Advances in Social Behavior Research Vol.16 Issue 9 EWA Publishing
Available Online: 30 October 2025 DOI: 10.54254/2753-7102/2025.28935

Study on using artificial intelligence in education: pros and cons

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Abstract. With an emphasis on both the benefits and drawbacks, this study offers a thorough examination of the use of Artificial Intelligence (AI) in education. The study investigates the complex effects of AI on teaching and learning. Personalised learning, automated evaluation, improved accessibility, data-driven insights for teachers, and administrative efficiency are some of the benefits of artificial intelligence in education. These advantages demonstrate how AI can be used to develop more efficient, interesting, and fair learning environments. The article does, however, also critically analyse the drawbacks, including ethical issues with privacy and bias, the possibility of educators losing their jobs due to an over-reliance on technology, the need for substantial infrastructure and cost, the impact of a lack of human interaction on socioemotional development, and data security.

Keywords: artificial intelligence, education, educational technology, E-Learning, machine learning in education

1. Introduction

Ancient myths and philosophical investigations into the nature of creation and thought are the origins of the idea of Artificial Intelligence (AI). However, pioneers like Alan Turing laid the groundwork for the current era of AI in the middle of the 20th century. Turing introduced the idea of the Turing Test as a standard for machine intelligence in 1950 when he asked the fundamental question, "Can machines think?" in his paper "Computing Machinery and Intelligence" [1]. The theoretical foundation for AI was established during this time.

John McCarthy, Nathaniel Rochester, Marvin Minsky, and Claude Shannon organized the Dartmouth Workshop in 1956, where the term "Artificial Intelligence" was formally created. Many people believe that this occasion marked the beginning of AI as a separate academic discipline [2]. Early successes included the creation of mathematical theorem-proving programs such as Allen Newell, Herbert Simon, and Cliff Shaw's Logic Theorist (1956) and Joseph Weizenbaum's ELIZA (1966), an early natural language processing program [3].

Despite early hope, the field went through "AI winters," or times when funding and interest were lower. These were mostly brought on by the early computational power limitations and the overestimation of immediate capabilities. Nonetheless, the 21st century saw a notable resurgence of AI due to developments in computing, data accessibility, and algorithmic breakthroughs, especially in machine learning and deep learning. AI is now incorporated into many facets of daily life, from driverless cars to tailored recommendations [4].

Research on Artificial Intelligence in Education (AIEd) dates back to the early 1990s, so the practice is not a recent development. The goal of early AIEd systems was to create Intelligent Tutoring Systems (ITS) that could provide individualised instruction and adjust to the needs of each student [5]. By providing individualised feedback and learning paths based on student performance and cognitive models, these systems sought to emulate human tutors.

As a result of developments in data analytics, machine learning, and natural language processing, the use of artificial intelligence in educational environments has seen a significant increase in recent years. AI has the potential to revolutionise teaching and learning methods at all educational levels, according to recent study [6]. AIEd can improve the quality of learning by assisting students in developing their ability to solve problems and collaborate online [7]. For example, Vieriu's 2024 study examined how students' perceptions of AI technologies affected their academic performance and learning processes [8].

The transformative impact of AI in education is a common topic of discussion, with a focus on the need for educators to adopt these technologies [9]. A common theme in the literature is the transition from conventional "push" education systems to more individualised "pull" systems made possible by AI [10]. A reassessment of educational paradigms has also been prompted by the growing use of generative AI tools, which have created new opportunities for knowledge development, academic research, and AI-assisted authoring [11]. AI has the potential to solve important educational issues and revolutionise teaching and

learning methods worldwide, according to organisations like the United Nations Educational, Scientific and Cultural Organization (UNESCO) [12].

With a particular focus on the benefits and drawbacks, the current study attempts to present a thorough analysis of the state of AI in education today. Through a review of the literature and a summary of the main conclusions, this study aims to clarify the advantages AI offers educational settings, such as individualised instruction and administrative effectiveness, while also critically addressing the drawbacks and moral dilemmas, such as privacy issues, the possibility of job displacement, and the necessity of human interaction. The ultimate objective is to provide a fair viewpoint that educates technology developers, educators, and legislators on how to responsibly and successfully incorporate AI into teaching methods.

2. Some uses of artificial intelligence in education

In many respects, AI is revolutionising education by improving administrative effectiveness and learning experiences. Key applications of AI in education include the following:

Adaptive Learning Platforms: Personalised learning is supported by adaptive learning platforms, such as DreamBox and Knewton, which use AI to modify the level of instruction based on student performance.

Chatbots for Student Support: AI chatbots are being used by educational institutions to improve accessibility and response times by answering questions from students regarding schedules, courses, and administrative procedure

Automated Grading Systems: Programs such as Gradescope use AI to help teachers grade assignments and tests, especially multiple-choice and short-answer questions, so that feedback can be provided more quickly.

Learning Analytics: By using AI to evaluate student data and spot patterns, platforms such as Civitas Learning assist educational institutions in raising retention rates by resolving problems early.

Language Learning Apps: Apps such as Duolingo use AI to customise language lessons according to user progress, offering practice opportunities and exercises that are specifically designed for each user.

Virtual Reality Learning: AI is utilised in VR settings for science and history courses, enabling students to investigate simulations and immersive experiences that improve comprehension.

Plagiarism Detection: To ensure academic integrity, programs such as Turnitin employ AI algorithms to examine student work for originality.

Professional Development: AI-powered platforms give teachers access to tools and training to improve their instruction and stay current with industry best practices.

These applications show how AI is being incorporated into different facets of education to help teachers and students achieve better results.

3. Pros and cons of using artificial intelligence in education

3.1. Pros of using artificial intelligence in education

In the recent years, the adoption and use of AI has become significant in education. The use of AI in education has many advantages. Figure 1 shows the pros of using AI in Education. Table 1 summarizes the key benefits of integrating AI into educational practices.

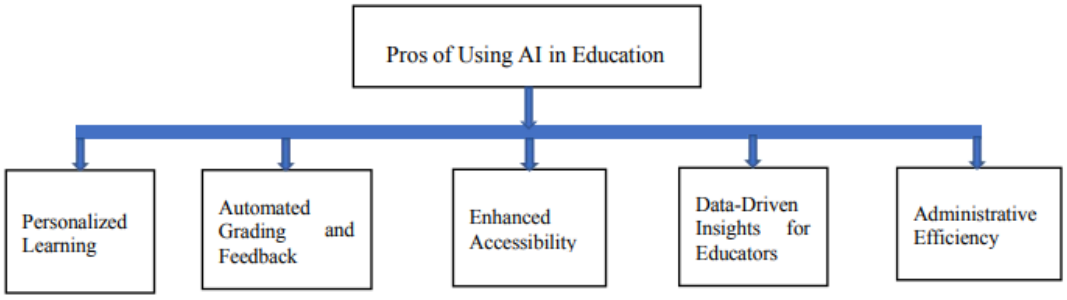

Figure 1. Pros of using AI in education

Table 1. Pros of using artificial intelligence in education

Pros	Description	Key Benefits
Personalized Learning	AI platforms adapt to individual student needs, learning styles, and pace, creating customized learning paths and providing tailored feedback.	Optimized engagement, improved comprehension, enhanced academic outcomes, increased student motivation.
Automated Grading and Feedback	AI tools streamline assessment by automating grading of various assignments and providing immediate, constructive feedback to students.	Reduced educator workload, timely learning adjustments, enhanced learning efficiency.
Enhanced Accessibility	AI technologies offer tools like speech-to-text, text-to-speech, and real-time translation, breaking down barriers for students with special needs.	Equitable access to educational content, inclusive learning environment.
Data-Driven Insights for Educators	AI systems analyze educational data to identify learning patterns, predict student performance, and flag at-risk students.	Proactive intervention, adjusted teaching strategies, effective resource allocation, better educational outcomes.
Administrative Efficiency	AI automates routine administrative tasks such as scheduling, admissions, and inquiries.	Frees up educators and staff for complex responsibilities, improved operational effectiveness, better resource utilization.

3.2. Cons of using artificial intelligence in education

According to the method of using AI, the use of AI in education has a number of cons. Figure 2 shows the cons of using AI in Education. Table 2 summarizes the key cons of integrating AI into educational practices.

Table 2. Cons of using artificial intelligence in education

Cons	Description	Potential Risks/Consequences
Ethical Concerns: Privacy and Bias	AI systems require access to large datasets of student information, raising privacy concerns and the risk of perpetuating biases from training data.	Data privacy breaches, unfair or discriminatoryoutcomes, disadvantaging certain student groups.
Job Displacement for Educators	Sophisticated AI tools for grading, tutoring, and content delivery raise concerns about the potential redundancy or diminished roles for human teachers.	Job insecurity for educators, need for role transformation and policy-making.
Over-Reliance on Technology and Reduced Critical Thinking	Excessive AI integration may lead to students becoming overly dependent on technology, hindering the development of independent critical thinking and problem-solving skills.	Lack of cognitive ability for independent analysis, reduced creativity,underdeveloped higher-order thinking skills.
CostandInfrastructure Requirements	Implementing and maintaining AI systems, hardware, software, and high-speed internet is expensive.	Financial barriers for institutions, exacerbation of educational inequalities, digital divide.
Lack of Human Interaction and Socio-Emotional Development	Over-relianceonAIcan diminishhumaninteraction between students and teachers, and among peers.	Negativeimpactonsocio-emotionalgrowth, communicationskills,and empathy development.
Data Security Issues	Processing vast amounts of sensitive student data by AI systems poses significant data security risks.	Data breaches, unauthorized access, misuse of information, identity theft, erosion of trust.

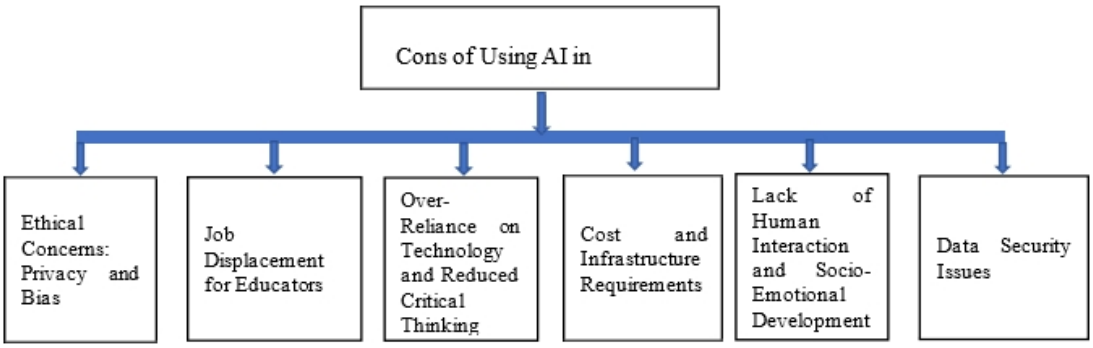

Figure 2. Cons of using AI in education

4. Discussion

There are many opportunities and difficulties associated with integrating AI into education. AI has the potential to completely transform education by providing individualised experiences, automating administrative work, and improving accessibility [8, 12, 13]. These advantages may result in learning environments that are more effective, interesting, and fair. The quick development and application of AI technologies, however, also calls for careful evaluation of their possible disadvantages, such as moral conundrums pertaining to bias and privacy, the possibility of educators losing their jobs, and worries that an excessive reliance on AI could impede the growth of critical thinking abilities [14-16].

For AI to be successfully and responsibly integrated into education, innovation and ethical considerations must be balanced. To create strong frameworks that address data privacy, algorithmic transparency, and fair access to AI tools, educational institutions, legislators, and tech developers must work together. To reduce biases in AI systems and guarantee that these tools benefit all students equally, proactive steps are required. In order for educators to embrace new AI-driven tools, comprehend their pedagogical implications, and use AI to enhance their instruction rather than fear it, professional development is also essential [17].

AI has significant ramifications for education in the future. The distinctive human aspects of teaching, such as empathy, sophisticated problem-solving, and promoting socioemotional development, cannot be replaced by AI, even though it can automate repetitive tasks [14]. The difficulty is in creating AI tools that support human teachers and free them up to concentrate on these more complex facets of instruction. AI will probably change curricula, evaluation techniques, and the essence of learning itself as it develops further. Thus, to fully utilise AI's transformative potential while preserving the fundamental principles of education, continued research, critical analysis, and adaptive strategies are necessary.

5. Conclusion

AI is at a turning point in its development in the field of education, presenting both enormous opportunities and formidable obstacles. The present study has methodically investigated the benefits and drawbacks of implementing AI in education. Personalised learning, automated grading, improved accessibility, data-driven insights, and administrative efficiency are just a few advantages that highlight AI's potential to improve educational procedures and results. On the other hand, the ethical issues of bias and privacy, the possibility of educators losing their jobs due to an excessive reliance on technology, the high cost and infrastructure requirements, the loss of human interaction, and data security concerns draw attention to the difficulties and potential hazards that must be avoided.

In the end, successfully incorporating AI into education is a pedagogical and ethical undertaking rather than just a technological one. It necessitates a careful, well-rounded strategy that puts the welfare of students first, encourages fair access, and helps teachers transition into new roles. AI can be a potent instrument to improve educational opportunities, encourage creativity, and get students ready for a future that is increasingly influenced by intelligent technologies if the problems are addressed early on and the advantages are strategically utilised. Realising the full potential of AI in education in a responsible and efficient manner will require ongoing discussion, investigation, and cooperation among all stakeholders.

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