

systems might not use these resources as intensely, widening the gap between those who benefit from AI-supported learning and those who do not (Kim, 2023). Professional development, therefore, becomes necessary to empower the teachers with knowledge of AI technologies and imbue them with the confidence to apply these tools in their pedagogical approaches. Educators are asking for more training that would highlight ethical AI use, data privacy, and the potential effect AI can have on the relationships within the classroom (Kostrić, 2021; Felix, 2020). These initiatives would assist educators in managing the intricacies of artificial intelligence, ensuring that its deployment is consistent with educational objectives and principles (Wang et al., 2023).

Professional development of teachers in an effective way to overcome this gap in AI-supported learning needs to be geared toward both the technical knowledge of AI and deeper understandings of ethical issues thrown up by AI-data privacy concerns, with its potential consequences for classroom relationships. This would imply that such professional development should align with emphases within the DigCompEdu framework on empowering teachers across multiple dimensions: In developing their own competencies with digital resource development, pedagogical methodologies, and evaluative techniques, educators might become more confident in exercising responsible use of AI tools. Furthermore, such professional development would allow instructors to better nurture students' digital literacy in ways that help them grapple with the ethical and practical problems linked to AI. This comprehensive strategy guarantees the incorporation of artificial intelligence in a manner that improves educational results while preserving the human-centric elements inherent in pedagogy (Kostrić, 2021; Kim, 2023; Wang et al., 2023). This balanced approach is based on the understanding that AI is not a substitution for teachers but rather their augmentation that helps with grading and lesson planning so that the teacher can spend more time interacting with the students (Alharbi, 2024; AIWS, 2023).

Applications of AI in education

Ng et al. (2023) performed a systematic review of 49 studies over a period of two decades, with the result being a much-needed insight into the growth of AI education. The review highlights three key research questions: types of learners involved in AI education, tools used, and teaching approaches applied. In the early days, AI education focused on computer science education at the higher education sector level. By 2021, however, AI literacy had gained momentum in K-12 due to the development and emergence of age-appropriate teaching tools. The pedagogical strategies identified in the article are dominated by collaborative project-based learning and the use of game elements. Such methodologies encourage problem-solving, creativity, and engagement in students. Teaching tools leveraged for scaffolding AI concepts in students ranged from robotics to software platforms and intelligent agents. Nevertheless, challenges were noted, including the lack of suitable resources for young learners and non-computer science majors and the complexity of some AI concepts. The review highlights the growing importance of AI literacy and shows the need for educators to adapt their teaching practices to integrate interdisciplinary and interactive tools that would make AI concepts understandable to all students.

Tools designed to support teachers

Intelligent Tutoring Systems are among the most prominent AI tools used in education. These systems simulate one-on-one human tutoring by providing personalized learning experiences to students based on their individual needs. They use algorithms to track student progress, analyze areas of difficulty, and provide tailored feedback. For instance, platforms like ASSISTments in the United States help students, particularly in mathematics, by offering tailored instruction based on their performance in practice exercises (Holmes & Tuomi, 2022). ITSs have shown particular efficacy in subjects like mathematics, science, and language learning. In mathematics, ITS platforms can guide students through problem-solving processes by offering hints, identifying misconceptions, and providing real-time feedback (Luckin et al., 2016). For example, in physics and chemistry, AI-driven platforms like Knewton and ALEKS adapt content delivery based on students' responses, helping them grasp complex concepts through gradual mastery of smaller components (Su & Yang, 2023). In language learning, AI-powered tutors like Duolingo offer personalized exercises based on a student's proficiency level, accelerating language acquisition through repetitive and targeted practice.

Systems like Carnegie Learning utilize AI algorithms to evaluate a student's comprehension and modify lesson plans, ensuring that each concept is mastered before moving on to more advanced topics (Cope et al., 2020). Such systems are particularly effective in subjects like mathematics and science, where understanding builds on previous knowledge. A significant benefit of adaptive learning platforms is their capacity to customize the learning experience for students with different skill levels. For example, students who find fractions or algebra difficult may receive extra practice exercises, while more advanced students face more challenging problems (Perrotta & Selwyn, 2019). This method guarantees that all students, no matter their learning speed, can achieve a solid understanding of the subject.

Furthermore, the use of AI platforms enables students to visualize the results of experiments that are hard to conduct in real life, such as ecosystems and chemical reactions. This also helps students to grasp concepts that are abstract in nature and also enables learning through experimentation (Holmes & Tuomi, 2022).

Another learning application of AI is in the area of tests and evaluations, where students can be given results and feedback immediately. Software such as Gradescope and AutoGradr employ machine learning to self-grade students' assignments and tests, thus freeing teachers' time while giving students timely and uniform feedback. Assignments in subjects such as computer science and mathematics entail code or problem-solving, and AI tools can check the correctness and effectiveness of the student's responses (Cope et al., 2020). Feedback systems that are facilitated by AI also facilitate self learning since students can go through their mistakes and enhance their comprehension before the final submission of their work. In writing and composition courses, technologies such as Grammarly give immediate feedback on grammar, syntax, and style, which can be used to improve the students' writing skills through repeated practice (Su & Yang, 2023).

ClassDojo is an example of an AI-based application that helps teachers to maintain discipline and control the level of students' participation. ClassDojo enables teachers to monitor student behavior in the classroom in real time, communicate with parents, and differentiate lessons according to students' needs. By so doing, this tool helps instill a more organized and responsive classroom management system and thus, allows the teachers to spend more time teaching rather than

managing the class (Carnegie Learning, 2024).

Otter.ai and ModMath are great examples of AI technologies that are rather helpful for students with disabilities. Otter.ai allows students with hearing impairments to follow lectures and discussions by providing real-time speech transcription. ModMath, on the other hand, is intended for students with dyslexia or motor skill challenges, enabling them to solve mathematical problems on a computer without writing by hand. These tools enhance more participation and access to classroom content and materials so that all students can participate irrespective of their physical or learning disabilities (Khan Academy, 2023).

Tools designed to support students

In addition to being helpful for teachers, AI solutions offer several tools that are very helpful for students, including individual learning, improving cooperation, and creativity. One of the most engaging ways AI supports student learning is through educational games, such as Minecraft: Education Edition and DragonBox, two of the best applications for kids and parents. In Minecraft, AI builds dynamic educational experiences and makes programming, mathematics, science, and history come alive for students. This way, the game is designed to fit the student's answers, and thus, every learner is engaged at his or her level of understanding, promoting deep learning while exploring and solving problems (Alawajee & Delafield-Butt, 2021). Minecraft in education benefits learning and social engagement. *International Journal of Game-Based Learning (IJGBL)*, 11 (4), 19-56.). Likewise, DragonBox employs the use of artificial intelligence to tailor math problems to the learner's level and thus is especially beneficial in teaching the basics of math (Holmes & Tuomi, 2022).

Smart applications like Socratic by Google, and Photomath change the way students solve their assignments. Socratic uses artificial intelligence to provide students with answers to questions they pose on diverse topics and in the process provides individualized explanations that are suited to the student's learning ability and speed (D'Mello & Graesser 2023). It is most beneficial for homework and study purposes and offers extensive answers to the questions in academic areas such as mathematics, science, and humanities. Likewise, Photomath is an AI-based app to solve mathematical problems by capturing the problems and providing solutions along with the explanations to help students to learn the concepts behind the solutions (Zain et al., 2023). These tools are very useful in assisting students in dealing with complex topics since they are given real-time feedback and instructions.

The use of AI has also improved language learning through the development of applications such as Duolingo and Babbel. Duolingo adapts the lessons depending on the learner's performance, which means that the tasks given to the students are always challenging, but not beyond the learners' capabilities. The use of an AI-driven system makes it easier to track the mistakes that the student makes and adjust the subsequent lessons to correct the mistakes. Likewise, Babbel incorporates AI to assist the student in monitoring their progress in learning the vocabulary and grammar in the course (Kessler et al., 2023). These language learning tools help in making it easier for the students, especially those in primary and middle schools, to learn languages by making it a unique experience.

Another aspect where the AI tools such as Miro and Padlet have brought a change in education is collaboration. Miro is an AI-based collaboration tool that allows students to form groups, discuss concepts, and participate in visual planning. This tool promotes effective collaboration in real-time as students can create a board that they can all work on, add notes, and build projects together (Karsen et al., 2022). Padlet, on the other hand, supports collaborative learning by allowing students to post and display their ideas, projects and notes in an attractive digital canvas. It also has AI components that assist in managing and categorizing the content to enhance the students' teamwork. Such platforms encourage engagement and collaboration, both important competencies in today's work settings.

In science education, tools such as Labster and Phet Interactive Simulations offer students virtual labs and interactive experiments, allowing them to delve into complex scientific concepts without needing physical lab equipment. Labster features AI-driven simulations that enable students to perform biology, chemistry, and physics experiments in a virtual environment, allowing them to test hypotheses and investigate scientific principles safely (Tsirulnikov et al., 2023). Similarly, Phet Interactive Simulations offers AI-powered simulations across various scientific disciplines, giving students hands-on experience with experiments that may be otherwise out of reach due to limited resources. These tools are especially valuable for students who lack regular access to fully equipped labs, helping them engage more deeply with scientific inquiry.

To encourage creativity, platforms like Canva and Animoto enable students to showcase their ideas through visual design and video production. Canva is a design tool powered by AI that assists students in crafting visually striking projects, including posters, presentations, and infographics, by offering customizable templates and design suggestions generated by AI (Belda-Medina & Goddard, 2024). Animoto is a video creation tool that leverages AI to simplify the video-making process. It provides ready-made templates and enhanced effects that make it easy for even younger students to create videos.

AI also assists students in staying organized through tools such as Todoist and MyStudyLife. Todoist is a task management app that utilizes AI to help students monitor their assignments, exams, and activities by sending reminders and allowing for customizable to-do lists. Similarly, MyStudyLife enables students to oversee their school schedules, deadlines, and exam dates, aiding them in managing their time more effectively. These tools are particularly beneficial for students who find time management challenging, providing AI-driven solutions to help them keep up with their academic obligations (Bouchrika, 2024).

Mental health plays a vital role in the well-being of students, and AI tools such as Woebot and Moodpath offer valuable emotional support for those facing anxiety, stress, or other emotional difficulties. Woebot is an AI-powered chatbot designed to assist students in managing their mental health by providing real-time support and coping strategies (Fitzpatrick et al., 2017). Moodpath monitors students' emotional states and delivers insights and resources to help them better comprehend and handle their feelings. These AI tools introduce a new dimension of emotional support, especially for students who may lack immediate access to mental health professionals.

AI applications in education provide numerous advantages for students, including personalized learning experiences, improved problem-solving tools, collaborative platforms, and emotional

support. It is believed that with the improvement of artificial intelligence technology, its applications in education will also become more and more powerful, creating opportunities for students to study in progressively interactive, personalized, and supportive environments.

Methodology

The aim of this paper is to explore the opinions and attitudes of prospective teachers from the Faculty of Teacher Education at the University of Zagreb regarding the use of Artificial Intelligence (AI) in education. The study aims to find out the students' perceptions of AI, positive and negative attitudes towards AI, the courses they think will benefit most from incorporating AI, and the specific AI applications that are most useful for teachers and students. This quantitative study is based on an online questionnaire and aims to identify the perceptions of prospective primary school teachers on the opportunities and limitations of AI in teaching practices, as well as their preferences on the use of AI tools as learners and teachers. The paper formulates three hypotheses:

Hypothesis 1: There are no statistically significant differences in opinions and attitudes toward using AI in teaching based on the students' year of study.

Hypothesis 2: There are no statistically significant differences in opinions and attitudes toward using AI in teaching based on the students' study module.

Hypothesis 3: There are no statistically significant differences between the average rating of positive and the average rating of negative aspects of AI in teaching.

The survey included 56 students from the University of Zagreb, Faculty of Teacher Education, including all five years of academic studies and different modules: Croatian Language, Art Culture, Informatics, Educational Sciences, and English and German Language programs. The questionnaire was voluntary and anonymous and consisted of three sections. The first part was used to collect data on the study year and the module or program students were studying.

Following the previous section, the participants were asked to answer some questions regarding their opinions of artificial intelligence in the educational sector. Participants were given statements and were then asked to indicate their level of agreement or disagreement with the presented statement. The instrument utilized a Likert-type scale between 1 and 5, with each number corresponding to the following levels of consensus:

1 - completely disagree (lowest level of agreement), 2 - mostly disagree (partial disagreement), 3 - neutral (neither agree nor disagree), 4 - mostly agree (partial agreement) 5 - completely agree (highest level of agreement).

The third part of the questionnaire consisted of questions about the possible application of AI technologies in learning. Students were asked which subjects they think would be most helped by AI, which AI tools are helpful for teachers, and which AI tools are helpful for students in primary education. Further, they were asked how often they would incorporate AI tools in their teaching in the future. At the end of the questionnaire, they responded to an open-ended question: „What changes do you think AI will bring to primary education in the next 10 years?“ The answers were coded and given categories, which will be discussed in the next section of the paper, and the

statistically significant differences were analyzed with the help of the appropriate statistical tests.

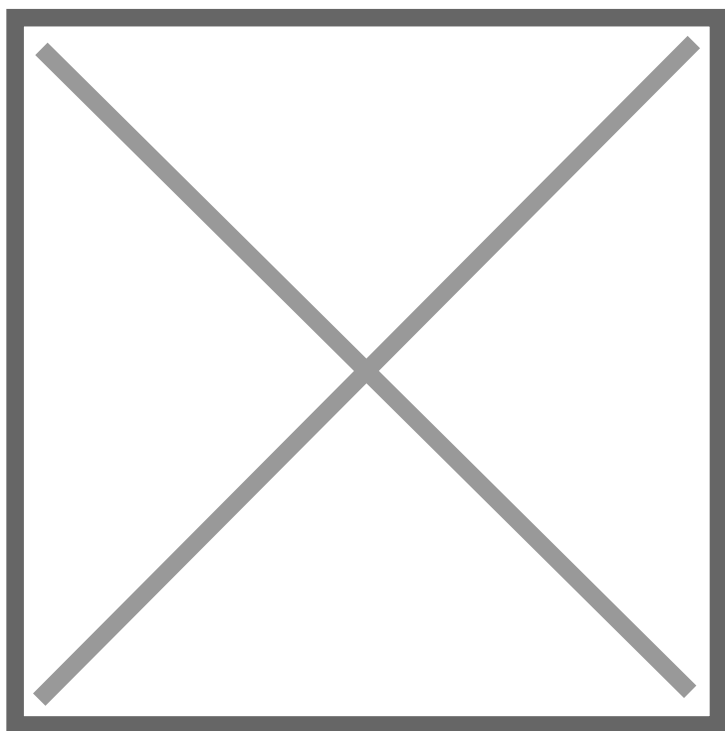
Results and discussion

The study included 56 students from the Faculty of Teacher Education, University of Zagreb.

In Chart 1, students' responses regarding their year of study are displayed. The distribution is as follows: **12%** of students are in their first year of study, **29%** in second year, **36%** in third year, **9%** in fourth year and **14%** in fifth year.

Chart 1

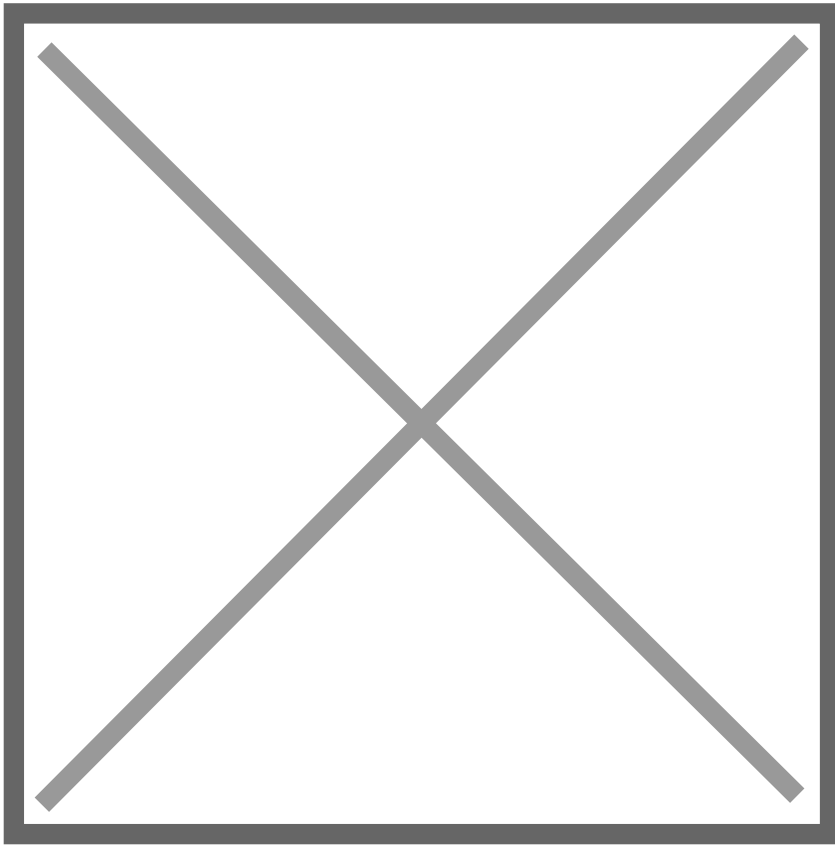
Distribution of students by year of study



When it comes to their study module or study program, Chart 2 shows the distribution of students in each module: **21%** Croatian Language module, **12%** Art Culture module, **32%** Informatics module, **11%** Educational Sciences module, **20%** English Language program, **4%** German Language program.

Chart 2

Distriburion of studenty by study module/program

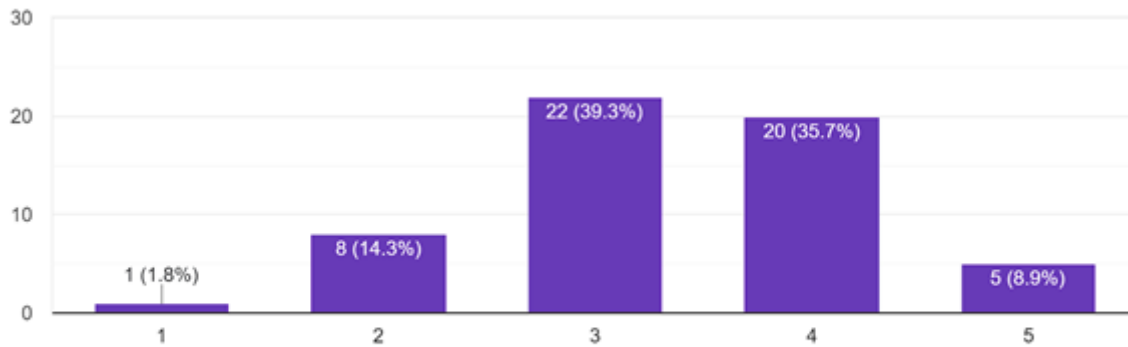


In the questionnaire, after students provided their year of study and study module/program, they were asked to respond to whether, during their studies so far, they had engaged with topics related to artificial intelligence (AI) or educational technology in any course. **64.3%** of the students answered yes and **35.7%** answered no.

The following question was: „**How would you rate your familiarity with artificial intelligence technologies?**“ Students answered on a scale from **1 to 5**, where **1** indicated „not familiar at all“ and **5** indicated „very familiar.“ The answers are displayed in Chart 3, where it can be observed that most students answered 3 (somewhat familiar) **39.3%** and 4 (familiar) **35.7%**. Only one student answered not familiar at all and only five students rated their familiarity as very familiar.

Chart 3

Familiarity with artificial intelligence technologies



To determine the method for analyzing the collected research results, the Kolmogorov-Smirnov test was conducted. The test indicated that the distributions of the measured dependent variables significantly deviate from the normal Gaussian distribution. Given this result and the sample size, non-parametric statistical indicators and results from non-parametric statistical tests will be taken into consideration.

The data shown in Table 1 provides an analysis of student perceptions regarding the positive aspects of AI in education. The results show that students have a somewhat favorable view of AI's role in enhancing educational experiences. For instance, AI's potential to **improve access to education for students with special needs** received one of the highest average scores ($M = 3.53$), indicating that students see value in AI's ability to create more inclusive learning environments. Similarly, the potential of AI to **facilitate lesson planning and organization for teachers** was rated relatively highly ($M = 3.54$), suggesting that students recognize the practical benefits AI can offer to teachers.

However, the perceived ability of AI to **allow teachers to focus more on individualized support** received a lower average score ($M = 2.89$), highlighting some skepticism about AI's capacity to enable more personalized teacher-student interactions. Despite this, the overall positive mean score of **3.20** for AI-related aspects suggests that students generally view AI as a useful tool in enhancing both learning and teaching processes in primary education.

Table 1

Students' perceptions regarding the positive aspects of AI

Positive aspects	Mean	Median	Mode	Std. Deviation
AI can be useful in primary education.	3.13	3	3	1.04

AI can help personalize educational experiences for students.	3.16	3	4	1.09
AI can improve learning efficiency by providing students with immediate feedback.	3.21	3	3	1.17
AI technologies can increase student engagement through interactive learning methods.	3.05	3	4	1,22
AI can improve access to education for students with special needs.	3.53	4	4	1.20
AI can allow teachers to focus more on providing individualized support to students.	2.89	3	3	1.12
AI can facilitate lesson planning and organization for teachers.	3.54	4	4	1.15
Average rating of positive AI aspects.	3.20	3.42	3.57^a	.94

The data shown in Table 2 suggests that students perceive several significant negative aspects of AI in education, with the highest concern being that **AI may reduce students' critical thinking** by providing ready-made solutions (M = 4.59). This indicates a strong belief that relying on AI could prevent independent problem-solving and creativity in the learning process. The concern that **AI technologies could lead to an over-reliance on technology instead of creative learning methods** (M = 4.41) reflects a strong belief among respondents that there is a potential downside to integrating AI into education. This high mean score indicates that many students fear that AI might shift the focus from fostering creativity to overusing technology. Additionally, many students expressed concerns about the **ethical implications** of AI, such as privacy violations and algorithmic bias (M = 4.14), highlighting the importance of addressing these

issues in educational AI deployment. Students are also concerned that AI **may not yet be advanced enough to fully understand individual student needs** ($M = 4.18$), reflecting skepticism about AI's ability to provide the same level of personalized support that teachers can. Interestingly, the complexity of AI technology and its potential to complicate teachers' work received a lower score ($M = 3.04$), suggesting that while students see AI as a challenge, they are more worried about its effects on teaching quality and creativity than its difficulty. Overall, the average rating of negative attitudes towards AI in education ($M = 3.97$), reflects a relatively high level of concern among students. This suggests that, overall, students are more apprehensive than optimistic about the potential drawbacks of AI in educational settings.

Table 2

Students' perceptions regarding the negative aspects of AI

Negative aspects	Mean	Median	Mode	Std. Deviation
AI technologies in education may be too complex to use and could complicate teachers' everyday work.	3.04	3	2	1.15
The use of AI in education may diminish the importance of the teacher's role.	3.45	4	5	1.43
AI technologies could lead to an over-reliance on technology instead of creative learning methods.	4.41	5	5	.93
AI is not yet advanced enough to fully understand students' individual needs.	4.18	4	5	.93

AI may reduce students' critical thinking by providing ready-made solutions.	4.59	5	5	.82
I am concerned about the ethical implications of using AI in education, such as student privacy violations, algorithmic bias, and reducing the human element in teaching.	4.14	5	5	1.15
Average rating of negative aspects of AI.	3.96	4.08	4.67	.77

This strong concern highlights the necessity for careful and responsible implementation of AI technologies, ensuring that they complement, rather than replace, traditional pedagogical methods. It also suggests a demand for more transparency and discussion around how AI will impact teaching and learning, student engagement, and creativity.

The Kruskal-Wallis test was conducted to determine whether there are differences in opinions on the use of AI in teaching based on the year of study. The test showed a statistically significant difference regarding the year of study for two statements (Table 3). However, when comparing the arithmetic mean ranks for each year, it is not possible to conclude that students change their opinion consistently based on their year of study (for example, second year students are less likely to believe that AI can help students with special needs, but fifth year students believe this even less than second year students). While there is a statistically significant difference between certain groups of respondents depending on their year of study, the results are irregular across categories. Therefore, **Hypothesis 1** is partially confirmed.

Table 3

Differences in attitudes toward the use of AI in teaching based on the year of study

Differences in attitudes toward the use of AI in teaching based on the year of study.	Chi-Square	df	Asymp. Sig.
Perceived familiarity with AI technologies.	5.629	4	.229
AI can be useful in primary education.	3.753	4	.440

AI can help personalize educational experiences for students.	3.806	4	.433
AI can improve learning efficiency by providing students with immediate feedback.	1.843	4	.765
AI technologies can increase student engagement through interactive learning methods.	5.712	4	.222
AI can improve access to education for students with special needs.	11.444	4	.022
AI can allow teachers to focus more on providing individualized support to students.	3.446	4	.486
AI can facilitate teachers' planning and organization of lessons.	9.723	4	.045
AI technologies in education may be too complex to use and could complicate teachers' everyday work.	2.031	4	.730
The use of AI in education may diminish the importance of the teacher's role.	8.100	4	.088
AI technologies could lead to an over-reliance on technology instead of creative learning methods.	6.157	4	.188
AI is not yet advanced enough to fully understand students' individual needs.	8.637	4	.071
AI may reduce students' critical thinking by providing ready-made solutions.	3.872	4	.424
I am concerned about the ethical implications of using AI in education, such as student privacy violations, algorithmic bias, and reducing the human element in teaching.	8.690	4	.069
Average rating of positive AI aspects	5.332	4	.255

Average rating of negative aspects of AI	8.776	4	.067
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To determine whether there are differences in opinions on the use of AI in teaching based on the study module, the Kruskal-Wallis test was conducted for each statement and for the average rating of positive aspects. The test identified statistically significant differences based on the module for three statements shown in the Table 4, and for the average rating of positive aspects of AI.

Table 4

Differences in attitudes toward the use of AI in teaching based on the study module

Statement	Module / program	Mean Rank
AI can help personalize educational experiences for students.	English Language	25.50
	German Language	28.75
	Croatian Language	20.38
	Art Culture	17.64
	Educational Sciences	32.67
	Informatics	38.56
AI can improve learning efficiency by providing students with immediate feedback.	English Language	25.41
	German Language	38.25
	Croatian Language	24.79
	Art Culture	14.50
	Educational Sciences	39.17
	Informatics	33.67
AI can improve access to education for students with special needs.	English Language	22.05
	German Language	33.25
	Croatian Language	22.08
	Art Culture	14.00
	Educational Sciences	36.08
	Informatics	38.32
Average rating of positive AI aspects.	English Language	24.55
	German Language	28.00
	Croatian Language	22.00
	Art Culture	15.93
	Educational Sciences	36.58
	Informatics	36.41

When observing the arithmetic means of ranks, they indicate that students from the Informatics module generally express more positive opinions on three statements compared to other modules. For the average rating of positive aspects, a post-hoc analysis was conducted to determine between which modules the differences were statistically significant. Post-hoc tests revealed that students from the Informatics module express significantly more positive attitudes toward the use of AI in teaching compared to students from the English Language, Croatian Language, and Art Culture modules. However, no significant difference was found between students from the

Informatics module and those from the German Language or educational sciences modules. Therefore, it cannot be concluded that Informatics module students have more positive attitudes toward AI compared to other modules and **Hypothesis 2** is partially confirmed.

The Wilcoxon Signed Ranks test was conducted to determine whether there is a statistically significant difference between the average ratings of positive and negative aspects of AI in teaching. The result indicated that there is a statistically significant difference (Table 5).

Table 5

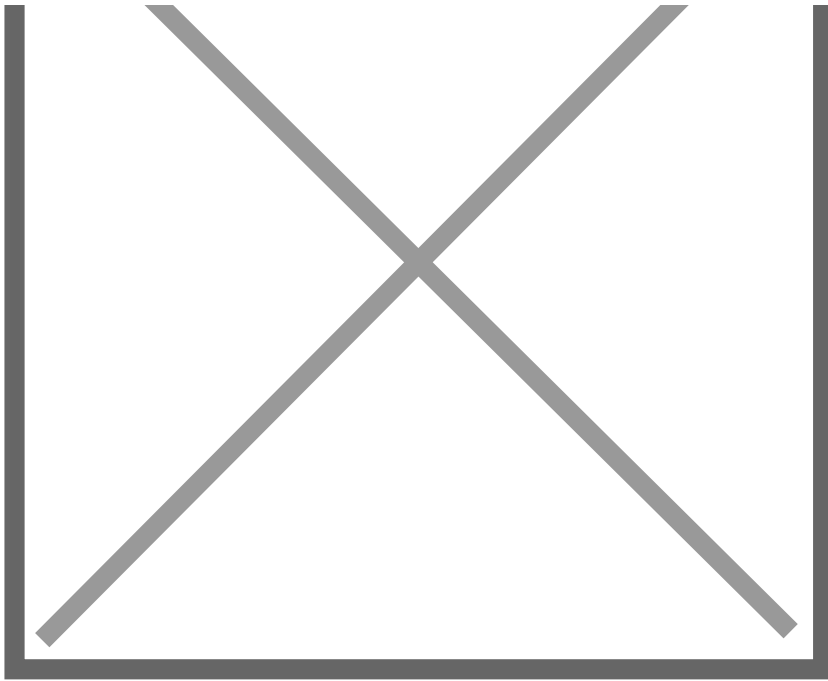
Differences in attitudes toward the use of AI in teaching based on the study module

Wilcoxon Signed Ranks Test	Average rating of negative aspects of AI Average rating of positive aspects of AI
Z	-3.846 ^b
Asymp. Sig. (2-tailed)	.000

By comparing the medians, it can be concluded that there is statistically significantly greater agreement with the negative aspects than with the positive aspects of using AI in teaching (Chart 4) so here it can be concluded that the **Hypothesis 3** is refuted.

Chart 4

Average rating of positive and negative aspects of using AI in teaching



In the next section of the questionnaire, students were presented with a list of applications that could be useful for teachers, and they were asked to select which ones they considered the most useful using a multiple-choice format. They were also able to write applications that they consider useful. The applications were as follows:

Intelligent Tutoring Systems: Carnegie Learning's MATHia – This system uses artificial intelligence to adapt math lessons to students based on their responses, providing personalized instructions and explanations.

Automated Grading and Feedback Systems: Grammarly – An AI tool that automatically reviews and evaluates written text's grammatical and stylistic aspects, offering feedback to help students improve their writing assignments. Turnitin – A platform that uses AI to analyze student papers, detect plagiarism, and provide feedback on the originality of the content.

Adaptive Learning Platforms: Khan Academy – An online educational platform that uses AI to personalize lessons and track student progress, adjusting the material according to their needs. DreamBox – An adaptive math learning platform that uses AI to tailor instructional content in real time based on student responses and progress.

AI for Data Analysis and Student Assessment: Civitas Learning – A platform that uses AI to analyze large amounts of student data to predict their success and provide interventions to improve outcomes. Edmentum – A system that leverages data analytics and AI to assess student progress and generate reports for teachers to understand student needs better.

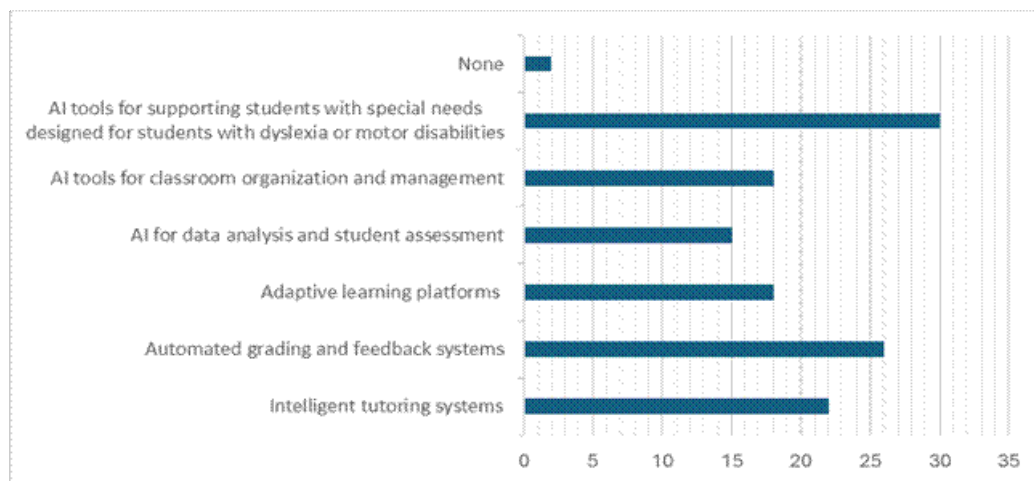
AI Tools for Classroom Organization and Management: ClassDojo – A platform incorporating AI to help teachers manage student behavior and engagement. Teachers can track student progress, communicate with parents, and customize student activities.

AI Tools for Supporting Students with Special Needs: Otter.ai – An AI-powered transcription tool that assists students with hearing or writing difficulties by providing real-time transcription of lectures. ModMath – An AI application designed for students with dyslexia or motor disabilities, allowing them to solve math problems on a digital platform without the need for handwriting.

As shown in Chart 5, most students (N=30) see the potential of AI tools for supporting students with special needs which is closely followed by Automated grading and feedback systems (N = 26). Two students answered none.

Chart 5

Usefulness of AI application designed to support teachers



When it comes to applications designed to support students, the list was as follows.

AI-driven educational games: like Minecraft: Education Edition, use AI to create dynamic educational scenarios where students can learn programming, math, science, and other subjects through interactive gameplay. DragonBox is an educational game that utilizes AI to tailor math challenges to the student’s knowledge level, especially helping with learning basic mathematical concepts.

AI tools for learning and problem-solving: Socratic by Google, an AI app that answers students' questions and provides problem solutions in various subjects with tailored explanations. Photomath is an AI tool that allows students to scan math problems and receive step-by-step solutions and explanations to better understand the material.

Language learning: Duolingo is an AI tool that personalizes lessons according to the student's progress, adjusting the difficulty of tasks for more effective language learning. Babbel is another AI language-learning app that adapts lessons to the student's needs and tracks progress in vocabulary and grammar.

AI tools for collaboration and teamwork: Miro provides an AI-powered platform that enables students to work in teams, brainstorm together, and visually plan projects. Padlet is an online tool using AI to facilitate collaboration, allowing students to share ideas, work, and projects in one place.

AI tools for scientific experiments and simulations: Labster, offer virtual labs and scientific experiment simulations, enabling students to explore biology, chemistry, physics, and other scientific fields. Phet Interactive Simulations uses AI-driven simulations that allow students to explore various scientific concepts and experiments in an interactive environment.

Creativity and design: Canva is an AI design tool that helps students create visually appealing projects, such as posters, presentations, and infographics, with customizable templates and elements. Animoto is an AI-powered video creation tool that allows students to make video content using templates and AI-driven effects easily.

Creative writing development: Storybird is an AI platform that guides students through creating and writing their own stories, providing ideas and visual support.

Research and information gathering: Kiddle is an AI-powered search engine tailored for children, ensuring safe and relevant results for younger students when searching for topics for their projects. Elicit is an AI tool that assists students in researching various topics by suggesting relevant articles and sources and providing summaries.

AI tools for virtual and augmented reality: Google Expeditions, an AI-powered AR and VR platform that allows students to take virtual trips and explore historical, scientific, and cultural locations.

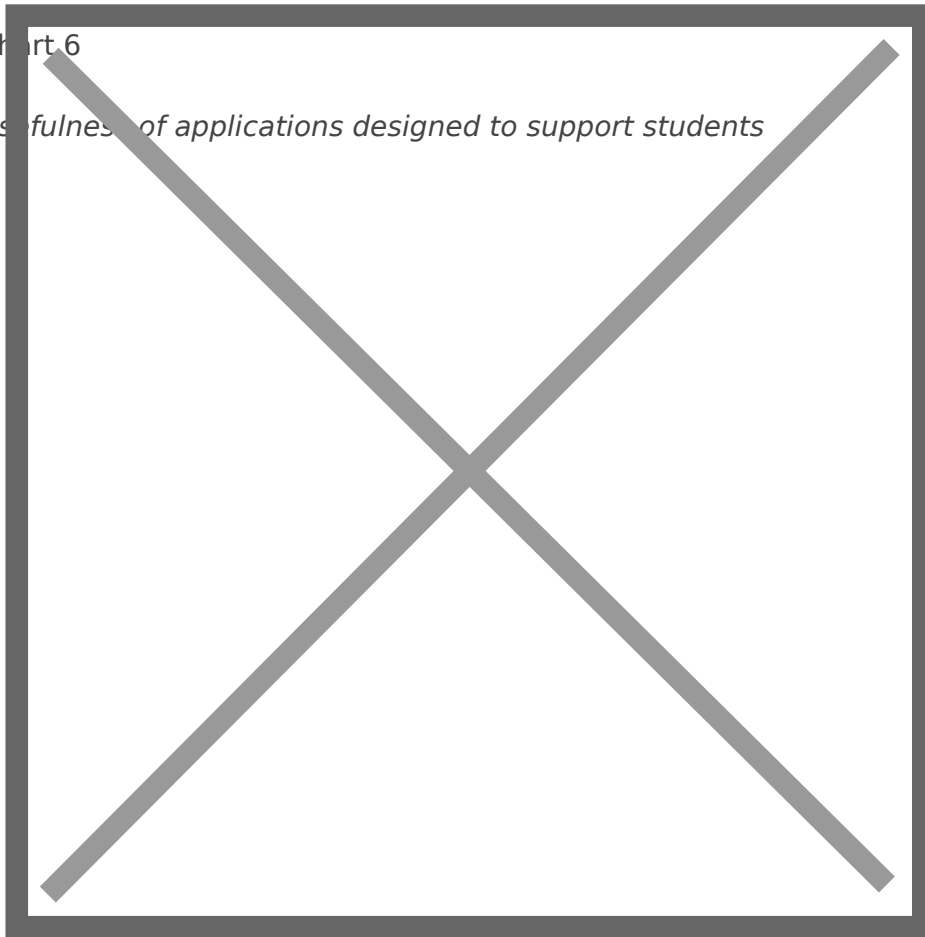
Time management and organization: Todoist is an AI tool that helps students organize their tasks and activities by providing reminders and customizable to-do lists. MyStudyLife is an AI app that helps students track school assignments, deadlines, and exam dates, assisting them in better managing their time.

Mental health and emotional support: Woebot is an AI chatbot that provides emotional support to students, helping them manage anxiety, stress, and emotional challenges. Moodpath is an AI app that monitors students' emotional states and provides tools to better understand and manage their emotions.

As shown in Chart 6, most students (N=29) see the potential of AI tools used for language learning and scientific experiments and simulations (N=29). This is closely followed by AI tools for Creativity and design (N=28). On the low end of the score, students don't really see the benefits of using AI tools for research and information (N=12) and creative writing (N=6), also, one student answered „None.“

Chart 6

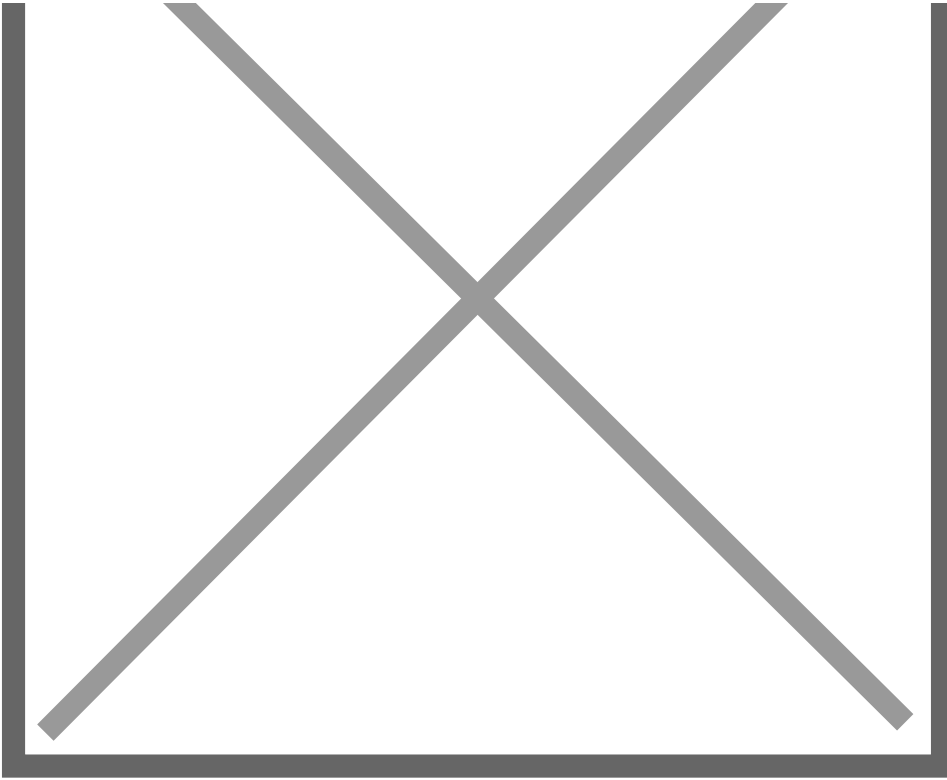
Usefulness of applications designed to support students



Regarding the subjects they think should be supported by AI (Chart 7) the subject Informatics was mentioned most often (N=40).

Chart 7

Usefulness of applications in various subjects



Here is a categorization of the provided text into a few key categories:

1. Positive Impacts of AI on Education:

Ease of Use for Teachers: AI will likely facilitate the preparation of materials and assignments, reducing the workload for teachers. Teachers will be able to track and evaluate student progress more easily and make their classes more engaging.

Enhanced Learning Tools: More tools will make learning more interesting both in class and independently. AI will provide personalized learning, adapting to each student's pace, interests, and needs, helping students with different abilities to progress better.

Administrative Automation: AI will automate administrative tasks like grading and progress tracking, reducing the burden on teachers.

Interactive Learning for Abstract Concepts: AI will help explain complex topics visually, especially in subjects like natural sciences.

Increased Efficiency: AI can make teaching more efficient and lessen the burden on teachers, making classes more effective and fun.

2. Negative Impacts of AI on Education:

Over-reliance on AI: Both teachers and students may become too dependent on AI, leading to a reduction in independence and creativity. Over-reliance on AI might diminish critical thinking skills and logical reasoning among students.

Decreased Teacher Involvement: The role of teachers might be diminished, with AI tools handling tasks that were previously teacher-led, potentially leading to a decrease in the importance of the teacher-student relationship.

Laziness and Reduced Critical Thinking: Students might rely on AI to complete assignments, leading to a lack of effort and reduced engagement in learning. AI might encourage a „shortcut“ mentality, where students seek easy solutions rather than learning and problem-solving.

Reduced Socialization and Communication: The use of AI may lead to less social interaction and communication among students, affecting their social skills and ability to focus.

3. Mixed Impacts and Concerns:

Balance between Benefits and Risks: While AI can provide valuable tools for learning, especially in areas where schools lack resources (e.g., science labs), there is concern about maintaining emotional and human interaction in education, which is crucial for child development.

Need for Gradual Implementation: Technology should be introduced gradually to avoid negative impacts on critical thinking and ensure that AI enhances rather than replaces human elements in education.

4. Skepticism and Caution:

Skepticism toward AI Integration: Many fear that the integration of AI will lead to a loss of key educational values, such as creativity, problem-solving, and personal development. Some believe AI will lead to laziness and a lack of effort in both teaching and learning processes.

Potential for Negative Long-term Effects: Some express concern that the long-term impact of AI will be a decrease in socialization and hands-on learning, with children becoming overly reliant on technology for solutions.

Conclusion

In conclusion, this study examined the attitudes of prospective primary school teachers towards the use of AI in education, focusing on three hypotheses. The first hypothesis proposed that there

are no statistically significant differences in opinions and attitudes based on the students' year of study. The results partially supported this hypothesis, as some differences were found across study years, particularly regarding the perception of AI's role in supporting students with special needs and facilitating lesson planning. Therefore, it was concluded that the year of study has only a minor influence on shaping attitudes and opinions, as the observed differences were not consistent across all evaluated categories.

The second hypothesis suggested that there are no statistically significant differences in opinions based on the students' study module. This hypothesis was also partially confirmed, as students from the Informatics module exhibited significantly more positive attitudes towards AI compared to those from the language and arts modules. Nevertheless, no significant differences were found between Informatics and some other modules, such as Educational Sciences, highlighting a subtle connection between the study module and attitudes toward AI.

The third hypothesis, which stated that there are no statistically significant differences between the average ratings of positive and negative aspects of AI in teaching, was refuted. The results indicated a statistically significant difference, with students rating the negative aspects of AI—such as concerns about critical thinking, creativity, and ethical implications—more strongly than the positive aspects, such as AI's potential to improve learning efficiency and support personalized education.

Overall, what these findings show is the complexity of integrating AI into education. Prospective teachers not only see the potential benefits of using AI with students but also are very cautious about the possible drawbacks. They worry about the potential impact of creative AI on the kind of work that students do and on the kinds of decisions that teachers make about the kind of work that students do. And they especially worry about the kind of impact that creative AI could have on student autonomy.

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