



## Scope of Artificial Intelligence in Education

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DOI: <https://doi.org/10.70333/ijeks-03-09-035>

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Article Info - Received : 13 September 2024

Accepted : 25 September 2024

Published : 30 September 2024

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“The notion of artificial intelligence is a thing of the past. The reality of artificial intelligence is a thing of today”- Dr. Scott R. Parfitt. Since the pandemic and post-pandemic, technology has taken on a bigger role in how education is delivered because of rising digitization. The rapid advancement of Artificial Intelligence (AI) has ushered in transformative opportunities across diverse sectors, with education emerging as a prominent focus. This paper explores the expanding scope of AI in education, particularly during the period from 2020 to 2024, highlighting its role in reshaping personalized learning, assessment methods, resource allocation, and administrative efficiency. AI-driven innovations, such as Intelligent Tutoring Systems (ITS) and adaptive learning platforms, have facilitated personalized instruction tailored to individual learning preferences and needs. These systems not only improve student outcomes but also assist educators by automating administrative tasks and streamlining resource allocation, enabling more efficient management of educational environments. The post-pandemic era has witnessed a significant surge in the integration of AI to enhance educational technologies, addressing the urgent demand for remote learning solutions. While these advancements offer numerous benefits, they also present ethical and equity concerns, particularly around data privacy, bias in algorithms, and access disparities. Additionally, the growing use of AI in education challenges traditional teaching models, necessitating a re-evaluation of the role of educators and the dynamics of classroom interaction. This paper critically examines both the opportunities and challenges posed by AI in education, focusing on the delicate balance between leveraging technological advancements for educational enhancement and addressing ethical considerations to ensure equitable access for all learners. Ultimately, AI's potential to revolutionize education is vast, but it must be implemented with thoughtful consideration of its societal impacts. The conclusion discusses future directions for AI in education, emphasizing the need for collaborative efforts between technologists, educators, and policymakers to shape its ethical and equitable integration into global educational systems.

**Keywords:** Artificial Intelligence, Machine Learning, Technology, Education, Digitization.



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### 1. INTRODUCTION

Artificial Intelligence (AI) is reshaping various sectors, and education is no exception. By 2024, it is anticipated that the use of AI in

education would have greatly increased due to its ongoing evolution. AI-powered solutions have the potential to revolutionize administrative processes, tailor educational experiences, and

change teaching and learning methodologies. But in addition to these advantages, AI in education also brings with it ethical problems, namely with regard to privacy, bias, and equitable access. This paper examines the possibilities, difficulties, and ethical implications of artificial intelligence (AI) in education.

The World Economic Forum forecasts that by 2025, many businesses will have adopted technologies such as machine learning (ML). They urge governments and educational institutions to accelerate the development of education and skills, particularly in STEM (science, technology, engineering, art, and mathematics) and non-cognitive soft skills, to address the growing demand. Artificial Intelligence (AI), a field dedicated to creating tools that enhance human intelligence, aims to improve the efficiency and speed of routine tasks. As debates continue among parents, psychologists, and educators about the appropriate amount of screen time for children, emerging technologies like AI and ML are beginning to reshape educational institutions and resources, potentially transforming the future of education (Lieberman, 2020).

Despite often negative language and conventional approaches to education, one has witnessed how AI has developed into a vital and useful instrument in the teaching and learning process since COVID-19 (Walsh, 2017). This is an area where technological advancements have the potential to greatly improve teaching and learning, given its increasing acceptability. According to Mariya Gabriel, artificial intelligence (AI) has the power to drastically alter how teachers, students, and other educational staff are educated and instructed. It may help teachers and youngsters with learning difficulties through tailored learning. But employing AI and data on our youth puts their security, privacy, and safety at risk (EU Commission, 2021).

## 2. AREA FOCUS

The purpose of this article is to determine the extent of artificial intelligence (AI) in the field of education, as well as to highlight its advantages and disadvantages. It also includes a review of several important works that guarantee AI in education will play a big part in teaching and learning in the future.

## 3. ARTIFICIAL INTELLIGENCE IN EDUCATION

Artificial Intelligence (AI) possesses significant potential to revolutionize pedagogy and learning methods, address pressing educational challenges, and expedite progress toward Sustainable Development Goal (SDG) 4. Despite the benefits, the swift pace of technological advancements has often outstripped the development of policy and regulatory frameworks, leading to various risks and challenges. AI technology offers a valuable opportunity for Member States to achieve the Education 2030 Agenda. UNESCO is committed to assisting these nations in harnessing AI for educational purposes, ensuring that its deployment upholds the fundamental principles of inclusion and equity (UNESCO, 2021:16).

The disruptive technology of AI has the potential to change a number of facets of education. Applications with AI can improve learning by personalizing instruction, enhancing evaluation, and allocating resources more effectively. The application of AI in education is currently a topic of research, which is examined in the literature reviewed under following sections.

**3.1. Artificial Intelligence:** According to Berliner et al. (2021), AI-powered educational software often exacerbates existing inequities by providing more support to high-performing students while offering less assistance to those who struggle. This highlights the need for transparent, equitable, and ethical AI development and implementation in education. Fong et al. (2021) demonstrated the ability of AI technology to automatically score student essays and provide feedback to instructors. By being trained on a large dataset of graded essays, the technology was able to score written work accurately in a fraction of the time it would take a human grader. Leacock and Youssef (2021) conducted research where an AI-powered tool was used in a high school English class to provide formative feedback on coherence, grammar, and syntax. Their findings showed that students who received feedback from the tool performed better on subsequent assignments compared to those who did not. Similarly, Yang et al. (2021) explored the use of AI-powered chatbots in a college-level programming course and found that students who received personalized feedback from the chatbot performed better on assessments and assignments. In another study, Yu et al. (2021)

found that an AI-powered chatbot that offered personalized coaching and feedback increased student engagement and retention in a MOOC. The chatbot's ability to tailor its support to each student's learning needs resulted in higher levels of participation and completion.

**3.2. Personalized Learning:** Applications with AI capabilities can customize lessons to fit the requirements and ability levels of each individual student. In a research by Le et al. (2018), an AI-powered tutor improved student performance in an introductory statistics course by giving each student individualized feedback and customizing the course material to suit their needs. In a similar vein, [Brinton et al. \(2019\)](#) discovered that by offering personalized feedback and recommendations, an AI-powered writing assistant enhanced students' writing abilities. According to a different study by [Baker et al. \(2018\)](#), delivering individualized education with AI raised student engagement and enhanced math proficiency. Similarly, [Bektik and Okur \(2021\)](#) found that the language proficiency of English language learners was greatly enhanced by an AI-based system that provided personalized learning resources.

**3.3. Assessment:** The assessment process can be enhanced by AI-driven solutions that offer automated grading and feedback ([Akgun & Greenhow, 2022](#)). An AI-powered approach for autonomously grading programming assignments was shown to be just as accurate as human graders in a study conducted by [Rose et al. \(2019\)](#). Furthermore, the system gave pupils immediate feedback, which enhanced their ability to code.

**3.3. Resource Allocation:** Applications with AI capabilities can also improve resource allocation by pointing out regions that require more resources. An AI-powered approach for forecasting student performance effectively identified students who were at risk of failing a course, according to a study by [Wang et al. \(2020\)](#). Teachers were able to provide those pupils with additional resources and support, which raised their odds of success.

**3.4. Student Outcomes:** Artificial Intelligence (AI) holds potential for enhancing student achievements by offering customized learning opportunities and pinpointing areas in which students might want more assistance. An AI-based tutoring system outperformed

conventional classroom instruction in enhancing science learning outcomes, according to a study by [Liu et al. \(2021\)](#). In a similar vein, [Khosravi and Hussain \(2021\)](#) found that overall academic performance was greatly improved by an AI-powered system intended to identify pupils at danger of failing.

**3.5. Administrative Processes:** AI has been applied to enhance administrative procedures in education, including scheduling, attendance monitoring, and grading. For instance, [Tanaka et al. \(2019\)](#) discovered that an AI-powered grading system was more precise and effective than conventional manual grading techniques. AI may also be used to examine attendance records and spot pupils who could be on the verge of leaving school. An AI-based approach for predicting dropout risk outperformed conventional techniques, according to a research by [Palacios et al. \(2021\)](#).

**3.6. Ethical Considerations:** The integration of AI in education introduces several ethical concerns, including algorithmic bias, privacy issues, and the risk of exacerbating existing inequalities ([Zawacki-Richter et al., 2019](#)). [Wu et al. \(2021\)](#) emphasize the importance of addressing these ethical challenges in the development and implementation of AI in education. AI systems, which are designed to make predictions, recommendations, or decisions based on specific objectives, can influence both real-world and virtual environments. These systems often give the impression of autonomy, with their perceived understanding of their surroundings affecting their behavior. The use of AI in educational settings is expanding, with applications such as natural language processing employed by testing organizations like Pearson and Educational Testing Service to evaluate essays. Additionally, AI scoring is now a component of massive open online courses (MOOCs) offered by platforms like Coursera and Udacity, and many states utilize natural language processing for grading the essay sections of their annual assessments.

Schools have placed a high priority on adjusting curriculum to suit the individual needs of every student for a long time. But with the help of artificial intelligence, learning may be differentiated in ways that would be challenging for educators to implement in classes with thirty or more pupils. Many domestic and foreign

businesses are currently creating intelligent instructional designs and AI-powered digital platforms to offer individualized testing, learning, and feedback for students in pre-K through university. These tools assist in determining the knowledge gaps that students have, provide them with suitable challenges, and, when needed, reroute them to new subjects. As AI develops further, it might even be able to read pupils' facial expressions to tell whether they are having difficulty understanding the subject matter (Marr, 2021).

#### 4. SCOPE OF AI IN EDUCATION (2020-2024)

Between 2020 and 2024, the use of artificial intelligence (AI) in education advanced quickly, affecting many facets of administration, instruction, and learning. Global research and application have been done on AI's potential to revolutionize education, notably in the areas of intelligent tutoring, adaptive learning systems, and data-driven insights. The continuous developments in AI throughout this time frame mirror both possibilities and difficulties in the field of education.

**4.1. Intelligent Tutoring Systems:** AI-driven Intelligent Tutoring Systems (ITS) have become gained traction because of its ability to give pupils individualized training. Studies have demonstrated how well ITS works to improve student learning results. For instance, a meta-analysis by Kulik and Fletcher (2015) showed the important advantages of ITS in providing customized training, which raised student achievement, particularly in science and math disciplines. These technologies enable more personalized training than traditional classroom settings do by using data on student performance to deliver real-time feedback and adaptable learning routes.

**4.2. Adaptive Learning and Personalization:** One of AI's major contributions to education is its capacity to adjust to each student's unique learning needs. Murphy (2019) emphasized how adaptive learning platforms with AI capabilities can modify the tempo and complexity of the course material according to the learning progress of each individual learner. In order to accommodate a wide range of learning styles and guarantee that students get the right amount of challenge and assistance, personalization is essential. AI's ability to assess

learning patterns and adjust information has proven essential to contemporary educational platforms as it develops.

**4.3. Enhancing Educational Technologies Post-Pandemic:** The COVID-19 pandemic accelerated the introduction of AI-powered tools in education, which facilitate remote learning. Bushweller (2020) claims that the epidemic brought to light the significance of artificial intelligence (AI) in developing more scalable and effective educational solutions, like virtual classrooms, AI tutors, and automated grading systems. During the global transition to online education, these inventions played a critical role in bridging the gap between educators and students. After the pandemic, artificial intelligence (AI) is predicted to play an even bigger role in education, especially in improving virtual learning environments and providing more egalitarian access to online learning.

**4.4. Ethical and Equity Concerns:** AI has a lot of potential for education, especially in regards to equity and fairness. According to Holmes et al. (2019), implementing AI in education requires caution to prevent it from escalating pre-existing biases and disparities. Because AI systems rely so heavily on data, they run the risk of displaying algorithmic biases that disproportionately affect students in underrepresented groups. For AI applications to be successful in education in the long run, it is imperative that they are created with equity in mind.

**4.5. Impact on Traditional Teaching Models:** AI has an influence on teaching methods in addition to student learning. Cheung et al. (2003) talked about how teachers might make better instructional decisions by using AI-driven analytics to gain insights into student performance. AI can help identify pupils who require extra help so that teachers can intervene more successfully. Additionally, this technology makes administrative duties like attendance and grading more efficient, giving teachers more time to concentrate on engaging students directly.

One critical aspect of effective teaching is the need for educators to continuously update their knowledge base. Relying solely on outdated information is insufficient in an evolving educational landscape. Teachers must not only convey established facts but also comprehend and share new insights with their students. However, many educators tend to confine themselves to a

narrow range of subjects, limiting their capacity to explore broader domains of knowledge. The integration of Artificial Intelligence (AI) in education offers a solution to this limitation by providing educators with instant access to vast resources of information. AI allows teachers to expand their understanding of topics outside their primary areas of expertise, enabling them to refresh and enhance their existing knowledge. This access to updated and diverse information helps ensure that students receive a more comprehensive and well-rounded education, preparing them for the demands of the twenty-first century (Harper, 2021).

Furthermore, recent research has highlighted the importance of addressing both the cognitive and emotional needs of students through AI-supported systems. A study by Hwang et al. (2020) demonstrated that when AI systems considered the emotional states of learners, task engagement and performance improved. This finding underscores the potential of AI to support the affective needs of students, enhancing their overall learning experience. The research suggests that future AI in education (AIEd) technology designs should be more inclusive, accounting for the diverse emotional and cognitive needs of students. By doing so, AIEd can promote more personalized and effective learning environments, ultimately leading to improved educational outcomes.

As AI educational solutions evolve, they are increasingly poised to bridge gaps in teaching and learning, enabling educators to accomplish more than ever before. AI can promote efficiency by automating administrative tasks such as grading, attendance tracking, and performance monitoring, which typically consume a considerable portion of teachers' time. By simplifying these processes, AI allows teachers to dedicate more time to fostering comprehension and adaptation—skills that are uniquely human and where AI would struggle to excel (Holmes et al., 2019). Additionally, AI has the potential to deliver highly personalized learning experiences, adjusting instructional content to meet the specific needs and learning pace of individual students. This personalization ensures that students receive the necessary support and challenges, helping to close achievement gaps (Kulik & Fletcher, 2015). The optimal use of AI in education (AIEd) is one in which teachers and machines collaborate to

achieve the best possible outcomes for students. While AI efficiently handles routine tasks and provides data-driven insights, teachers can focus on developing the critical thinking, creativity, and adaptability of their students—skills that require human empathy and intuition (Murphy, 2019). This collaborative model creates a balanced approach, leveraging the strengths of both educators and technology to enhance student learning and success.

There are several advantages of using AI in teaching. AI-powered personalized learning can increase student motivation and engagement since students are more likely to be interested in material that is pertinent to their particular needs and preferences. Intelligent tutoring systems driven by AI can potentially improve the quality of training by offering personalized, interactive, and interesting learning opportunities. Teachers' workloads can be reduced by automated assessment systems, allowing them to concentrate on teaching rather than grading. Yet, there are a number of difficulties with using AI in education. The likelihood of bias in AI systems is one of the major difficulties. The prejudices of its creators or the data used to train them can be reflected in AI algorithms, which might result in unjust judgments of student work. While students may rely too much on technology and lose the interpersonal relationships that are crucial for learning, there is also fear that the use of AI in education may result in the dehumanization of the educational process (Hwang et al., 2020). Although there are some advantages to using AI in education, we must keep a close eye on how it develops and how it will affect our society as a whole, writes Matthew Lynch (2018), one of the top writers on the subject (My Vision for the Future of Artificial Intelligence in Education), who is careful to explore both the benefits and potential drawbacks.

Garito (1991) highlighted early on that AI has been disrupting the traditional role of teachers since the early 1990s. This disruption has only intensified with advancements in AI technology, as more educators and scholars have recognized its capacity to provide more efficient and effective teaching and learning methods. In recent years, AI has increasingly influenced educational practices globally, particularly in regions such as the Global South, where it has the potential to bridge educational gaps. Additionally, AI is transforming

emerging educational models like Massive Open Online Courses (MOOCs), blended learning environments, flipped classrooms, and other innovative instructional frameworks. These models leverage AI to enhance learning experiences through personalized instruction, automation, and adaptive learning systems, ultimately reshaping how education is delivered and consumed (Al Braiki et al., 2020; Reynolds et al., 2020; Roschelle et al., 2020; Zhang et al., 2020).

In smart classrooms, AI can enhance teaching and learning in a variety of ways. One of AI's most important advantages is its capacity to tailor learning opportunities for specific pupils. In order to create tailored learning plans and adaptive assessments, AI-powered apps may examine student data, including learning habits, preferences, and performance. This might enhance academic performance, motivation, and student involvement (Timms, 2016). A smart classroom is a cutting-edge learning space that makes use of technology to improve instruction and learning. In order to enhance teaching and learning, it is furnished with a variety of gadgets, including interactive whiteboards, tablets, and laptops that may be combined with AI-powered software and apps. Smart classrooms provide a number of advantages, such as increased motivation and engagement, individualized learning opportunities, and effective use of time and resources. By providing intelligent data analysis, individualized feedback, and automated evaluations, the incorporation of AI can further increase these advantages (Munoz & Vadillo, 2020). With individualized learning experiences, data analysis, and task automation, the use of AI in smart classrooms has the potential to change education. Yet, it also comes with a number of problems, such as possible biases and a lack of personal contact. It is crucial to make sure that AI is created and applied in a way that is transparent, equitable, and ethical as technology becomes more commonplace in education. The potential for improved teaching and learning in smart classrooms can be increased by the appropriate integration of AI (Deng & Sun, 2020).

The future of education may be significantly impacted by AI. AI-powered customized learning systems may provide students unique, needs-based learning experiences, enhancing learning results. Intelligent

tutoring systems driven by AI can improve the quality of training by offering personalized, interactive, and interesting learning experiences. Teachers' workloads can be reduced by automated assessment systems, allowing them to concentrate on teaching rather than grading. Yet, thoughtful preparation and study will be needed to include AI into education. The ethical application of the technology and the consideration of potential biases in AI algorithms will be the responsibility of educators (Chen et al., 2020).

By enabling individualized learning, intelligent tutoring, and automated evaluation systems, AI has the potential to revolutionize education. There are many advantages to using AI in education, but there are also issues that must be resolved. The future of education may be significantly impacted by AI, but its implementation will need to be well planned and thought out in order to guarantee that it is utilized responsibly and that it strengthens rather than replaces human relationships in the learning process (Roll & Wylie, 2016).

As academics and practitioners continue to look for new methods to use AI to enhance learning outcomes, the future of AI in education looks bright. The creation of more transparent and comprehensible AI models is one of the main areas of attention. Transparent AI models would make it possible for educators and policymakers to comprehend how AI algorithms operate, the data used to train the models, as well as any potential biases and constraints on the models. This can lessen the possibility that AI will continue to reinforce prejudices and educational inequities. The creation of AI models that can assist non-cognitive abilities like creativity, critical thinking, and social-emotional learning is another area of interest. While the capacity of AI models to comprehend and assist these skills is currently constrained, continuing research intends to overcome this gap (Wong et al., 2020).

## 5. CONCLUSION

In conclusion, the shift toward online and blended learning, accelerated by the COVID-19 pandemic, has introduced innovative methods for educators and learners to engage more flexibly and meaningfully. However, this transition also revealed significant challenges, such as disparities in access to digital technologies, institutional digital capacities, teacher preparedness, and the

general population's digital skills. The integration of AI into education (AIEd) presents a promising avenue for addressing some of these issues by enhancing teaching methods, personalizing learning experiences, and supporting more efficient administrative tasks.

As noted by Finn in the 1960s, technology is not merely a tool but a way of thinking—a perspective that is crucial when considering the incorporation of AI into education (Finn, 1960). For AIEd to reach its full potential, it requires not only multidisciplinary collaboration but also an ethical framework that addresses concerns about equity, access, and responsible use. The ongoing research in AIEd, supported by educational data mining, learning analytics, and other interdisciplinary fields, is laying the groundwork for future educational innovations. Emerging technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) are expected to further transform human-technology interactions in educational contexts, particularly when combined with AI (Zhang & Aslan, 2020).

As AI continues to evolve across sectors, including education, healthcare, and finance, the emphasis on ethical considerations and responsible development becomes even more pressing (O'Connor, 2023). Moving forward, stakeholders—educators, administrators, researchers, and technologists—must work collaboratively to ensure that the development and implementation of AIEd are inclusive, equitable, and focused on improving learning outcomes for all students. The future of education will be shaped by this balance between innovation and ethics, providing both opportunities and challenges as AI becomes more integrated into teaching and learning environments.

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**Cite this article as:** Romero D’Souza (2024). Scope of Artificial Intelligence in Education, *International Journal of Emerging Knowledge Studies*. 3(9), pp.670-678. <https://doi.org/10.70333/ijeks-03-09-035>