



THE FUTURE OF EDUCATION IN THE ERA OF ARTIFICIAL INTELLIGENCE: CHALLENGES, OPPORTUNITIES AND ETHICS

Mirko Smoljić²

Abstract

In today's digital age, artificial intelligence (AI) is playing an increasingly significant role in transforming education. This article explores how the rapid development of AI is reshaping traditional educational practices and shaping the future of education in the 21st century. The focus is on analyzing the impact of AI on personalized learning, curriculum adaptation, and the optimization of the educational experience in higher education. AI enables the personalization of educational experiences by adjusting materials, teaching methods, and evaluation according to individual student needs and abilities. This approach can significantly enhance student engagement and learning outcomes, promoting active learning and independent exploration. Despite its numerous advantages, the implementation of AI in education faces a range of challenges, including issues of data security, fairness in grading algorithms, and ethical dilemmas related to automated decision-making in the educational process. These challenges require careful consideration and the development of clear guidelines to ensure that AI technologies serve the well-being of all students and the educational community as a whole. Through a review of relevant literature, analysis of current practices, and the application of survey research, this article identifies key trends, challenges, and opportunities of AI in transforming education. Contemporary educational systems need to be prepared for continuous adaptation and innovation to fully harness the potential of AI and ensure high-quality education in the digital era.

Key words: *Artificial Intelligence, education, personalized learning, data security, ethical aspects.*

Introduction

In today's world, artificial intelligence (AI) has become an integral part of almost every sector, from industry and finance to healthcare and education. AI refers to the capability of computers and systems to perform tasks that traditionally require human intelligence, such as speech recognition, decision-making, problem-solving, and learning from experience. Its application in education represents one of the most

² Prof. Mirko Smoljić, PhD, Academician of IRASA, North University, Trg dr Žarka Dolinara 1, Koprivnica, Republic of Croatia, msmoljic@unin.hr



significant and promising directions for the development of modern society. Through personalized learning, AI promises to transform educational processes, making them more adaptable, efficient, and accessible to a wide range of students.

Traditional education often follows a one-size-fits-all approach, where all students are exposed to the same curriculum regardless of their individual abilities, interests, and learning styles. While this approach was effective in a certain era, it is increasingly becoming inadequate in the dynamic world we live in. Personalized learning, supported by AI technologies, offers a solution to these challenges by enabling teachers and educational institutions to tailor curricula and teaching methods to the specific needs of each student. AI can analyze student data, identify their strengths and weaknesses, and suggest materials and methods that best suit their individual learning styles.

However, despite this promising potential, the implementation of AI in education also brings with it a number of challenges. Foremost among these is the issue of data privacy, given that AI systems require the collection and analysis of large amounts of personal student data to provide personalized experiences. This opens up a whole spectrum of ethical issues, including the fairness and transparency of algorithms that make decisions about educational outcomes, as well as the potential risks of automation in education, which could lead to the dehumanization of the educational process.

Moreover, technological innovations in education do not come without obstacles. Differences in access to technology, infrastructural challenges in certain regions, and insufficient digital literacy among teachers and students present additional barriers to the broader application of AI in educational systems. Despite this, the need for transformation of education through innovation is becoming increasingly apparent, and AI is emerging as a key catalyst for this change.

The aim of this paper is to explore how artificial intelligence is transforming the educational system, with a focus on personalized learning, curriculum adaptation, and the optimization of the educational experience in higher education. In this context, the paper also analyzes the main challenges accompanying this transformation, including data security, fairness in grading algorithms, and ethical dilemmas related to automated decision-making in the educational process. Through a review of relevant literature and an analysis of current practices, this paper aims to provide insights into key trends, opportunities, and challenges in the application of AI in education, as well as offer guidelines for the future development of educational systems in the digital era.

The purpose of this paper is not only to highlight the current impact of AI on education but also to emphasize the necessity of thoughtful and ethically responsible application of these technologies. Ultimately, the goal is to ensure that AI serves as a tool for enhancing educational outcomes and the well-being of all participants in the educational process, and to contribute to the creation of an educational system that is prepared for the challenges and opportunities of the 21st century.



Overview of previous research on the impact of AI on educational processes

Previous research on the impact of AI on educational processes demonstrates a significant potential for enhancing learning efficiency, adapting educational content, and optimizing teaching methods. Studies indicate that the application of AI in education can increase the individualization of the educational process, leading to better learning outcomes compared to traditional teaching methods. For example, research conducted by EdTechXGlobal (2019)³ found that students using AI-supported learning tools achieved better test results compared to those who relied solely on traditional methods.

Other studies have focused on the role of AI in automating administrative tasks, such as grading and monitoring student progress. These systems not only reduce the burden on teachers but also provide students with rapid feedback, which is crucial for continuous learning progress. However, there are challenges associated with the implementation of AI in education, including issues of fairness, algorithm transparency, and potential bias in automated grading systems.

According to McCarthy (2004), who also defined the concept of artificial intelligence, AI is a science and research aimed at creating intelligent machines, particularly intelligent computer programs. The difficulty in fully defining artificial intelligence lies in the complexity of intelligence itself, which is challenging to comprehend. Due to the various interpretations of intelligence, defining AI encounters similar challenges, leading many experts to continue their research regardless of whether it falls under the domain of artificial intelligence.

AI in education is focused on developing and evaluating computer software designed to enhance teaching and learning. The goals of implementing AI in education include interpreting complex student responses, understanding why some students exhibit weaker performance, and providing students with assistance based on their academic results, in the form of hints or simulating the behavior of a human instructor [1].

Technology alone cannot influence the educational system; cooperation between technology and teachers is necessary to achieve the best possible results [1]. Technology does not pose a problem or threat to the educational system or the teaching profession; it offers potential solutions to specific issues and questions. As Woolf stated in her article, the best results will emerge from collaboration between technology and teachers.

Many components of intelligent teaching systems have their origins in artificial intelligence. Once these components become integrated into larger systems, they are no longer considered AI and are often forgotten as having originated from it [1]. The same author notes, "Many advanced AIs have been implemented in general programs, often without being labeled as AI because once something becomes useful and commonplace, it is no longer recognized as AI."

³ <https://www.century.tech/news/century-wins-edtechxglobal-all-star-award-2019/#>



The development of digital technologies such as computers, mobile devices, digital media, distribution tools, video games, and social platforms has sparked a revolution in education. The emergence of these technologies has influenced the perception of the school system and the processes of learning and teaching. Both students and professors use these technologies to manage their professional and academic lives more effectively [2].

Software that utilizes AI is now capable of communicating with students and, based on these interactions and the data collected throughout their education—such as academic achievements or attendance—can create individualized teaching approaches. Based on the gathered information, a tailored plan and curriculum can be developed for each student, and if a student shows weaker or stronger progress in a particular area, a specific learning plan is created in the form of additional support.

Teaching is not the only responsibility of educators. Teachers must also provide feedback and evaluate students to prepare them better for subsequent lessons. These responsibilities can also be facilitated by implementing software, such as writing tools that can analyze writing trends across multiple essays and provide feedback for each student that the teacher can review and adjust (Bryant J., Heitz C., Sanghvi S., et al.).

Virtual agents can collect and analyze data and, in the context of education, use the analyzed data to draw conclusions and make recommendations to students on what they should do to be more successful. Additionally, these insights can be shared with professors, who can then make decisions they believe are best for a particular student at that moment.

Examples of such systems include Algebra Tutor, eTeacher, Mathematics Tutor, Smart Tutor, AutoTutor, and others. These intelligent tutoring systems operate on the same principle, helping students and teachers make the most of their learning experiences. The systems use existing student knowledge data to adapt and provide appropriate tasks, assist students when they encounter problems they cannot solve, and monitor their overall progress. Teachers, on the other hand, have access to all the information and, through collaborative work with intelligent tutoring systems, design the best and most efficient teaching plans and curricula to ensure students receive the best possible education.

Research on the impact of personalized learning on student engagement and outcomes

Numerous studies confirm the positive impact of personalized learning supported by AI technologies on student engagement and academic outcomes. Research indicates that students participating in personalized educational programs often achieve better academic results compared to those in traditional educational settings.

For example, a study conducted by researchers at Stanford University suggests that personalized learning not only improves academic performance but also increases students' motivation and their ability to learn independently. Students demonstrated greater interest in classes, better concentration during learning, and a stronger sense



of accomplishment when they could track their own progress through personalized tasks and challenges.

However, it is important to note that the success of personalized learning depends on the quality of the AI systems used and the support provided by teachers in utilizing these tools. Research emphasizes the need for continuous education and training of teachers to ensure they can effectively integrate AI technologies into their teaching methods.

These findings highlight the potential of personalized learning to transform educational experiences by making them more engaging and tailored to individual student needs, ultimately leading to improved academic outcomes. Nonetheless, the role of educators remains crucial in maximizing the benefits of these advanced technologies.

Opportunities AI brings to the educational process

Artificial intelligence (AI) offers numerous opportunities that can significantly enhance the educational process, making it more efficient, adaptable, and accessible. Some of the key opportunities include:

Optimization of evaluation: AI enables the automatic grading of assignments, tests, and other forms of evaluation, which can significantly reduce the administrative burden on educators. The application of AI in evaluation can improve the accuracy and consistency of grading by eliminating subjectivity and human error. Algorithms can analyze essays, handle multiple-choice questions, and even evaluate more complex tasks, such as coding assignments. This automated evaluation allows teachers to focus more on providing personalized feedback to students.

Content adaptation: AI systems can tailor educational content to the individual needs and abilities of students. By analyzing student progress data, AI can identify weaknesses and suggest additional materials or different approaches to learning. Furthermore, AI can adjust the pace and difficulty of tasks according to the student's progress, ensuring that everyone learns in a way that best suits them. This adaptation not only improves learning outcomes but also increases student engagement and motivation.

Support for educators: AI can provide significant support to teachers in their daily work. In addition to automating administrative tasks, AI can analyze student data to offer insights into each student's progress and challenges. These insights enable teachers to better understand the needs of their students and tailor their teaching methods accordingly. Additionally, AI can assist in curriculum development, create customized lesson plans, and suggest new teaching strategies based on data analysis.

Ethics in the Application of AI

Given the widespread application of AI in education, several ethical issues arise that require careful consideration:

Privacy: AI systems in education collect and process large amounts of personal data from students, including their results, behavior, and interactions with platforms. This data can be highly sensitive, making it crucial to ensure strict privacy protection. There



is a risk of misuse or unauthorized access to this data, which could have serious consequences for students. Implementing clear data protection policies and adhering to international standards, such as the General Data Protection Regulation (GDPR), is essential for the ethical application of AI in higher education.

Algorithmic bias: The algorithms powering AI systems can be biased, depending on the data they are trained on. If the data used by algorithms is incomplete, biased, or inadequately representative of certain student groups, this can lead to unfair results and discrimination. For example, AI grading systems could unfairly assess students from minority groups or those with different learning styles. Transparency in algorithm development and the inclusion of diverse data sets are crucial to minimizing bias.

Transparency and accountability: The introduction of AI into the educational process requires a clear understanding of how these systems operate. Teachers, students, and parents need to be aware of how AI makes decisions and how data is processed. Transparency is key to building trust in AI systems, and accountability for the decisions made by AI must be clearly defined. If AI makes an incorrect decision, it must be clear who is responsible and how such errors can be corrected.

These opportunities and ethical considerations highlight the transformative potential of AI in education while emphasizing the importance of thoughtful and responsible implementation to ensure that these technologies benefit all participants in the educational process.

Challenges in practice

The implementation of AI in education faces numerous challenges that can complicate or slow down the transformation process:

Technical barriers: Introducing AI technologies requires significant investments in infrastructure, such as computers, software, and high-speed internet connections. Many institutions, particularly in underfunded regions, lack access to the necessary technology, potentially creating a digital divide between different higher education institutions. Additionally, issues with software compatibility and the complexity of integrating new AI systems with existing educational platforms can present significant challenges.

Organizational barriers: Successful application of AI in education requires adaptation from faculty, academic administrations, and educational policies. Professors often lack sufficient training and support to use new technologies effectively, which can lead to resistance to change. Furthermore, there is a need to redefine roles and responsibilities within institutions to ensure that AI technologies are effectively integrated into the educational process. This includes updating curricula, providing professional development, and creating a culture that embraces innovation.

Social barriers: The introduction of AI in education can raise concerns among students, parents, and society, particularly regarding the potential loss of human contact and personalization in education. There are fears that AI could replace teachers or dehumanize the educational process, reducing the role of critical thinking and



creativity. It is important to develop strategies that ensure AI serves as a tool to complement, rather than replace, the role of educators, and that education remains focused on the holistic development of students.

Overview of current practices in AI implementation in higher education

The application of artificial intelligence (AI) in higher education is becoming increasingly widespread, aimed at enhancing teaching processes, improving student experiences, and optimizing administrative operations. Higher education institutions worldwide are adopting AI technologies to meet the needs of modern students, ensure the relevance of their programs, and improve the efficiency of educational processes. One of the most prominent applications of AI in higher education is the development of adaptive learning systems. These systems enable a personalized approach to education, tailoring content and teaching methods to the specific needs of each student. For example, universities such as Arizona State University and Georgia Tech use adaptive systems to customize courses for students, allowing them to learn at their own pace and in accordance with their learning styles.

Another significant practice is the use of AI to automate administrative tasks, such as course registration, student advising, and academic progress management. Chatbots, like those used at Deakin University in Australia, assist students in finding information, resolving administrative issues, and even providing support in course selection. These systems reduce the workload of administrative staff and allow students to access necessary information more quickly and easily.

Additionally, AI is used to analyze large amounts of data to improve decision-making related to curricula, identify students at risk of failure, and enhance student engagement. This data allows higher education institutions to make informed decisions about program changes, which can lead to better academic outcomes and higher student satisfaction.

These practices demonstrate how AI can be integrated into various aspects of higher education to improve both the efficiency of educational processes and the quality of the student experience. However, addressing the associated challenges is crucial for the successful and ethical implementation of AI in education.

Research

In a study conducted with a specific group of students and professors regarding the use of AI in higher education, a survey was used to address the following research questions: a) How aware and familiar are students and professors with the use of AI technologies in the educational process at their institutions? b) How do students and professors assess the impact of AI on the quality of education, particularly in terms of learning personalization and interaction? c) What are the main advantages and risks associated with the application of AI in higher education, as perceived by students and professors? d) Are there differences in the perception of benefits and risks



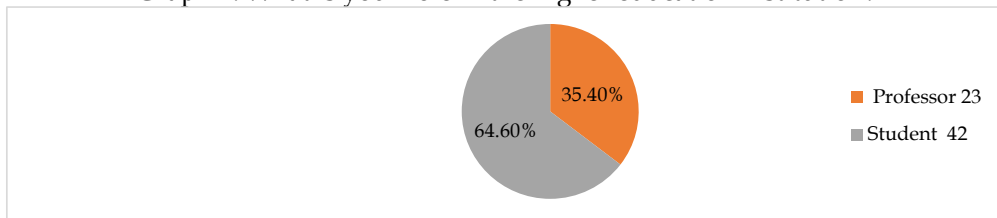
between students and professors regarding the use of AI in educational processes? e) How do students and professors perceive ethical issues related to the application of AI, such as data privacy, algorithmic bias, and the dehumanization of the educational process?

In this context, the main hypothesis (H1) was formulated: "The use of artificial intelligence in higher education positively influences the perception of the quality of the educational process among students and professors, but raises concerns regarding ethical issues and the reduction of human interaction." Several sub-hypotheses were also proposed within this main hypothesis: (H1a): "Students who use AI technologies in the educational process perceive greater personalization of learning compared to those who do not use them." (H1b): "Professors express greater concern about the potential reduction in the quality of human interaction in the educational process due to the application of AI, compared to students." (H1c): "There is a statistically significant difference in the perception of risks related to data privacy between students and professors, with professors showing a higher level of concern." (H1d): "A higher level of familiarity with AI technologies is associated with a more positive perception of their application in education, among both students and professors." (H1e): "Students and professors who use AI technologies in higher education have greater trust in these technologies and less concern about algorithmic bias compared to those who do not use them."

Empirical research results

Graph 1 shows the structure of respondents according to their roles at the higher education institution, where the majority are students (42 or 64.6%), while professors represent a smaller portion of the sample (23 or 35.4%). This distribution highlights the importance of the students' perspective in the survey results, given that their opinions dominate the sample. At the same time, although in the minority, professors play a key role in the implementation of technologies, making their views also significant for understanding the challenges and opportunities in the educational process. The graph provides insight into the demographic structure that may influence the interpretation of the research results.

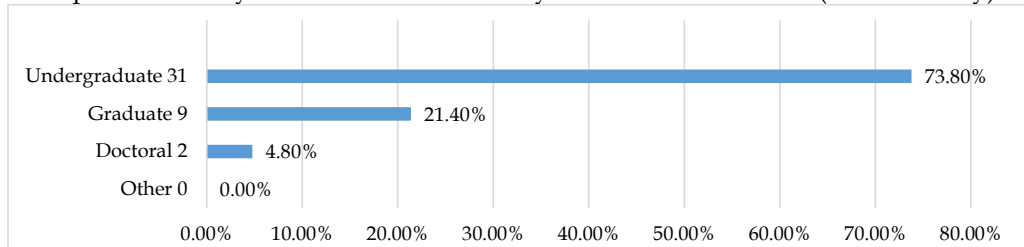
Graph 1. What is your role in the higher education institution?



Source: Author's research



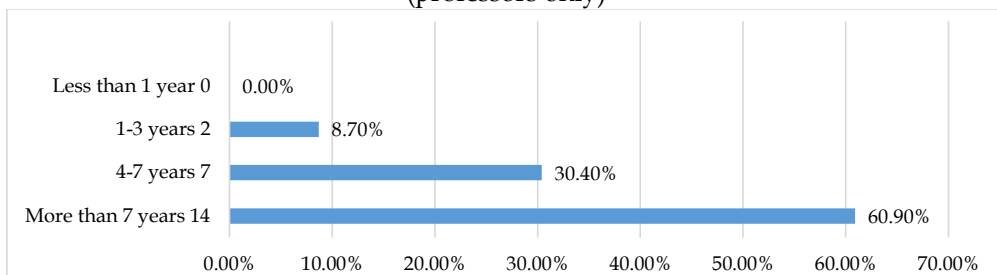
Graph 2. What is your current field of study or level of education? (students only)



Source: Author's research

Graph 2 shows the distribution of students by level of education, with the majority being undergraduate students (73.8%). This concentration suggests that most respondents are from the earlier stages of academic education, which may influence their attitudes toward AI technologies. Graduate students (21.4%) and doctoral students (4.8%) make up a smaller portion of the sample, but their perspectives, particularly in the context of applying AI to more advanced academic tasks, can provide important insights. This graph emphasizes the importance of understanding how perceptions of technology evolve as students progress through different levels of education.

Graph 3. How long have you been working as a professor in higher education? (professors only)

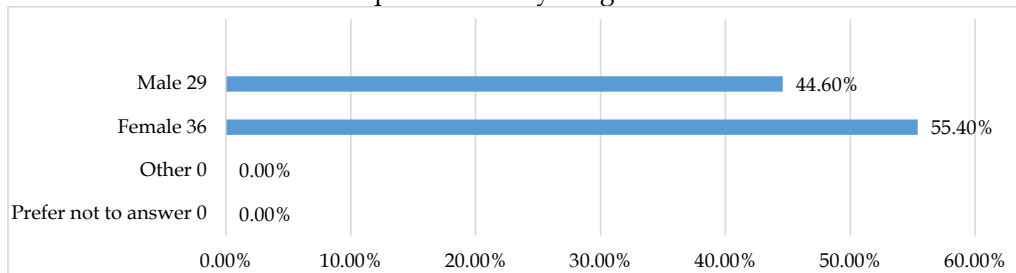


Source: Author's research

Graph 3 shows the distribution of professors by teaching experience, with the majority being professors with more than 7 years of experience (60.9%). This group of experienced professors may have a more conservative approach to new technologies, including AI. Professors with 4-7 years of experience (30.4%) also represent a significant group that is in the process of adapting to new technologies. Less represented are professors with 1-3 years of experience (8.7%), whose views, although more open to innovation, may not significantly impact the overall results. This graph highlights the importance of targeted training to support the specific needs of professors with different levels of experience in the context of applying AI technologies.



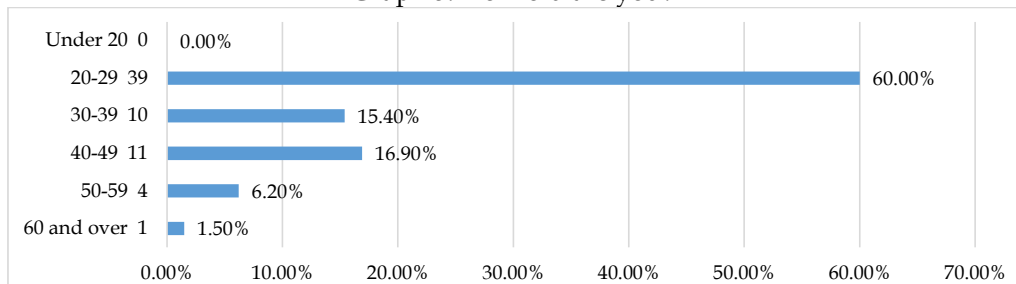
Graph 4. What is your gender?



Source: Author's research

Graph 4 shows the gender distribution of respondents, with a higher proportion of women (55.4%) compared to men (44.6%). This balanced representation of both genders ensures that the views of both men and women are well-represented in the results, although women have a slightly greater influence due to their larger number. The absence of responses in the "Other" and "Prefer not to answer" categories suggests that respondents are comfortable identifying within the provided gender categories. The gender structure allows for the analysis of potential differences in perceptions and attitudes towards technologies between men and women, which could be significant in further analyses.

Graph 5. How old are you?

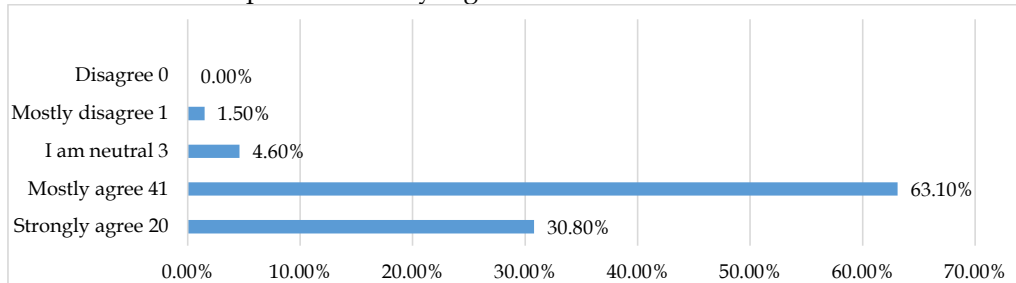


Source: Author's research

Graph 5 shows the age distribution of respondents, with the majority (60%) belonging to the 20 to 29 age group, indicating that younger adults dominate the survey. This could significantly impact the results, given the younger generation's openness to new technologies like AI. Respondents aged 30 to 49 make up a smaller but important part of the sample, allowing for a comparison of perceptions between younger and older groups. The absence of respondents under 20 years of age suggests a focus on adults involved in higher education. The age structure provides crucial context for analyzing attitudes toward AI technologies across different stages of life.



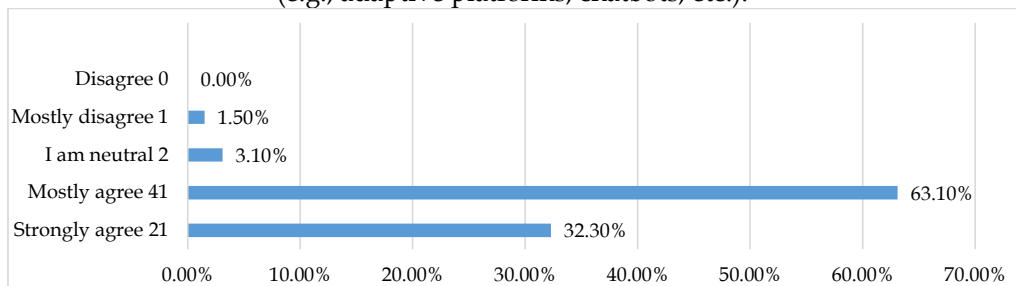
Graph 6. I am aware of the application of artificial intelligence in educational processes at my higher education institution.



Source: Author's research

Graph 6 shows a high level of awareness among respondents regarding the application of artificial intelligence (AI) in educational processes, with 93.9% of respondents agreeing or strongly agreeing with the statement about the presence of AI at their institution. Only a small number of respondents express a neutral stance (4.6%) or disagreement (1.5%), indicating rare unawareness or resistance to AI in education. These results suggest successful integration of AI technologies in higher education institutions and the potential for further positive perception and application of AI in education.

Graph 7. I use AI technologies in my education or teaching (e.g., adaptive platforms, chatbots, etc.).

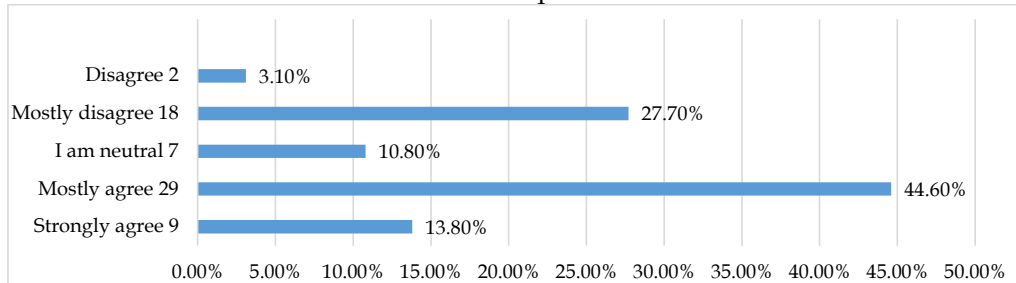


Source: Author's research

Graph 7 shows that the majority of respondents (95.4%) use AI technologies in education or teaching, with 63.1% mostly agreeing and 32.3% strongly agreeing with the statement. Only a small number of respondents are neutral (3.1%) or disagree (1.5%). These results indicate a widespread application and high level of acceptance of AI technologies, which have become an integral part of the educational experience. The near-total absence of negative attitudes suggests minimal resistance to AI, pointing towards further development and implementation of these tools in the educational system.



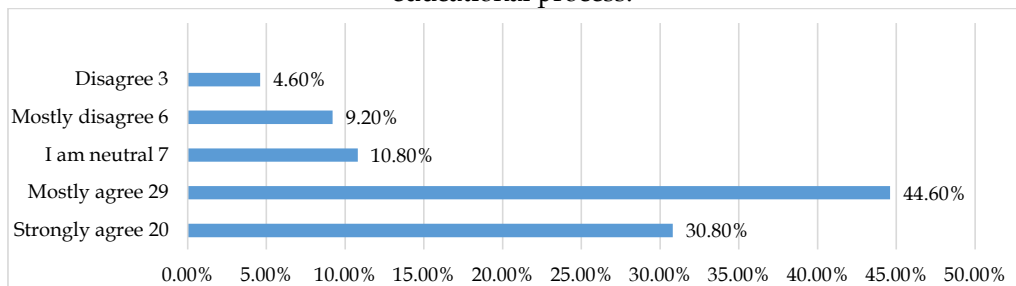
Graph 8. I have sufficient knowledge and skills to use AI technologies in the educational process.



Source: Author's research

Graph 8 shows that the majority of respondents (58.4%) believe they have sufficient knowledge and skills to use AI technologies, but a significant portion (30.8%) expresses uncertainty or a lack of skills. These results suggest a need for additional training to ensure greater competency among users of AI technologies. The high percentage of those who agree with the statement indicates a readiness for AI implementation, while the significant number of those who are unsure or disagree highlights the need for systematic support and additional resources.

Graph 9. I believe that AI technologies improve the quality of the educational process.

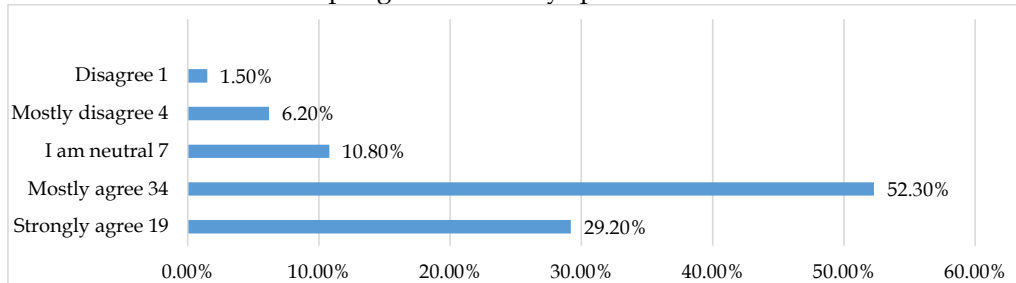


Source: Author's research

Graph 9 shows that the majority of respondents (75.4%) believe that AI technologies improve the quality of the educational process. A smaller portion of respondents (10.8%) holds a neutral stance, while 13.8% express disagreement. These results indicate a generally positive attitude towards AI in education, with a recognized value in enhancing teaching and administration. The neutral and negative attitudes suggest the presence of some doubts and the need for further evaluation to ensure the maximum benefit of AI technologies in education.



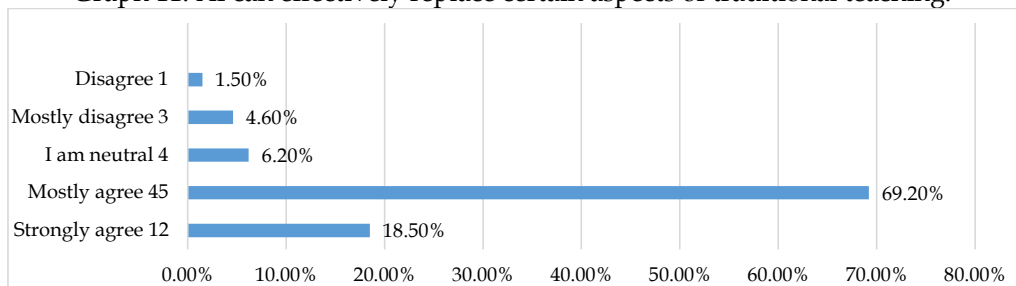
Graph 10. AI technologies enable better personalization of learning by adapting content to my specific needs.



Source: Author's research

Graph 10 shows that the majority of respondents (81.5%) believe that AI technologies enable better personalization of learning by adapting content to the specific needs of students. A smaller portion of respondents (10.8%) holds a neutral stance, while 7.7% express disagreement. These results suggest a recognized value of AI in the personalization of education, although there is a small number of respondents who are skeptical about the effectiveness of AI in replacing traditional teaching methods. Overall, the recognition of the importance of personalization through AI may encourage further adoption of these technologies in the educational process.

Graph 11. AI can effectively replace certain aspects of traditional teaching.

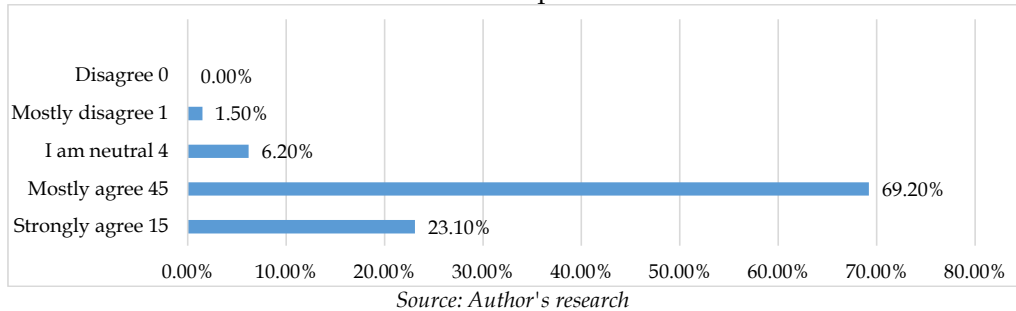


Source: Author's research

Graph 11 shows that the majority of respondents (87.7%) believe that AI technologies can effectively replace certain aspects of traditional teaching. A smaller number of respondents hold a neutral stance (6.2%) or express disagreement (6.1%), indicating some concern or caution. These results suggest that most respondents recognize the value of AI in the context of automating and adapting educational content, but some still emphasize the importance of the human element in teaching, particularly in providing emotional support and motivation. Overall, the respondents' views highlight the need for careful integration of AI to ensure that it complements, rather than replaces, key elements of traditional teaching.

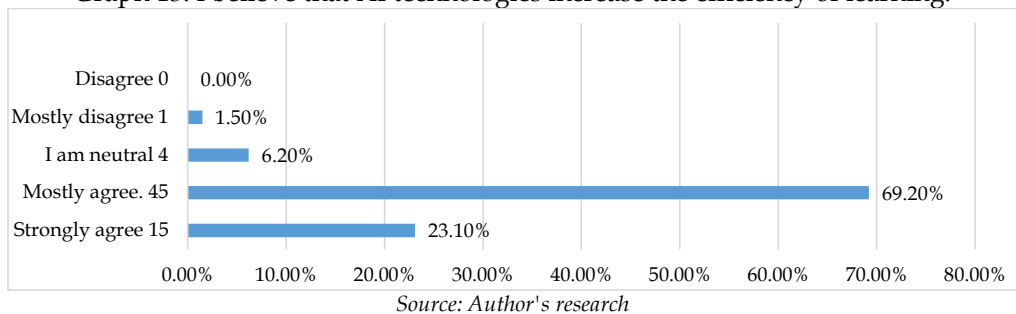


Graph 12. The use of AI technologies increases my engagement in the educational process.



Graph 12 shows that the majority of respondents (92.3%) believe that AI technologies increase their engagement in the educational process. A smaller portion of respondents (6.2%) holds a neutral stance, while only 1.5% express disagreement. These results indicate that AI technologies have a positive impact on the motivation and involvement of both students and educators, creating a more dynamic educational environment. The minimal disagreement suggests that most respondents see the benefit of AI in enhancing engagement, although personal preferences and specific learning styles may influence individual perceptions.

Graph 13. I believe that AI technologies increase the efficiency of learning.



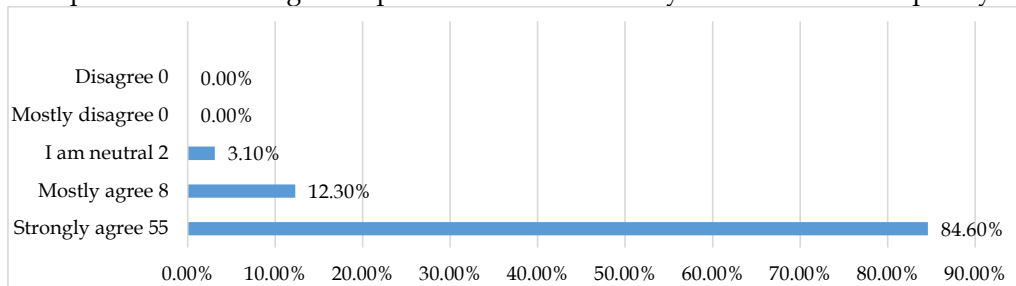
Graph 13 shows that the majority of respondents (92.3%) believe that AI technologies increase the efficiency of learning. Only a small number of respondents (6.2%) hold a neutral stance, while 1.5% express disagreement. These results indicate that most respondents trust AI technologies' ability to enhance learning efficiency, enabling faster acquisition of knowledge through personalized methods and adaptive systems. Although there are some reservations, the overall attitudes suggest widespread acceptance of AI as a tool for increasing efficiency in education, encouraging further adoption and exploration of these technologies.



SETI VI 2024

Book of Proceedings

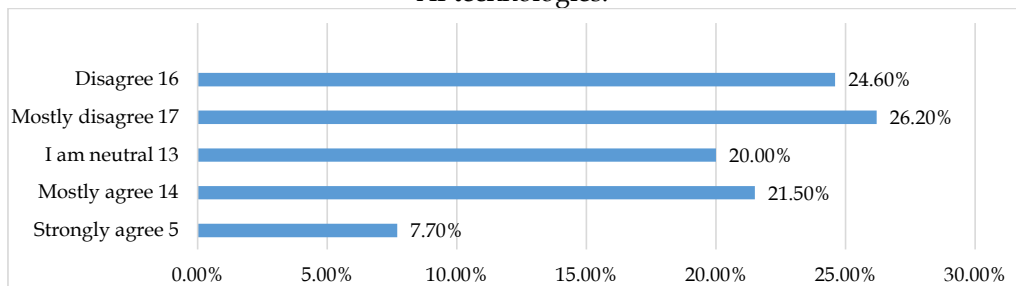
Graph 14. AI technologies help me access the necessary information more quickly.



Source: Author's research

Graph 14 shows that the vast majority of respondents (96.9%) believe that AI technologies significantly facilitate and accelerate access to the necessary information. Only 3.1% of respondents hold a neutral stance, with no negative responses. These results indicate an almost unanimous recognition of the benefits that AI technologies, such as smart search engines and automated systems, bring in enabling quicker access to information in an educational context. The absence of disagreement suggests high satisfaction and successful integration of AI tools in educational processes, leading to more efficient learning and work.

Graph 15. I am concerned about the potential misuse of data collected through AI technologies.

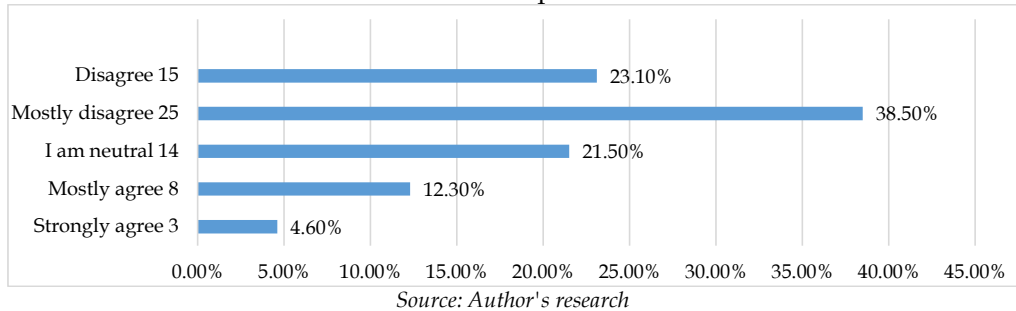


Source: Author's research

Graph 15 shows divided opinions among respondents regarding concerns about the misuse of data collected through AI technologies. Approximately 50.8% of respondents express a low level of concern, while 29.2% show some degree of concern. A neutral stance is held by 20% of respondents. The results suggest that the majority of respondents either trust data security or do not perceive a significant risk, while a smaller portion views AI as a potential threat to privacy. These divided opinions highlight the need for further education and transparency regarding data management through AI technologies to increase user trust.

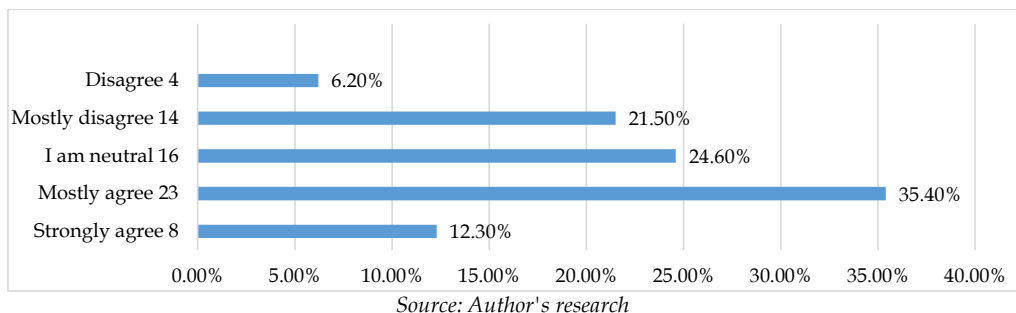


Graph 16. I believe that AI can lead to bias in grading and other aspects of the educational process.



Graph 16 shows that the majority of respondents (61.6%) are not concerned about the potential bias that AI technologies might introduce into the educational process, while 16.9% believe there is a risk of bias. A neutral stance is held by 21.5% of respondents, indicating indecision or a lack of information. The results suggest a general trust in the neutrality of AI technologies, but also highlight concerns among a smaller portion of respondents. These attitudes point to the need for further education and transparency regarding how AI algorithms operate, in order to reduce indecision and ensure objectivity in educational processes.

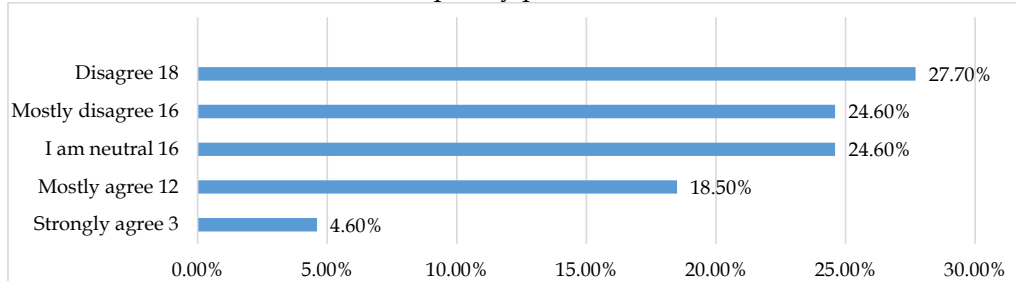
Graph 17. AI technologies can reduce the human component of education, which could negatively impact the overall learning experience.



Graph 17 shows divided opinions among respondents regarding the statement that AI technologies can reduce the human component of education. Concern about the reduction of the human element is expressed by 47.7% of respondents, while 27.7% believe that AI will not significantly impact the human component. A neutral stance is held by 24.6% of respondents. These results suggest that nearly half of the respondents see a potential risk in the reduction of interpersonal relationships and emotional support that AI may not be able to replicate, while a smaller portion of respondents believe that AI can be integrated without compromising the quality of the educational experience.



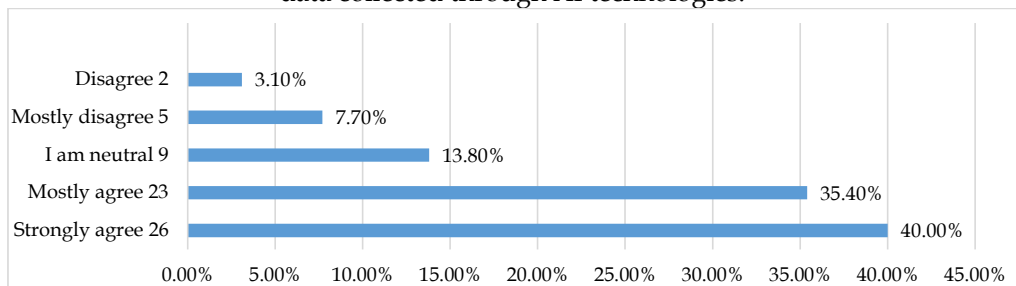
Graph 18. I believe that the data collected through AI systems in education is adequately protected.



Source: Author's research

Graph 18 shows divided opinions regarding the protection of data collected through AI systems in education. The majority of respondents (52.3%) doubt that the data is adequately protected, while 24.6% hold a neutral stance. Only 23.1% of respondents believe that the data is adequately protected. These results highlight concerns about potential risks related to privacy and data security, underscoring the need for greater transparency, education, and enhanced protective measures to increase trust in the security of data collected through AI technologies in education.

Graph 19. I believe that institutions should be more transparent about how they use data collected through AI technologies.

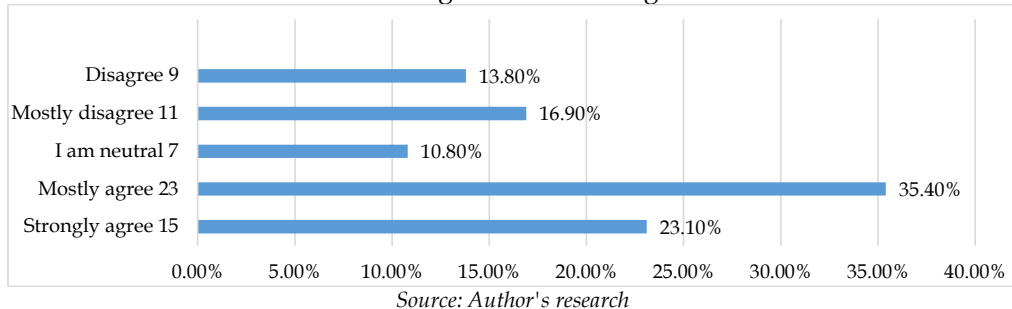


Source: Author's research

Graph 19 shows that the majority of respondents (75.4%) believe that institutions should be more transparent about how they use data collected through AI technologies. A neutral stance is held by 13.8% of respondents, while a smaller portion (10.8%) disagrees with the need for greater transparency. The results indicate a strong demand for increased clarity and awareness regarding data management. Institutions should consider improving their communication strategies to enhance user trust and ensure that all participants are adequately informed about data usage and protection.



Graph 20. AI systems in education should be subjected to stricter ethical guidelines and regulations.



Graph 20 shows that the majority of respondents (58.5%) support stricter ethical guidelines and regulations for AI systems in education. A neutral stance is held by 10.8% of respondents, while 30.7% do not support the idea of additional regulation. The results suggest that most respondents recognize the risks associated with AI technologies and believe that greater oversight is necessary. However, the presence of differing opinions indicates a need for broader dialogue and education to ensure that regulations address the concerns and needs of all participants in the educational process without hindering innovation.

Research analysis

In today's digital age, artificial intelligence (AI) is becoming an indispensable part of the educational process. The aim of this research was to examine the perceptions and attitudes of respondents towards the application of AI technologies in higher education, with a particular focus on issues of learning personalization, accelerated access to information, and potential risks such as bias and data misuse. The key hypothesis of the study was that AI technologies can significantly enhance the educational process but also carry risks that require stricter ethical guidelines and regulations.

The survey results clearly demonstrated that the majority of respondents recognize the potential of AI technologies in education. Specifically, 81.5% of respondents believe that AI technologies enable better personalization of learning by tailoring content to individual needs. This finding supports the hypothesis that AI technologies can improve the educational process through personalization. Furthermore, the near-unanimous support (96.9%) for the statement that AI technologies accelerate access to necessary information further strengthens the view that AI significantly improves learning efficiency, enabling students and educators to work more quickly and effectively.

However, the results also reveal significant concerns among respondents regarding the potential risks of applying AI technologies. More than half of the respondents (52.3%) expressed doubts about the adequate protection of data collected through AI



systems, while 16.9% believe that AI could lead to bias in grading and other aspects of the educational process. These results highlight recognized risks and confirm the need for stricter regulations and ethical guidelines to ensure fairness and security in the use of AI technologies in education.

Overall, the research indicates a strong belief in the benefits of AI for improving educational outcomes, but it also underscores the importance of addressing the ethical and security concerns associated with these technologies. As AI continues to integrate into educational systems, ensuring that these concerns are adequately addressed will be crucial for maintaining trust and achieving the full potential of AI in education.

The sub-hypotheses of the research were also largely confirmed. The first sub-hypothesis, which suggests that AI technologies significantly enhance student and teacher engagement and motivation, was validated by the fact that 92.3% of respondents recognize the positive impact of AI on their involvement in the educational process. The second sub-hypothesis, which highlights concerns about the potential misuse of data and bias, was also confirmed through the expressed concerns of respondents regarding these issues.

The third sub-hypothesis, which suggests that AI technologies may reduce the human component in education, received partial confirmation. While 47.7% of respondents share this concern, 27.7% believe that AI will not significantly affect the human component of education, indicating divided opinions among respondents.

Based on these results, it can be concluded that the main hypothesis of the research is confirmed. AI technologies indeed have the potential to significantly improve the educational process through personalization and faster access to information. However, the risks identified also call for careful regulation and the implementation of stricter ethical guidelines. These conclusions underscore the need for further research, policy development, and education for all participants in the educational process to ensure that the application of AI technologies is safe, effective, and fair for all users.

Conclusion

This research has shown that artificial intelligence (AI) holds significant potential for enhancing the educational process in higher education, particularly through the personalization of learning and the acceleration of access to information. The majority of respondents recognize these advantages but also emphasize the need for stricter ethical guidelines and regulations to ensure data security and prevent bias.

While the results confirmed the main hypothesis that AI can improve the educational process, they also highlighted the necessity of careful regulation to manage associated risks. Future research should focus on the ethical aspects of AI application, its long-term effects on educational outcomes, and the education of users to ensure the effective and safe use of AI technologies in education.

In conclusion, although AI technologies offer substantial opportunities, their implementation must be carefully monitored and regulated to maximize benefits and minimize potential risks.



References

- [1] Woolf, P.B. (2015). AI and Education: Celebrating 30 years of Marriage. URL: http://ceur-ws.org/Vol-1432/ai_ed_pap5.pdf (accessed 17. 07. 2024.)
- [2] Collins A., Halverson R. (2010). The second educational revolution: rethinking education in the age of technology. <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-2729.2009.00339.x> (accessed 10. 07. 2024.)
- [3] Bryant J., Heitz C., Sanghvi S. i sur. (2020). How artificial intelligence will impact K-12 teachers. <https://www.mckinsey.com/industries/public-and-social%20sector/our-%20insights/how-artificial-intelligence-will-impact-k-12-teachers> (accessed 09. 07. 2024.)
- [3] Computer Business Review (CBR) (2020). What is Nvidia?, <https://www.cbronline.com/what-is/what-is-nvidia-4956361/> (accessed 10. 07. 2024.)
- [4] Copeland, J. (2000). What is artificial intelligence? http://www.alanturing.net/turing_archive/pages/Reference%20Articles/what_is_AI/W%20hat%20is%20AI04.html (accessed 13. 06. 2024.)
- [5] European Commission (2018). Share of Jobs Requiring AI Skills - Indded.com, https://knowledge4policy.ec.europa.eu/visualisation/share-jobs-requiring-ai-kills-inddedcom_en (accessed 14. 06. 2024.)
- [6] Freedman, R., Ali, S.S., Mcroy, S. (2000). Links: what is an intelligent tutoring system? https://www.researchgate.net/publication/220098051_Links_what_is_an_intelligent_tutoring_system (accessed 25. 08. 2024.)
- [7] McKinsey Global Institute (2018). Deep learning's origins and pioneers, <https://www.mckinsey.com/featured-insights/artificial-intelligence/deep-learning-origins-and-pioneers> (accessed 19. 05. 2024.)
- [8] Michael (2018). How Chatbots Use Artificial Intelligence to Satisfy Customers Faster & Easier than Ever Before, <https://freshdesk.com/customer-support/customer-satisfaction-ai-chatbots-blog/> (accessed 04. 07. 2024.)
- [9] National Association of Independent Schools (NAIS) (2018). The Third Education Revolution, https://www.nesacenter.org/uploaded/conferences/FLC/2018/handouts/DonnaOrem_T hirdEdRevolution2018.pdf (accessed 14. 06. 2024.)
- [10] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC, OJ EU L 119, 4 May 2016 (accessed 03. 08. 2024.)
- [11] Turing, A. M. (1950). I. – COMPUTING MACHINERY AND INTELLIGENCE, <https://academic.oup.com/mind/article/LIX/236/433/986238> (accessed 12. 07. 2024.)
- [12] <https://www.timeshighereducation.com/hub/blackboard/p/survey-higher-ed-leaders-say-ai-can-improve-student-experience> (accessed 14.07.2024.)