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# THE USE OF ARTIFICIAL INTELLIGENCE IN EDUCATION

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***Abstract.*** *Artificial intelligence (AI) and machine learning are some of the most valuable tools in educational technology today. The use of AI in education is on the rise as more and more AI-based platforms and integrated solutions emerge to support and enhance the learning experience. The authors provide a comprehensive overview of latest research papers, offering diverse perspectives on the current role of AI in education. Spanning from 2018 to 2023, these studies collectively shed light on the far-reaching potential of AI in education, its ethical considerations, and emerging trends in the field. From the pursuit of precision education to tailoring learning experiences, from its effects on administrative tasks to its potential for improving student-teacher interactions, these studies cover a wide range of educational aspects. By synthesizing these research findings, this article aims to offer a holistic understanding of how AI is reshaping the future of education, highlighting the importance of cross-disciplinary collaboration between educators and AI experts. As AI continues to revolutionize education, this article underscores the crucial need for addressing ethical concerns and the responsible integration of AI in education, fostering sustainable development in the field.*

***Keywords:*** *AI, education system, technology, personalized learning, innovative teaching methods*

## INTRODUCTION

Artificial Intelligence (AI) has become a transformative force in various sectors, and its potential impact on education is increasingly evident. As technological advancements continue to shape our modern world, education, too, stands on the cusp of a significant transformation. This introduction delves into the evolving landscape of AI in education, outlining the key factors contributing to its growing prominence and highlighting its implications for both learners and educators.

In recent years, AI has made notable strides in education, offering innovative solutions that extend beyond conventional teaching and learning practices. The application of AI in educational settings aims to revolutionize traditional pedagogical methods, making learning more personalized, efficient, and adaptable. The adoption of AI-driven technologies in education brings about numerous opportunities, yet it also raises important questions about its ethical use, equity, and the future role of educators.

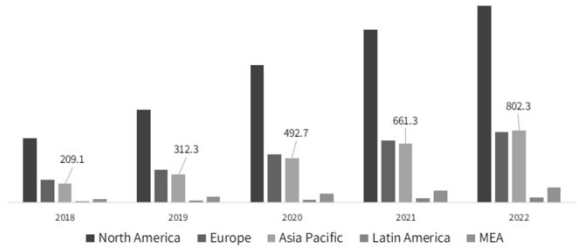


**Figure 1.** Global AI in Education Market, 2018-2022 (USD Milion)
Source: https://www.gminsights.com/industry-analysis/artificial-intelligence-ai-in-education-market [19]

This article provides a comprehensive overview of the current state of AI in education, drawing insights from a range of studies and research papers. By examining how AI is being harnessed for administration, instruction, and learning, we gain a deeper understanding of its impact and potential benefits in shaping the educational landscape. Furthermore, the study explores ethical considerations and challenges associated with the integration of AI in education.

## EXPERIMENTAL

In an era characterized by rapid technological advancements and societal shifts, the implication of AI in different fields is rising. This transformation holds particular significance in the educational environment, as it has the potential to reshape the way students and teachers engage in learning activities and enhance quality as well as a deeper knowledge. Therefore, the present study starts with the identification and curation of certfied academic sources, which collectively offer a comprehensive view towards the adoption of AI techologies in education. Subsequently, these selected sources will be analysed, enabling the authors to synthesize key insights and assess challenges, trends and also benefits of driving this transformative process.
Main objective: Determining the current state of integrating AI in the educational system.
In order to achieve this objective, a series of activities were carried out such as:

1. Utilizing academic databases, digital libraries, and research portals to conduct a comprehensive search for pertinent articles, studies, and reports concerning the implementation of AI technologies in education over the past five years, employing specific keywords.
2. Choosing reliable sources and scholarly publications to guarantee the information's credibility and exclusively focusing on articles related to the usage of AI in the public education field.
3. Analyzing and consolidating the materials that discuss AI implementation to facilitate and update the process of learning.
4. Draw current state and future trends for integrating AI in education in a discussion that is based on the research findings from scientific articles world-wide.

This study offers a holistic view and recent insights into the present status of AI integration in the educational system. It enhances our comprehension of how these technological advancements impact students' learning experiences and the teaching process.

## RESULTS

Artificial intelligence (AI) is becoming widely accessible through low-cost smart devices and has the potential to impact education in two ways: (1) improving teaching methods and educators' roles, and (2) influencing the nature and content of education. This article discusses the challenges and opportunities AI presents in the field of education. It suggests that AI may replace some professions, transform others, and create new ones. In education, AI will act as both a reformer and a facilitator, changing the nature of tasks and roles [1].

This study aimed to assess the impact of artificial intelligence (AI) on education, focusing on administration, teaching, and learning. It employed a qualitative research approach using a literature review. AI is a field involving the development of technology with human-like cognitive abilities, including learning, adaptation, and decision-making. The study found that AI has been widely adopted in various educational contexts, from computer-based systems to web-based platforms and autonomous instructional tools like robots and chatbots. These technologies have improved teaching quality, efficiency, and personalized learning, enhancing the overall educational experience [2].

ChatGPT was launched to the public on November 30, 2022, and quickly gained over one million subscribers in a week. This generative AI tool impressed with its ability to perform complex tasks, particularly in education. This study explores the potential benefits and drawbacks of ChatGPT in teaching and learning. Benefits include personalized and interactive learning and generating prompts for formative assessment. However, limitations like generating incorrect information, biases, and privacy issues are noted. The study recommends that policymakers, researchers, educators, and tech experts collaborate to ensure the safe and constructive use of such AI tools in education [3].

Digital technologies have become integral to our lives, influencing how we seek information, communicate, and even our behavior. Education is no exception to this transformation. This article aims to explore the potential impact of a rtificial technologies on the learning process and predict changes in education. The review covers four categories: personalized educational content, innovative teaching methods, technology-enhanced assessments, and student-teacher communication. Drawing from existing literature, the article outlines how Artificial Intelligence (AI) is likely to reshape the educational landscape [4].

This study aimed to evaluate the impact of AI in education, focusing on administration, instruction, and learning. Using a qualitative research approach and a literature review, the study found that AI has been widely adopted in education. Initially, it was used in computers and online education systems, and more recently, in humanoid robots and chatbots. These technologies have improved administrative tasks and personalized learning content, enhancing the overall quality of education [5].

This research aims to provide a comprehensive review of influential studies in Artificial Intelligence in Education (AIEd). The study analyzed 45 articles and assessed their trends, focus areas, and technology use. The findings indicate growing interest in AIEd, but a need for deeper integration of advanced technologies and educational theories. Suggestions include applying AI in physical classrooms, enhancing intelligent tutoring systems, adopting advanced deep learning techniques, leveraging natural language processing for personalized education, and combining AI with educational theories [6].

Education 4.0 increasingly relies on artificial intelligence (AI) to meet the growing demand for personalized learning. This paper introduces an innovative approach in which AI, smart sensors, and wearable devices support self-regulated learning in higher education. The study utilizes learning analytics and machine learning algorithms to predict students' final scores before their final exams. An Early Recognition System is proposed, using real data from a blended learning course that includes personalized tests, adaptive learning based on N. A. Crowder's Auto Tutor theory, and self-assessment feedback. The focus is on enhancing student success and experiences for the benefit of students, professors, and administration [7].

In the past decade, we collaborated with educators and computer scientists at the University of Illinois to explore the role of "artificial intelligence" in education. Our aim was to design and research new learning environments that go beyond the first-generation digital ones. We started by understanding the nature and potential of machine intelligence in education. This paper presents our conceptual and practical findings. Our main discovery is that AI, as it has developed in the past 75 years, won't replace teachers because it operates differently from human intelligence. However, within certain boundaries, AI has the potential to enhance education, making it more, not less, human [8].

With the growing interest in artificial intelligence (AI) in education, many experts anticipate changes in the roles of teachers and school leaders. This study aims to explore potential scenarios and implications of AI in education. It used a qualitative approach to gather opinions from participants across different sectors. The findings suggest that AI will bring both advantages and challenges to schools and teachers. The study offers recommendations for the use of AI and how to address potential issues. Participants generally hold positive views on AI, though some teachers and academics express concerns about the future of teaching. Legal experts focus on the legal aspects of AI in education, while engineers see AI as a tool to enhance the quality and accessibility of education for all [9].

Advancements in computing technology have enabled the use of Artificial Intelligence in Education (AIED) applications. AIED involves the application of AI in educational settings to enhance teaching, learning, and decision-making. AI technologies mimic human intelligence to offer personalized guidance to students and assist teachers and policymakers. This paper defines AIED's roles and offers a framework for its implementation in various learning and teaching contexts. It addresses the interdisciplinary nature of AIED research and provides guidance for researchers with diverse backgrounds in both computers and education. The paper also

outlines ten research topics in AIED and describes the types of articles sought for publication in this journal [10].

Augmented reality has advanced to the point where it's becoming crucial in various industries like military, education, medicine, manufacturing, training, navigation, and gaming. This article explores the broad applications of augmented reality, particularly in the education sector, and emphasizes the need for more research to enhance interactive learning experiences. It highlights recent studies that inspire educators to leverage augmented reality for improved learning environments in the coming decade [11].

This document addresses the impact of Artificial Intelligence (AI) on education, especially in developing countries. It discusses the importance of AI in improving learning outcomes and preparing learners for an AI-driven future. It also highlights six key challenges and policy considerations regarding AI in education. These challenges include the need for comprehensive public policy, ensuring inclusion and equity, preparing teachers, developing quality data systems, promoting meaningful research, and addressing ethics and transparency concerns in AI use. This document encourages further discussions on AI's potential and risks in education for sustainable development [12].

The study examines trends in Artificial Intelligence in Education (AIED) research using bibliometric analysis. It includes document type, source, country, language, affiliations, funding, subject area, research stations, and top-cited publications. The findings reveal a significant increase in AIED research in recent years. Most documents are articles, mainly from China, and written in English. The primary source is the "Journal of Physics: Conference Series," with a focus on Computer Science. Prominent research trends in the last decade include its application to students, education in engineering, teaching methods, e-learning, the education system, and AI in the curriculum. AIED has the potential to revolutionize education [13].

In recent years, computer equipment, software, and online services have improved classrooms and teaching methods. However, the true revolution in education is expected to come from artificial intelligence (AI). AI has a proven track record of transforming various fields, and it has the potential to bring significant changes to education. AI can enable expert systems to interact with the environment using technologies like visual perception, speech recognition, and intelligent behavior, similar to human capabilities. This chapter discusses the role of AI in education, including its market size, impact on education, and case studies of AI applications like smart content, tutoring systems, virtual facilitators, and learning environments. These AI tools aim to enhance learning and life outcomes for all. The chapter also addresses the associated issues and challenges [14].

The use of artificial intelligence in education (AIEd) is a relatively new field, and existing literature reviews haven't thoroughly explored how AI technologies impact learning, teaching, assessment, and administration in education. This systematic review, covering the last decade, aims to shed light on the opportunities and challenges in AIEd. Using matrix coding and content analysis, the study identifies 13 roles of AI technologies in educational domains, 7 learning outcomes, and 10 significant challenges. The findings offer insights into the current state of AIEd research and suggest future research directions [15].

In his 2019 ICCE keynote, Stephen Yang highlighted the challenge of precision education through AI and learning analytics. Precision education aims to identify struggling students early and provide timely help based on their learning experiences. This special issue promotes a dialogue between technology and human aspects, aiming to enhance our understanding of precision education. The issue includes 13 research papers focused on AI, machine learning, and learning analytics in education to deepen our insights into their applications [16].

Artificial Intelligence in Education (AIEd) is a rapidly emerging field in educational technology. This study provides a systematic review of AI applications in higher education. Out of 2656 publications spanning from 2007 to 2018, 146 articles were included in the analysis. The results indicate that most AIEd research comes from Computer Science and STEM fields, primarily employing quantitative methods. The study identifies four key areas of AIEd application in academic and administrative services, including profiling, assessment, personalization, and intelligent tutoring systems. The study also highlights the need for more attention to ethical and educational aspects in AIEd, as well as a stronger connection to pedagogical perspectives [17].

This study conducted a content analysis of research papers that explore the application of artificial intelligence (AI) in education. The analysis examined 100 papers, which included 63 empirical papers and 37 analytic papers published between 2010 and 2020. The research questions in these papers were categorized into three layers: development (involving classification, matching, recommendation, and deep learning), application (involving feedback, reasoning, and adaptive learning), and integration (involving aspects like affective

computing, role-playing, immersive learning, and gamification). The research offers a comprehensive overview of how AI is being used in the field of education, contributing to the theoretical foundation of AI in education and suggesting avenues for collaborative research between educators and AI engineers [18].

## DISCUSSION

The digitalization of education has seen significant advances due to the integration of artificial intelligence (AI). A multitude of studies provide insights into the current state of AI in digital education and offer valuable findings to shape the direction of this transformative field. These studies collectively illustrate the growing impact of AI in education, emphasizing the potential to create more personalized, adaptive, and effective learning environments. While AI presents numerous opportunities, it also poses ethical and pedagogical challenges that require careful consideration. Collaboration between educators and AI experts, as well as continued research and integration, is essential to unlock AI's full potential in the digitalization of education. As the field continues to evolve, AI is positioned to reshape education, emphasizing the need for an interdisciplinary approach to address the dynamic educational landscape.

1. Transformative Potential: AI's transformative potential within education is a recurrent theme across these studies. Whether through personalization, content enhancement, or improved administration, AI offers the promise of revolutionizing education, making it more effective and accessible.
2. Personalization and Adaptability: A significant trend across these studies underscores the importance of personalization and adaptability in education. AI has the capacity to tailor learning experiences, provide timely interventions, and engage with students at a personalized level.
3. Ethical Considerations: The inclusion of ethical discussions in these studies highlights the importance of considering the implications and potential risks associated with AI in education. Conversations on ethical AI adoption and transparency are crucial for the sustainable development of educational AI.
4. Collaboration and Integration: The call for collaborative efforts between educators and AI engineers is evident, emphasizing the need to bridge the gap between pedagogical theories and advanced technologies. Integrating AI effectively into educational practices remains a common challenge and opportunity.
5. Precision Education: The concept of precision education, as introduced by Stephen Yang, offers an innovative approach to addressing student needs through AI, enhancing our understanding of how AI can identify and support struggling students.
6. Beyond Replacement: AI's role in education is not one of replacement but enhancement. As illustrated by Cope, Bill, Mary Kalantzis, and Duane Searsmith, AI operates differently from human intelligence. Rather than supplanting teachers, AI has the potential to make education more human and effective.
7. Multiple Sectors: AI's reach extends across various educational sectors, from traditional classrooms to online platforms and hybrid models. This adaptability underlines AI's versatility in different learning contexts.
8. Student-Teacher Interaction: The use of AI, smart sensors, and wearable devices for self-regulated learning, as explored by Chassignol et al., highlights the potential for enhancing student-teacher communication, an integral aspect of modern education.
9. Comprehensive Integration: Deeper integration of advanced technologies with educational theories, as advocated by Zawacki-Richter et al., is essential to strengthen the field. Bridging the gap between AI's capabilities and educational objectives remains a priority.
10. Evolving Trends: The work of Xia et al. offers insights into AI trends within the educational sector, showcasing the ever-evolving nature of AI's role in shaping modern education.

## CONCLUSION

Several consistent themes and trends emerge from these studies. AI is rapidly gaining traction in the field of education, providing opportunities to enhance learning and teaching experiences. The potential benefits include personalized learning, formative assessment, and improved administrative efficiency. Despite these advancements, concerns persist. Issues such as biases in data training, privacy concerns, ethical considerations, and the need for meaningful research are brought to the forefront. The need for deeper integration of advanced technologies and educational theories is consistently emphasized in these studies. In light of these findings, there is a clear need for continued research and collaboration among educators, researchers, policymakers, and AI engineers. Ensuring the ethical and constructive use of AI in education remains a priority. The integration of advanced technologies, AI theories, and educational perspectives is a promising path for the future.

These studies collectively underscore that AI is poised to bring significant changes to education, and a thoughtful, interdisciplinary approach is essential for realizing its potential while addressing its challenges. The transformative impact of AI on education continues to be a topic of growing importance, requiring ongoing exploration and discussion. As AI technologies continue to evolve, their role in education will be a dynamic and ever-changing landscape.

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