


Education 4.0 and the application of Artificial Intelligence (AI) in teaching

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ABSTRACT

The objective of this research was to analyze the impact of artificial intelligence on contemporary education, investigating how its implementation has influenced teaching and learning methods, as well as educational outcomes. As for the methods, the research adopted a quantitative exploratory approach, applying questionnaires to 102 teachers from different educational institutions. The questionnaires, conducted in person or virtually, encompassed a five-point Likert scale to capture perceptions about artificial intelligence in education, and the data were analyzed through descriptive statistics and graphs. As a result, the analysis of the results of the questionnaires applied to teachers evidenced a perception about the potential impact of artificial intelligence (AI) on contemporary education. The majority of participants agreed on the effectiveness of AI in personalizing teaching, recognizing its role in tailoring the educational process to the individual needs of students, reflecting a substantial acceptance of technology as a transformative force in the educational landscape. However, there was a significant portion of teachers who expressed concerns and disagreements

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regarding the use of AI in education, especially regarding student assessment and feedback. These divergences highlighted challenges such as the lack of technological infrastructure, resistance to change, ethical issues, and the need for teacher training for the effective use of AI. In light of this, fostering a collaborative dialogue between educators, researchers, technology professionals, and policymakers was key to addressing these challenges and fully exploiting the potential of AI in positively transforming education, preparing students for the challenges of the 21st century.

Keywords: Artificial intelligence, Technology, Education.



INTRODUCTION

In recent years, technology has played an increasingly significant role in transforming the educational landscape around the world. With the rapid and continuous advancement of technology, the way students learn and teachers teach has undergone profound changes. Previously, the educational environment was characterized by traditional classrooms, with blackboards and chalk, and printed teaching materials (MACHADO; 2021; MONTEIRO, 2023).

However, with the rise of digital devices, internet access, and a variety of educational software and applications, the possibilities for teaching and learning have expanded exponentially. This paradigm shift not only accompanies the evolution of society towards an increasingly digitized world, but also offers unprecedented opportunities to improve the quality and accessibility of education (TELES; NAGUMO, 2023).

Artificial intelligence is a field of computer science that focuses on developing systems and machines that are capable of performing tasks that typically require human intelligence. This includes activities such as pattern recognition, decision-making, problem-solving, and learning (GIRAFFE; KHOLS-SANTOS, 2023).

AI systems are designed to learn from data, identify patterns, and make decisions based on those patterns, thereby simulating human thinking. In education, AI can be applied in a variety of ways, from personalizing teaching to automating administrative processes, offering enormous potential to improve the effectiveness and efficiency of the education system (VICARI; 2021).

In view of the above, the objective of this research was to analyze the impact of artificial intelligence on contemporary education, investigating how its implementation has influenced teaching and learning methods, as well as educational outcomes.

METHODOLOGY

The methodology adopted for this research was exploratory, with a quantitative approach. The main objective was to investigate the impact of artificial intelligence on contemporary education by exploring teachers' perceptions and experiences regarding this emerging technology. To this end, questionnaires were applied to a sample of 102 teachers from different educational institutions, covering different levels of education and areas of activity.

The application of the questionnaires was conducted in person or virtually, according to the availability and preference of the participants. Prior to the application, a brief explanation of the objectives and procedures of the research was provided, ensuring the informed consent of the participants. Then, the teachers were instructed on how to fill out the questionnaire correctly and completely.



The questionnaire encompassed a five-point Likert scale, ranging from "strongly disagree" to "strongly agree," to capture teachers' opinions and perceptions regarding the use of artificial intelligence in education. This scale allowed participants to express their level of agreement or disagreement with specific statements about different aspects of AI in the educational context, offering a quantitative measure of teachers' attitudes and feelings.

Each item in the questionnaire featured a series of statements on topics such as the effectiveness of AI in personalizing teaching, the challenges faced in implementing this technology, and expectations regarding its future impact on education

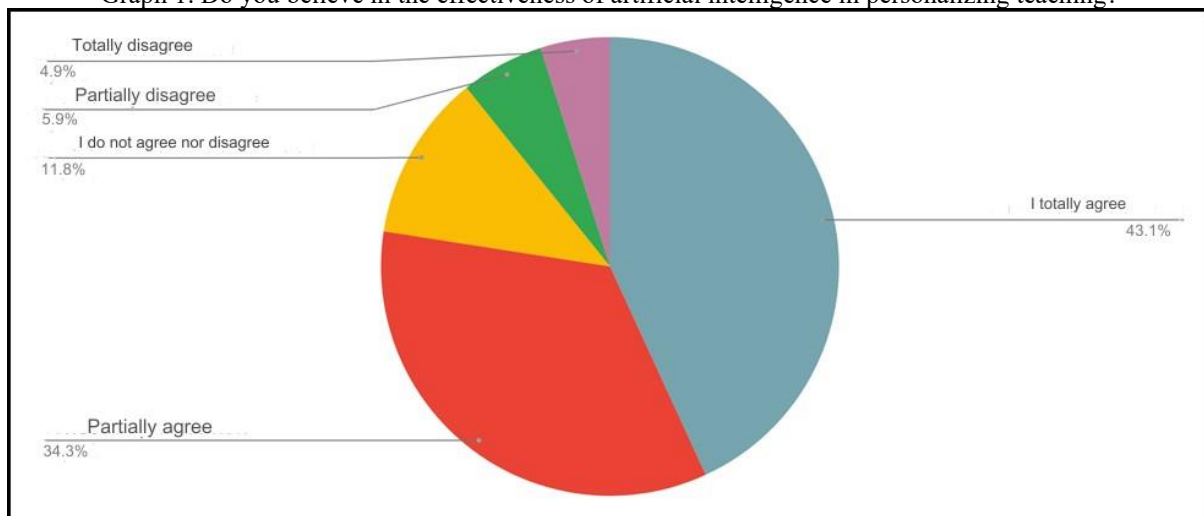
For the analysis of the data collected through the questionnaire, descriptive statistics techniques were used, such as calculating the mean of the answers and using graphs to visualize the results. The average was calculated for each item of the questionnaire, providing a general measure of the teachers' position in relation to the statements presented. In addition, graphs were used to visually represent the distributions of the participants' responses to each item of the Likert scale, allowing a clearer and more detailed analysis of the trends and patterns present in the data.

RESULTS AND DATA ANALYSIS

After collecting and analyzing the data from the questionnaires applied to teachers, it was possible to gain an understanding of the perceptions and experiences regarding the use of artificial intelligence in contemporary education. The results presented below highlight the main trends and patterns observed in the participants' responses.

First, we sought to inquire about the effectiveness of artificial intelligence in the personalization of teaching, as shown in graph 1.

Graph 1. Do you believe in the effectiveness of artificial intelligence in personalizing teaching?



Source: Survey data (2024).

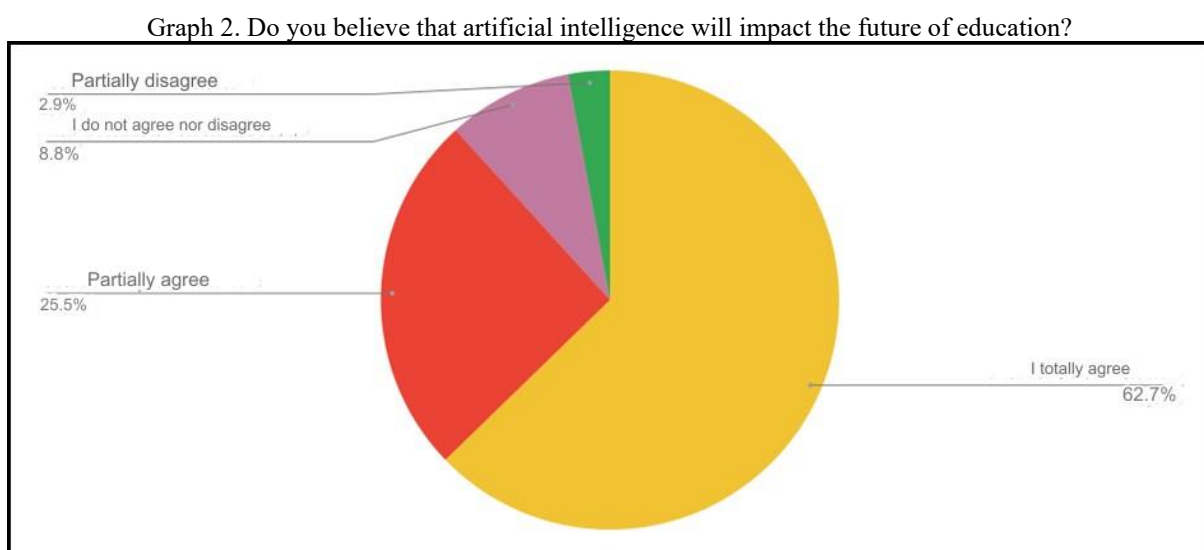


By analyzing the predominance of the answer in which the majority of teachers strongly agree (approximately 43%) with the effectiveness of artificial intelligence in personalizing teaching, it is possible to infer a number of relevant considerations. First, the high agreement among educators suggests a widespread recognition of the potential transformative impact that artificial intelligence can have in the educational context. This result can be interpreted as a demonstration of confidence in AI's ability to adapt the educational process to meet the individual needs of learners more efficiently and effectively.

This confidence can be grounded in a number of factors, such as the growing evidence that personalization of teaching is associated with increased student motivation and engagement, and the perception that artificial intelligence can provide valuable analysis and insights into student progress and struggles. Teachers who fully agree with the effectiveness of AI in personalizing teaching may be inclined to consider technology as an ally in improving their pedagogical practices, aiming for a more adaptive and student-centered education.

However, it is important to note that total agreement is not unanimous, and a significant portion of teachers expressed partial or total disagreement with this effectiveness. These disagreements may reflect legitimate concerns, such as the potential replacement of the teacher's role, the quality of AI-generated recommendations, and ethical issues related to the use of student data. These considerations underscore the importance of an ongoing dialogue and a thoughtful approach when integrating artificial intelligence into education.

Subsequently, participants were asked about the impacts of artificial intelligence on the future of education, as illustrated in graph 2.

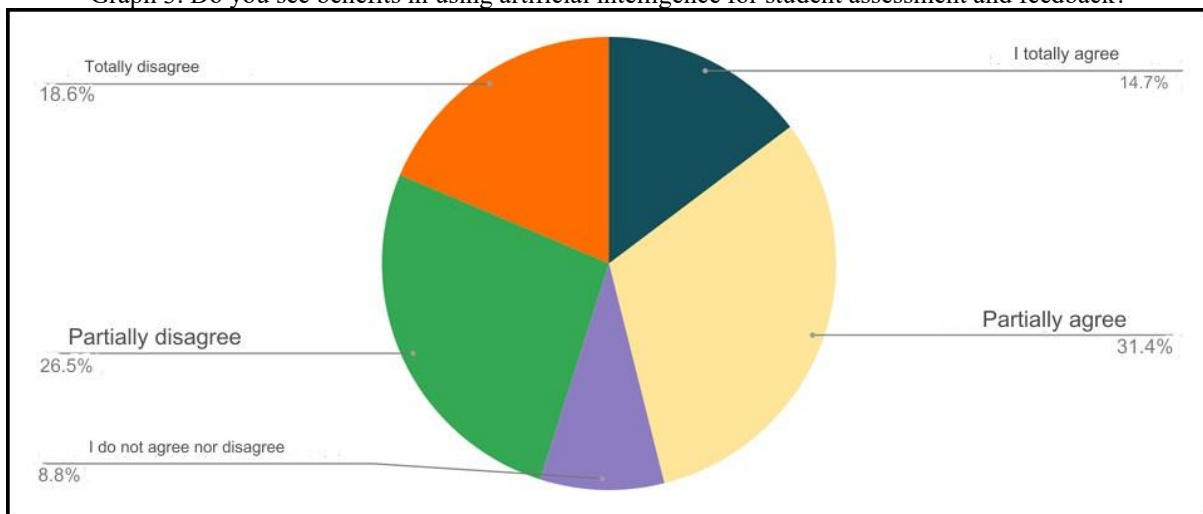


Source: Survey data (2024).

When analyzing the result, it is observed that the majority of teachers (approximately 63%) strongly agree with the statement that artificial intelligence will impact the future of education. This result demonstrates a broad acceptance and recognition by educators regarding the transformative role that artificial intelligence will play in the educational landscape. The total agreement reflects a substantial confidence in artificial intelligence's ability to significantly shape and influence the future of education.

Following this line of investigation, the participants were asked about their perceptions regarding the use of artificial intelligence for student assessment and feedback, as shown in graph 3.

Graph 3. Do you see benefits in using artificial intelligence for student assessment and feedback?

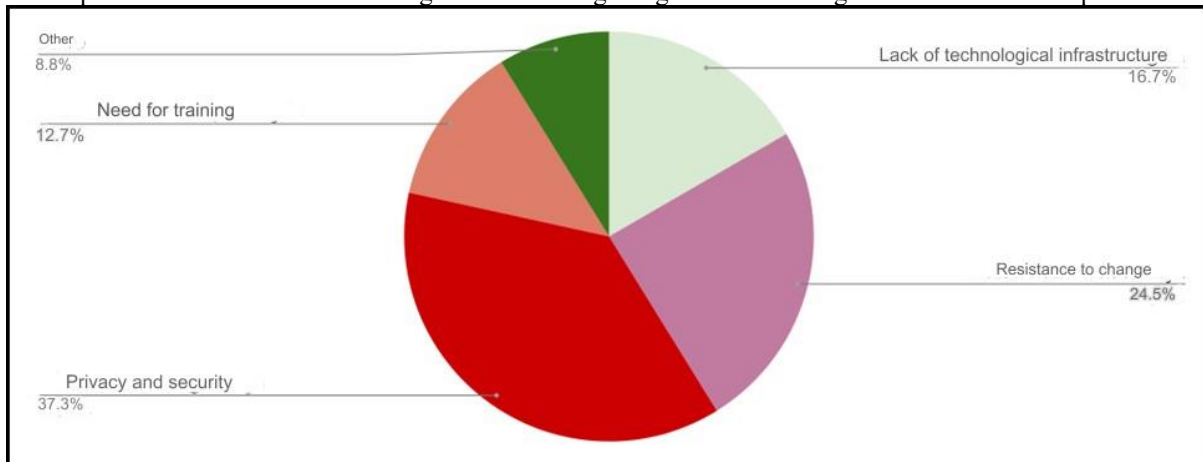


Source: Survey data (2024).

The analysis of this result reveals a division between the teachers' answers. Although the majority still partially agree with the usefulness of artificial intelligence for student assessment and feedback, it is notable that a considerable portion of the participants partially or totally disagree with this proposition. This division of opinions suggests that there are a variety of perspectives and concerns among educators regarding the use of artificial intelligence for these specific purposes.

In the fourth question, participants were invited to share their views on the challenges faced in integrating artificial intelligence into educational practice, as shown in graph 4.

Graph 4. What are the main challenges faced in integrating artificial intelligence into educational practice?



Source: Survey data (2024).

When analyzing this result, a diversity of challenges identified by the teachers can be observed. Among the main challenges mentioned are the lack of adequate technological infrastructure in educational institutions, resistance to change on the part of educators, concern about the privacy and security of student data, as well as the need for teacher training and training for the effective use of artificial intelligence. These challenges highlight the complexity and obstacles that come with integrating emerging technologies into education, and underscore the importance of effective strategic and policy approaches to address these issues holistically and sustainably.

FINAL THOUGHTS

After a detailed analysis of the results obtained through the questionnaires applied to teachers, it becomes evident that there is a widespread perception about the potential impact of artificial intelligence on contemporary education. The data reveals that the majority of participants agree with the effectiveness of artificial intelligence in personalizing teaching, recognizing its key role in adapting the educational process to the individual needs of students. Furthermore, the confidence expressed in artificial intelligence's ability to shape the future of education reflects a substantial acceptance of the technology as a transformative force in the education landscape.

However, it is important to highlight that, despite the prevailing agreement, there is a significant portion of teachers who express concerns and disagreements regarding the use of artificial intelligence in education, especially with regard to student assessment and feedback. These divergences point to the existence of a variety of perspectives and challenges to be considered in the integration of technology into educational practice.

Among the main challenges identified by the participants are the lack of adequate technological infrastructure, resistance to change on the part of educators, ethical issues related to the privacy and security of student data, as well as the need for training and teacher training for the



effective use of artificial intelligence. These challenges highlight the complexity involved in implementing emerging technologies in education and underscore the importance of a strategic and holistic approach to addressing these issues.

In light of this, it is critical to foster an ongoing and collaborative dialogue between educators, researchers, technology professionals, and policymakers to address these challenges effectively. Only through a collaborative and solution-oriented approach will it be possible to fully exploit the potential of artificial intelligence to positively transform education and prepare students for the challenges of the 21st century.



REFERENCES

1. Giraffa, L., & Khols-Santos, P. (2023). Inteligência Artificial e Educação: conceitos, aplicações e implicações no fazer docente. *Educação em Análise, 8*(1), 116–134.
2. Machado, J. L. A. (2021). Inteligência artificial e educação. *Trem de Letras, 8*(1), e021011.
3. Monteiro, J. C. S. (2023). Assistente chatgpt na educação: possibilidades e desafios. *Ibero-Americana De Humanidades, Ciências E Educação, 9*(6), 2899–2906.
4. Ngiraze, J. A. (2023). O papel da inteligência artificial na detecção de lacunas no processo de ensino e aprendizagem. *Revista Multidisciplinar Do Nordeste Mineiro, 8*(1).
5. Teles, L., & Nagumo, E. (2023). Uma inteligência artificial na educação para além do modelo behaviorista. *Revista Ponto de Vista, 12*(3), 01–15.
6. Vicari, R. M. (2021). Influências das Tecnologias da Inteligência Artificial no ensino. *Estudos avançados, 35*, 101.