

# Advancing the Teaching Method in the Era of Widespread Artificial Intelligence Application: An Explorative Study

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**Abstract:** *This paper explores the application of artificial intelligence (AI) in education to improve teaching processes. Through the analysis of relevant literature, various aspects of the application of AI technologies in the educational sector are explored. It has been found that AI can provide a personalized academic experience and more efficient information retrieval; however, AI answers are perceived as often lacking in accuracy and correctness and should not be unquestioningly trusted. The research instrument was an online survey given to 105 university students with several types of questions to discover whether our students were familiar with the concept of AI tools. Through the analysis of the available literature and the student's response, it is concluded that a viable option to improve the learning and teaching process is a balance between traditional teaching methods and the application of AI technologies, where AI could support teachers through dynamic and interactive lessons and provide additional resources tailored to individual student needs. At the same time, the need for careful development and use of AI technologies concerning ethical principles and continuous expert supervision is strongly emphasized, underlining the crucial role of educators, researchers, and policymakers in ensuring responsible AI use in education.*

**Keywords:** *education improvement; teaching; artificial intelligence; motivating students*

## 1. NAVIGATING THE CHANGING LANDSCAPE OF TECHNOLOGY EDUCATION AND EMPLOYMENT

In an era marked by rapid technological advancement and evolving job markets, the assumptions guiding education must adapt to society's shifting needs. While universities continue to teach competencies that align with past industry demands, a looming discrepancy exists between these skills and the future employment landscape.

A prime example of this dissonance is the prevalent focus on programming languages in technology education. Despite emphasizing programming skills, forecasts suggest that many programming-related jobs may succumb to automation and artificial intelligence (AI) in the coming years. Consequently, technical companies are already experiencing layoffs, signaling a broader trend poised to escalate.

In this evolving scenario, the survival and success of students in the technology sector hinge on a combination of motivation, talent, and adaptability. Only the "best of the best"—those who possess a keen understanding of emerging technologies, maintain unwavering motivation, and demonstrate exceptional talent—will likely thrive in this competitive landscape. However, the question

remains: What is the place and role of other students in technology?

While the future may indeed favor the technologically adept, it would be remiss to overlook the diverse skill sets and contributions of students beyond the elite cohort. In a field as multifaceted as technology, a spectrum of roles and opportunities extends beyond programming alone. Students with strengths in design, user experience, project management, and entrepreneurship will continue to play pivotal roles in driving innovation and progress.

Furthermore, the advent of AI and automation does not negate the need for human ingenuity, creativity, and empathy – qualities that machines cannot replicate. As such, students who possess a blend of technical and soft skills, such as critical thinking, communication, and collaboration, will remain indispensable in navigating the complexities of the digital age.

In essence, while the technological landscape may undergo profound transformations, the role of students in technology extends far beyond mere proficiency in programming languages. As educators and policymakers grapple with preparing the next generation for an uncertain future, it becomes increasingly crucial to cultivate a diverse range of

skills, perspectives, and talents – ensuring that all students are equipped to contribute meaningfully to the ever-evolving world of technology. Incorporating technology into teaching is a powerful strategy in the digital age. It provides access to a wealth of information and resources, making learning more engaging and relevant. Technology can be used for interactive lessons, online research, virtual simulations, and multimedia presentations, enhancing students' understanding and expanding their horizons. It also prepares them for the technology-driven world they will encounter outside school [1].

An illustrative example of AI technology integration in the classroom is its use in addressing code-related tasks during hands-on lectures. Students frequently seek assistance from AI tools when faced with complex programming challenges, regardless of the language used. These tools generate a general response, providing a basic code structure to be incorporated into existing projects. However, despite AI's considerable help, a solid understanding of programming principles and logic is vital for effectively using AI-generated solutions within the task context. Students who do not possess fundamental programming skills and syntax knowledge often struggle to implement AI-generated code within their projects. AI aids by offering conceptual guidance and a preliminary solution, but expertise in the subject matter is essential for completing the task and producing functional code.

Another concrete application of AI in educational settings is its ability to generate descriptions for machine learning (ML) datasets. When encountering ML datasets for the first time, tasks such as data analysis, understanding, and separating predictors from outcomes can be daunting, especially if the dataset was not initially intended for ML applications. Students leverage AI-generated insights to enhance their project work, using AI for dataset analysis and explanatory purposes. However, relying on AI solutions without critically assessing their validity can result in illogical and insignificant outcomes. This highlights the importance of foundational knowledge for effectively merging AI-generated solutions with ongoing work. While AI assistance can significantly improve the effectiveness of classroom tasks, human expertise and critical thinking are indispensable for ensuring their completion and accuracy. In this study, we explore student perceptions of using AI tools in education, including students beyond the elite cohort who often lack motivation and knowledge for a more classical and rigorous technical study but still have specific interests and talents that would greatly benefit from personalized academic experience and study gamification in line with Gen Z preferences.

AI has the potential to transform education, and many researchers aim to understand students' perspectives on AI in educational settings by analyzing survey responses from diverse academic backgrounds [2], [3], [4]. In addition, students' opinions on the use of AI in specific tasks were analysed, such as in essay writing [5].

The goal of this study is to explore the application of AI in education to improve teaching processes. This study aims to understand how AI can be utilized to create a personalized academic experience, enhance information retrieval, and support dynamic and interactive lessons. The purpose of the study is to analyze various aspects of AI application in education, determine students' familiarity with AI tools, and evaluate their perceptions and attitudes towards AI in educational settings. This study seeks to find balance between traditional teaching methods and AI technologies while emphasizing the need for ethical AI development and continuous expert supervision. Additionally, the goal is to gain insight into responsible AI use in education, providing additional resources tailored to individual student needs and preparing them for the technology-driven world [6].

## 2. METHODOLOGY

Our study employed a mixed research design, integrating qualitative and quantitative approaches to analyze the research questions comprehensively. The survey group included 105 Faculty of Technical Sciences Čačak students, comprising 80 first-year and 25 third-year primary academic Information Technology (IT) students. The gender distribution included 29 females and 76 males, offering a diverse demographic representation.

The questionnaire used in this study was meticulously developed by combining an adapted attitude scale with a set of original questions designed by the researchers. The adapted attitude scale was tailored to capture students' perceptions and attitudes towards integrating AI in educational settings [7]. The original questions were explicitly crafted to explore various dimensions of AI application in teaching, such as the types of tasks where AI was utilized, the effectiveness of AI in assisting with these tasks, and the students' overall experience with AI tools in their coursework. This comprehensive instrument ensured that the data collected would provide detailed insights into this research's specific areas of interest, as illustrated in Table 1.

Data was collected through a structured survey administered to the students during April 2024. The survey was designed to be both accessible and engaging, encouraging maximum participation from the students. To ensure the reliability and validity of the responses, the survey was

administered under supervised conditions, with clear instructions provided to the participants. The questions were framed to elicit honest and

reflective responses, focusing on their studies' practical aspects of AI application.

**Table 1.** To thirteen survey questions, students could answer with: 1 = I strongly disagree, 2 = I do not agree, 3 = I neither agree nor disagree (neutral), 4 = I agree, 5 = I strongly agree. Results are later normalized to range -2 to 2, zero being neutral, making it easier to appreciate positive or negative attitudes towards AI.

1.	Artificial intelligence is part of my everyday life.	1	2	3	4	5
2.	Artificial intelligence is part of my academic life.	1	2	3	4	5
3.	I am familiar with intelligent systems capable of answering my questions (ChatBot).	1	2	3	4	5
4.	I use intelligent systems during learning (e.g. ChatGPT, Gemini, Copilot, etc.)	1	2	3	4	5
5.	Intelligent systems are very reliable and always give correct answers.	1	2	3	4	5
6.	Artificial intelligence is sufficiently developed for use in teaching.	1	2	3	4	5
7.	Artificial intelligence can help improve education.	1	2	3	4	5
8.	Lectures in studies should also include the study of the use of intelligent learning systems.	1	2	3	4	5
9.	I would quickly get used to a form of teaching that uses intelligent teaching systems.	1	2	3	4	5
10.	Teachers would provide better education to students with the use of intelligent systems.	1	2	3	4	5
11.	Realization of pre-exam and exam obligations with the use of intelligent systems would reflect my real knowledge.	1	2	3	4	5
12.	There are problems with studying that could be partially or completely solved by using artificial intelligence.	1	2	3	4	5
13.	In my daily life and work, I no longer need my own knowledge, because I can supplement it by using artificial intelligence tools.	1	2	3	4	5

The data collection process involved several steps:

1. **Pre-Survey Preparation:** Before administering the survey, an introductory session was held to explain the purpose of the study, the importance of their participation, and how their responses would contribute to the research. This session aimed to build trust and ensure informed consent from all participants.
2. **Survey Administration:** The survey was distributed during regular class sessions to ensure a high response rate. Participants were given sufficient time to complete the questionnaire, and researchers were available to clarify any questions.
3. **Data Entry and Cleaning:** Upon collection, the survey responses were carefully entered into a digital database. A data cleaning process was performed to identify any inconsistencies or errors in the responses, ensuring the integrity of the dataset.

The analysis phase involved both statistical techniques and qualitative response analysis. Descriptive statistics were used to summarize the demographic characteristics of the sample and the overall responses to the questionnaire items. Inferential statistics were employed to examine differences between groups (e.g., first-year vs. third-year students, males vs. females) and to identify significant patterns and correlations within the data. Additionally, qualitative responses from

open-ended questions were analyzed using thematic analysis. This approach allowed the researchers to identify common themes and insights related to the students' experiences and attitudes towards AI in their education. Integrating quantitative and qualitative findings provided a rich, nuanced understanding of the research questions.

### 3. RESULTS AND DISCUSSION

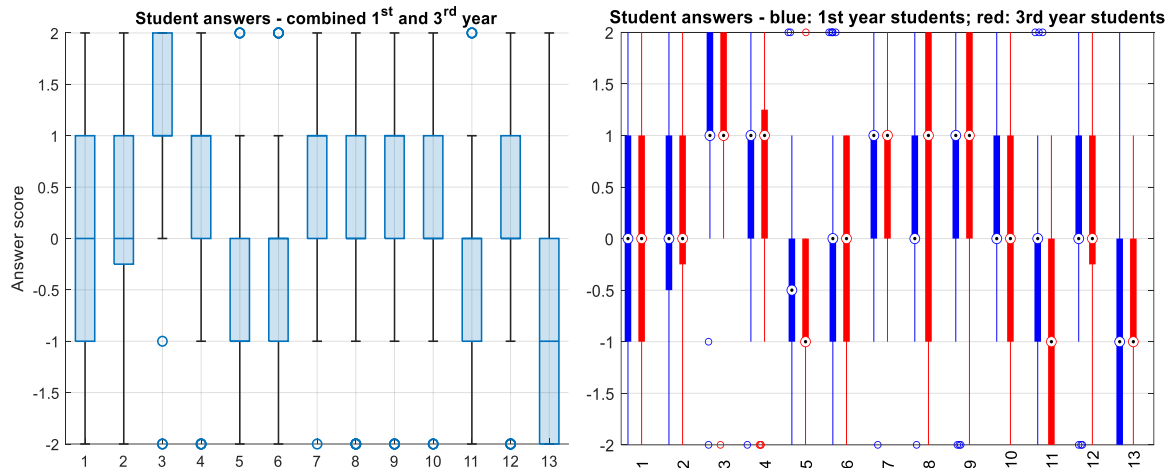
#### 3.1 Pool results

Students answered 13 questions (q1-q13) and indicated the following opinions [8]:

- Majority of students do not rely much on AI systems in daily life or studies (q1-q2)
- Students are aware of AI systems (q3) and use them occasionally (q4), with male students being one point more positive than female students.
- Students doubt whether AI is sufficiently developed and believe that AI-provided answers are not always correct (q5-q6).
- Students believe that AI could eventually help them and would like to see some AI aspects in education. They believe that education could benefit from it and that they would get used to it quickly (q7-q10, q12).
- Students are generally aware that using AI tools during exams would reflect insufficiently their actual knowledge (q11).

- While believing that some knowledge augmentation is possible, students generally think that AI could not replace the lack of their knowledge sufficiently and that doing exams using AI systems would represent their actual knowledge. Female students are even more conservative on this than males (q13).
- The answers given by 1st and 3rd year students are pretty similar. Notable exceptions are that 3rd-year students show more awareness that AI currently often provides wrong answers (q5), but are still a bit more positive in wanting to learn how to use AI (q8).

The figure 1 shows box plots of student responses to 13 questions, with zero indicating indifference, positive values showing preference for AI, and negative values indicating skepticism, and compares responses of 1st and 3rd-year students. The results reveal minimal overall differences. However, 3rd-year students demonstrate greater awareness of AI's current inaccuracies (q5), are more positive about including AI training in the curriculum (q8), and believe more strongly that using AI during exams would not reflect their true knowledge (q11).



**Figure 1.** Box plot analysis of student responses by academic year. (left) Combined analysis of responses for 1<sup>st</sup> and 3<sup>rd</sup> year students. (right) Comparative analysis of responses for 1<sup>st</sup> and 3<sup>rd</sup> year students.

### 3.2. Student Comments

The following subsection presents the students' views and opinions provided as part of the survey, answering two additional open-ended questions:

1) If you think that you don't need more of your knowledge in your daily life and work but can supplement it by using AI tools, state how and in which cases intelligent systems can compensate for your lack of knowledge.

2) If you have problems while studying that could be partially or entirely solved using AI, state what those problems are and how AI-based tools would help you.

The excerpts of the student answers are as follows:

**Coding help:** AI can significantly increase the efficiency of the software development process, speed up projects and facilitate problem orientation and identification:

- Learning support: AI systems can provide coding support and advice, even for beginners, to facilitate learning and skill development.
- Real-time code analysis: AI tools can analyze code as you write it and alert you to potential errors or problems.
- Suggestions for corrections: AI can detect errors and offer suggestions for correcting them, speeding up the debugging process.

- Automated testing: AI can generate and run tests for your code, uncovering bugs that might otherwise go unnoticed.
- Real-time error prediction and resolution: AI can be programmed to monitor code execution in real-time and convert any errors that occur.
- Automatic code check: AI can analyze code and identify potential errors or non-compliance with coding standards. This helps in early detection and correction of mistakes before problems become significant.
- Learning from historical data: Based on previously discovered bugs and fixes, AI can learn how to better identify and predict potential problems in code.
- Static code analysis: AI static analysis tools can inspect code without executing it and identify structural and logical errors.
- Code optimization recommendations: AI can analyze existing code and recommend optimizing and implementing coding best practices.
- Analysis and prediction of problematic parts of the code: AI can analyze large code banks and predict possible problem areas or points of non-conformance. This helps teams focus their efforts where they are most needed.

- Automatic code generation: Some AI systems can automatically generate code based on criteria and requirements, significantly speeding up the software development process.

**Work verification:** AI-assisted verification can significantly improve student work accuracy and quality, allowing them to make faster learning progress. One could compare one's answers to AI's, and AI can find and correct mistakes in the following ways:

- Comparison of answers: The ability to compare your answers with those provided by the AI allows you to spot differences and potential errors quickly.
- Error identification: AI can analyze your work and point out the errors you have made, be they logical, syntactic or conceptual. It can assist in finding and remembering information that is easily forgotten or overlooked, contributing to the accuracy and quality of your work.
- Suggestions for corrections: In addition to detecting errors, AI can offer specific suggestions for correcting them, helping you improve your solution.
- Analysis and explanation: AI can provide detailed analysis and explanation of why something is wrong and how to correct it, contributing to a deeper understanding of the matter.
- Continuous learning: Using AI for verification, you learn from your mistakes and constantly improve your knowledge and skills.

**Information searching and sharing:** Using AI to search and share information greatly improves the efficiency of obtaining information compared to traditional search methods such as Google.

- AI enables faster finding and sharing of information from any domain. Instead of using Google to browse and search over many pages manually, we could get instant answers, saving time and effort.
- Processing large amounts of data: AI can quickly analyze and synthesize information from many sources, allowing for more comprehensive and accurate answers.
- Natural language processing: AI systems use technologies like natural language processing (NLP) to understand complex queries and provide answers tailored to your needs.
- Personalization: AI can tailor search results to your interests and past queries, providing the most relevant information.
- Interactive search: Through interactive conversations, AI can clarify your queries and provide more detailed answers based on your additional questions or clarifications.
- Integration of different sources: AI can combine information from various sources, including

academic databases, newspaper articles, and technical documents, to give you the most comprehensive answers possible.

**Learning and problem-solving:** AI can enhance our ability to find answers to things we don't know or understand, thereby improving the efficiency and quality of the learning and problem-solving process:

- AI could help with searching for answers to things we do not know or understand, providing ideas on how to understand and solve problems better, and obtaining a complete answer, even for things otherwise difficult to find
- Compare solutions: AI tools can search for previous solutions to a problem and identify the best approaches for specific issues or tasks.
- Additional explanations and information: AI can supplement the material with explanations, examples, and additional information where a more profound understanding is needed. This provides students with additional learning resources and enriches their knowledge of the topic.
- AI could aid us by providing different perspectives and approaches to (algorithm) problems we are solving, which could significantly enrich our understanding and prepare us for future challenges.
- Condensing text: AI can create (short) summaries of longer pieces of text/theory, discerning the most critical aspects, concepts, and information, particularly mathematical and theoretical "stuff." This would make it easy for students to quickly review and absorb essential details [6].
- If teachers fail to explain specific lessons or examples sufficiently, we could get additional information and explanations through AI.
- AI can specifically focus on mathematical and theoretical parts of the text, which is especially useful in scientific fields. This helps students better understand and assimilate complex concepts and formulas.

**Enriching classes:** AI could make classes and lessons more interesting, engaging, and effective:

- Personalization of learning: AI can analyze students' needs, interests, and performances and suggest personalized materials and activities that match their learning styles. This will improve student engagement and result in more efficient knowledge acquisition.
- Interactive content: Interactive AI applications and content can engage students in new ways, allowing them to participate actively in their learning.

Generating assignments and tests: AI can automatically create assignments and tests

tailored to students' levels of understanding and aligned with instructional objectives.

- Virtual Assistants: AI can be used to develop virtual assistants that can answer students' questions, explain concepts, and provide additional resources.
- AI can be used to find information easily forgotten or overlooked, like factual information or even grammar errors
- Integration of games and simulations: learning through games and simulations can effectively stimulate learning and achieve set goals.
- Adapting pace and learning styles: AI can analyze student progress and automatically adjust the pace and style of teaching to maximize understanding and learning.
- AI can allow students to make up for missed lectures more efficiently and receive the necessary explanations, thereby increasing the accessibility and efficiency of education.
- AI can replace attendance in classes and help us catch up and get an explanation of missed lectures. It could even replace consulting teachers since needed information could be obtained for most of the questions.
- AI can find additional information for deeper exploring and research into specific topics
- AI can help write seminar and term papers, with general-purpose and boring writing, to significantly save time and energy, making the research and writing process more manageable.

**Limitations and concerns:** AI can make mistakes and provide wrong answers despite progress. More knowledge and control on the human side are welcome, and students should avoid unquestioningly adopting AI-provided answers.

- There is no problem AI can solve that students cannot solve. We must be careful, as AI responses can often be wrong and do not provide complete solutions. Too big reliance on AI can detriment our learning process and skills
- The inclusion of AI in the educational process can be helpful, but it must be used with an awareness of its limits and possible errors
- Lack of knowledge cannot be substituted in case of mathematical calculation as results and formulas provided by AI could be erroneous, and AI cannot completely replace the human mind in this field
- In the IT sector, one's study, knowledge, and understanding are most important, always better, and irreplaceable, and should be maintained. AI can help to find patterns, find errors, fill in the knowledge, and do "easier stuff," but it cannot replace humans or provide complete solutions

- Self-learning, knowledge, and understanding are crucial to success in the IT sector. While AI can bring many benefits, it is essential to remember that people still play a vital role in developing and applying these technologies.
- Learning to use AI in classes shouldn't be a large part of the class but just a little help.

AI tools have profoundly reshaped university teaching and learning globally, with reported benefits in improving student learning and accessibility. The findings of this study align with similar research, demonstrating a mostly positive attitude towards AI tools in education while also acknowledging concerns and limitations [2]. Previous studies have shown that AI technologies enhance learning and accessibility, with students appreciating benefits such as grammar checks and plagiarism detection, although they also express concerns about the impact on creativity and critical thinking. A study that analyzed a survey responses from students of diverse academic backgrounds and educational levels revealed generally positive perceptions of AI's benefits but also concerns about its drawbacks, necessitating measures to mitigate negative impacts while leveraging AI's advantages [13]. The study which explored students' perceptions of AI in academic essay writing among undergraduates, found that while AI tools were positively received for their benefits in grammar checks, plagiarism detection, and more, there were concerns about impacts on creativity and critical thinking, highlighting the need for a balanced integration of AI to support academic writing while preserving human ingenuity [5]. Another study highlights positive attitudes towards the use of AI in education while emphasizing the need for digital literacy to ensure its effective integration without compromising educational quality [3]. These studies highlight the necessity for a balanced integration of AI to support educational quality and foster human ingenuity. However, the current scarcity of research on student perspectives limits comprehensive insights into their practical engagement. This study aims to fill this gap by elucidating how AI tools affect students throughout their university education. As found in a study from 2023, the majority of students exhibited low familiarity, limited experience, and confidence with AI tools, emphasizing the need for tailored education and redesigned assessments to mitigate academic integrity risks [4]. Our research contributes to this body of work by emphasizing that students' positive opinions on AI are often idealistic, revealing a gap between their expectations and the current capabilities of AI. Matching positive opinions over AI with predominantly neutral to skeptic results from the questionnaire and seeing the current AI limitations brings an understanding that provided student comments are actually a list of wishes rather than a reality of what AI can offer at the current stage

of development. Although most students are aware of issues with the incorrectness and lack of accuracy of answers that AI can provide, there is still a tendency to mix the current AI performance with their apparent needs. This also shows that student needs, interests and capabilities have changed and that the classical education system cannot provide satisfactory solutions [9].

This study provides a unique perspective by identifying that while students recognize the inaccuracies and limitations of AI, they still see potential in its application for personalized academic experiences, real-time feedback, and efficient information retrieval. Unlike previous research, our study underscores the inevitability of advancing teaching methods to incorporate AI, suggesting that while AI should not replace traditional education, it can enhance the learning experience [8]. This highlights the need for further exploration and careful implementation of AI technologies, ensuring ethical considerations and continuous expert supervision.

#### 4. CONCLUSIONS

In this paper, we have performed an exploratory study on the application of AI in education to improve the teaching process. Many students had the opportunity to actively use AI tools in their classes or for home study, providing extraordinary insight into the potential of this technology. Through the analysis of the relevant literature and the results of the conducted research, numerous potential benefits of AI technologies in the education sector have been identified [10], including coding help, work verification, improved information search and problem-solving, enriching classes, etc. These findings point to the significant role that AI could play in transforming the educational experience and improving student success.

This study has identified a need to support a personalized academic experience with improved learning and problem-solving that enables faster error detection and more efficient information retrieval. Personalization should enable adapting content and resources to each student's needs and learning styles. Rapid error detection and learning support would allow students to receive real-time feedback, contributing to faster progress and improved learning outcomes. Instead of waiting for grades or teacher feedback, students could receive instant information about their work, allowing them to identify and correct deficiencies quickly. Also, obtaining information more efficiently would enable students to access relevant material more quickly, supporting the learning process.

It is our observation that advancing teaching methods is becoming inevitable. In particular, the role of AI in supporting teachers in organizing dynamic and interactive lessons and providing

additional resources adapted to the needs of each student was highlighted. However, using AI tools should not substitute classical education but enhance it and get students interested in studying. In student's view, learning to use AI tools should be a small part of the lesson. This conclusion highlights the need for further research and implementation of AI technologies to achieve an optimal balance between traditional and modern approaches in education. In addition, the importance of carefully developing AI technologies concerning ethical principles and continuous expert supervision was emphasized.

#### ACKNOWLEDGEMENTS

This study was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, and these results are parts of the Grant No. 451-03-66/2024-03/200132 with University of Kragujevac, Faculty of Technical Sciences Čačak.

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