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The Role of Artificial Intelligence in Education

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Abstract

The use of artificial intelligence (AI)-powered educational tools is growing over time and has the potential to completely transform the manner that education is provided. This paper looks at the pedagogical ramifications of artificial intelligence applications utilized in educational institutions. The study is qualitative research that analyzes an array of research on artificial intelligence-powered educational technologies using articles from peer-reviewed journals and conference proceedings. Content analysis is used to examine the literature to establish, the use of artificial intelligence in education, including its capabilities in educational processes, its pedagogical implications, and its challenges. The paper discusses how artificial intelligence could transform educational settings and educational resources, creating opportunities for services to be made scalable both inside and outside of the classroom. The paper concludes that while integrating artificial intelligence (AI) into education brings benefits to the education landscape, there are also significant risks. To fully utilize AI's technological innovation for educational purposes, ethical considerations must be taken into account.

Keywords: artificial intelligence, education, pedagogy.

1. Introduction

Advances in information and communication technology have had an important influence on artificial intelligence. Crompton and Burke (2023) in their study found that applications of AI are currently utilized in several fields including governments, education, business, medicine, communication, aviation, and engineering. These technological Innovations have permeated teaching and learning, as well as other sectors of academia, fostering effectiveness and efficiency (Chen, Chen & Lin, 2020). Education now benefits from the use of artificial intelligence, which also offers new challenges in academic practices (Ouyang & Jiao, 2021; Crompton & Burke, 2023). Applications of AI in education are frequently utilized in teaching, learning, and administration. AI applications support social learning in many ways such as summarizing conversations that a teacher can use to guide students toward course goals and objectives in college courses, supporting integrated group teaching based on learning models, and facilitating participation in online communities. Artificial intelligence refers to the ability of machines, especially computer systems, to simulate human intelligence processes. It is a body of

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computational techniques inspired by how humans sense, perceive, learn, and act through their nervous system and/or body. According to Chiu et al. (2023), artificial intelligence (AI) is the ability of digital machines to accomplish tasks typically carried out by intelligent beings. Artificial intelligence is associated with various technological disciplines, including computer vision, speech recognition, machine learning, big data, and natural language processing. Aldosari (2020) explains artificial intelligence as the scientific study of producing intelligent machines that behave like people. It includes the following fields: expert stems, speech recognition, neural networks, robotics, and natural language processing. AI is divided into different branches, including big data, machine learning, computer vision, speech, and natural language processing. According to Chen et al. (2020), artificial intelligence in education has been incorporated into administration, teaching, and learning. As used in this study, artificial intelligence (AI) in education refers to the application of AI technologies, such as chatbots, robots, intelligent tutoring systems, and automated assessment of all types of digital artifacts that enhance and augment education.

1.1 *Organization of this paper and its contribution*

This paper looks into studies examining artificial intelligence's applicability in educational settings and how it's affecting learning. The uses of AI in education, their pedagogical consequences, benefits, and challenges are all covered in this paper. This study advances our understanding of the educational ecosystem by examining the pedagogical effects of AI applications in the classroom and how AI is likely to develop in the future.

2. Artificial intelligence in education

Artificial intelligence (AI) has the potential to transform the educational landscape by automating administrative tasks, providing prompt feedback, and customizing teaching strategies to meet individual student needs. Furthermore, it can aid with assessment and grading, allowing educators to concentrate on designing curricula and delivering exceptional instruction. It is expected of institutions of learning to innovate in teaching and learning to keep up with new technological advancements (Aldosari, 2020). Artificial intelligence techniques, including machine learning, deep learning, artificial neural networks, natural language processing, and genetic algorithms, have enabled the development of intelligent learning environments that support behavior detection, model construction, and personalized recommendations for learning materials (Ouyang & Jiao, 2021). The principal objective of artificial intelligence is to facilitate machine information processing that approaches problem-solving as closely as possible to that of human beings. Artificial intelligence is impacting education in two primary ways, according to Aldosari (2020; Klutka, Ackerly & Magda, 2021): (1) Curriculum designed with AI in mind, which can be customized to fit the unique requirements of every learner. AI systems can create individualized learning pathways by analyzing student data, including learning preferences, skills, and shortcomings; (2) Automation of Administrative duties: By automating administrative duties, AI can free up educators' valuable time so they can concentrate on instructional activities and student engagement. Regular administrative duties like assigning grades, setting up classes, and maintaining student records can be performed by AI-powered systems: AI-generated emails can notify students of upcoming deadlines, encourage them to sign up for classes, turn in assignments on time, and pay fees on schedule. Furthermore, AI-based software is getting better at identifying plagiarized assignments. Artificial intelligence is currently being used in a variety of educational activities. A summary is presented in Table 1.

Table 1. Application of AI in the educational processes

	Technology	Application Area
1	Intelligent Tutoring Systems	Intelligent tutoring systems leverage artificial intelligence (AI) to deliver individualized learning experiences, making them increasingly powerful educational tools. These computer programs are made to provide students with tailored education and feedback. Through the use of AI approaches, these systems provide a learning environment that adjusts to each student's demands, resulting in a personalized educational experience.
2	Adaptive Courseware	Using artificial intelligence and machine learning techniques, adaptive learning software allows for real-time "adaptation" of a student's learning path, making learning more personalized. Furthermore, by examining the data gathered by adaptive learning software, educators and administrators can assess the needs of particular students or groups of students in a course (Klutka, Ackerly & Magda, 2021).
3	Students Grading	In artificial intelligence (AI) grading, assignments, projects, quizzes, and presentations are assessed and graded using computer algorithms and machine learning. Rule-based and data-driven algorithms are the two main types of algorithms used in AI grading. AI grading may give teachers and students rapid feedback, consistent standards, and tailored recommendations.
4	Administrative Tasks	Systems powered by artificial intelligence (AI) can execute tasks like resource and assignment distribution, attendance monitoring, and grade tabulation very quickly.
5	Global Classroom Possibility	Artificial Intelligence (AI) has the potential to dismantle classroom barriers, facilitating information sharing and worldwide learning opportunities for students (Aldosari, 2020).
6	Learning and instruction	With the aid of AI, educators can grade assignments and provide underachieving pupils with the support they require to succeed.
7	Administrative Support	Artificial intelligence (AI) tools are being used by colleges and universities to power a variety of administrative processes, including scheduling, budgeting, maintenance, information technology (IT), transportation, and student record systems. Additionally, statistics on recruitment, admission, and retention efforts are interpreted using these techniques to determine whether or not there is a chance that students will drop out of or fail a course. Consequently, to help and handle a student's issues before they arise, faculty members are informed of possible issues.
8	The FAQ Chatbot	Chabot's are applications that automate a variety of processes with machine learning (ML) and artificial intelligence (AI), leveraging the experience of educators to free up more time for more crucial facets of teaching. If a college responds slowly, the procedure of contacting them with a query may occasionally be slowed down or even stopped altogether. As a result, chatbots are always active, even when no one is there to answer queries.
9	Learning models	The main focus of this has been on creating learner profiles and building models of instructional behavior based on the academic goals' path-level expectations.

3. Artificial intelligence capabilities in educational processes

AI-powered products and services are a part of daily life for educators. Examples include voice assistants in their homes, grammar checkers, essay writers, and phone apps that organize travel automatically. Therefore, educators see opportunities to use AI-driven features, such as speech recognition, to increase the support provided to students with disabilities, multilingual learners, and other groups that could benefit from the improved customization and adaptability of digital learning resources. To better support multilingual students, students with disabilities, and other learners who could benefit from more personalization and adaptability in digital learning tools, teachers see opportunities to use AI-driven features like speech recognition, leverage artificial intelligence (AI) and machine learning (ML) to automate a range of tasks. Thus,

educational processes are progressing beyond their original attempts at digital transformation, which include digitizing workflows, automating daily chores, building increasingly sophisticated information, and building dashboards to enhance analytics. These days, institutions are utilizing AI to do tasks more effectively rather than just employing technology to complete the same tasks more efficiently. Education systems use a variety of AI techniques, including Decision Trees, Fuzzy Logic (FL), Genetic Algorithms, Bayesian Systems, Neural Networks, and Hidden Markov Systems. Fomunyam (2020) points out that many changes are expected to occur in the realm of education as a result of this cutting-edge technology, including the ability for computers to provide personalized lectures to individual students, which will relieve teachers of a substantial amount of their workload. Many predictive scenarios, including grade prediction, student success prediction, student retention, and student-teacher pairing, can be predicted with multiple model systems that are now under development.

AI can also be used to customize and modify instruction to each student's needs. AI helps instructors determine how well their students understand their lectures gives them the ability to provide the right hints, and works as a teacher for the students and makes them learn concepts easily. Furthermore, initiatives powered by artificial intelligence offer helpful feedback to instructors and students alike. Learners are empowered to tailor their learning to meet their own needs because of the simple and adaptable structure of these AI-influenced environments. Thus, artificial intelligence (AI) is a well-designed technology that can give teachers and students the chance to pursue learning effectively by offering a flexible arrangement, opportunities for cooperation, options, and control over the learning process (Jain & Jain, 2019). Generative AI is one of the most prevalent types of AI influencing educational processes. This is described as artificial intelligence (AI) that can replicate data without duplicating it by learning from preexisting information to create new, realistic material. New language and media, including text, speech, video, music, pictures, and software code, can be produced using generative AI. ChatGPT, a conversational model that can compose essays, explain artwork, and hold conversations with the user, is one contemporary example of generative AI. The capabilities of generative AI include the creation and augmentation of textual content, question answering, tone-based text manipulation, text summarization and simplification, software code creation, translation, and explanation. and improve the functionality of Chabot's.

4. Pedagogical implications of artificial intelligence in education

The industry relies on educational systems to produce graduates who are well-educated, well-trained, and possess the necessary skills to fulfill the demands of the modern workplace. As such, training and education should be more responsive to the needs of the job market. According to Jain and Jain (2019), the rise of AI is making many jobs obsolete, necessitating the need for whole new skill sets. Learning and teaching are being revolutionized by the AI era, which offers a paradigm shift in the field of education. Through pedagogy, educators can understand the most effective strategies to implement in a classroom. They can better adapt their classes to meet the needs of their pupils by understanding how various students absorb information and learn. To prepare students for the future, it is crucial to develop an AI education for educational institutions. AI technology is progressing quickly, and in the years to come, it is likely to play a bigger role in society. Academic institutions that provide training in the field to both students and teachers can guarantee that graduates are ready to contribute to the development of AI and handle the ethical, social, and economic issues that are likely to arise as AI becomes more widely used. AI can detect students who might be having difficulty early on and notify parents or instructors so that remedial measures can be taken to assist them catch up. AI can help with curriculum planning by helping to create and optimize plans based on student needs, educational standards, and accessible resources. Education institutions that use AI in their curricula become leaders in their fields and stand to gain from it as well.

When AI is incorporated into educational systems, a dynamic new world with significant pedagogical and ethical implications is created. Using AI tools in instruction can improve learning outcomes from a pedagogical standpoint. The capacity to deliver personalized feedback in a manner that encourages dialogue and assists students in refining their grammar is linked to virtual learning tutors and sophisticated chatbots. All students may learn more easily when they use technology-driven resources, even those with time and location restrictions that may arise in traditional learning environments. Students can learn whenever it is most convenient for them thanks to online learning platforms and programs, which give them more flexibility over when and how they learn. The availability of AI chatbots for learners at any time and on any device, including smartphones, is ascribed to the technology's capacity to build a virtual library that functions as a potent learning aid (Alghamdy, 2023). An opportunity to expose students to real-world, authentic systems of learning was presented using AI-powered virtual reality (VR) and augmented reality (AR). When VR techniques and AI are combined, the efficiency of EFL sessions is significantly improved (Li et al., 2020). VR and AI technologies can virtually take students to different cultural contexts, enabling them to have first-hand encounters with language in real-world settings. Using such a method increases learners' motivation and enhances the learning process. For instance, learners could virtually experience a busy street in Washington, DC, a bustling market in South Africa, and a beach in the Bahamas, giving them a glimpse of the diverse cultures where English is spoken and how the language applies to different situations. AI offers unique resources that converge remarkable flexibility and adaptability in creating learning experiences for students, including those with special needs. Not everyone can speak to communicate. People with speech-related disabilities need appropriate ways of self-expression. Using AI makes learning experiences personalized and tailored to the aptitude and place of each learner (Alghamdy, 2023). Artificial Intelligence (AI) offers several benefits to educational environments, such as customized learning, automated grading, and focused feedback, particularly for students with special needs. By analyzing student data and accounting for each student's unique learning preferences and competency level, AI algorithms may deliver individualized recommendations and evaluations.

The application of AI raises certain issues, nevertheless, such as the loss of the opportunity to teach critical and creative thinking. Human-computer interaction and critical thinking, two cornerstones of any learning process, are threatened by AI-learning technologies. The fact that learning is a constructed and evolving process is not acknowledged or embraced by the majority of those who employ artificial intelligence (AI) in teaching and learning. Instead, they have imposed a particular teaching methodology based on behaviorism and an objectivist epistemology, which fails to adequately capture the complexity of learning in educational processes. This is especially true for those with a background in computer science. Alghamdy (2023) links it to potential biases arising from the usage of AI software and the potential dehumanization of educational processes. For the sake of upholding ethical norms and safeguarding educational goals, there must always be a balance when implementing AI in educational contexts. Not only can it free up educators from the stress of marking hundreds of projects, but it can also offer personalized, adaptable, and interactive learning experiences that allow them to concentrate on what matters. i.e. teaching with empathy.

Educational artificial intelligence is a new field of research that has the potential to revolutionize both our methods and our students' learning. More advanced technology and resilient algorithms are liberating people's imaginations and holding out new possibilities like far less work and nearly free maintenance of more fruitful interactions. Artificial intelligence (AI) and other technologies can be used in education at various levels. In the case of educational processes, proposals have focused on two dimensions, i.e. institutional or strategic applications and facilitation of educational activities (Bates, Cobo, Mariño & Wheeler, 2020). Through process optimization, improved learning outcomes, and readiness for the needs of a world that is changing quickly, education could be significantly enhanced by artificial intelligence (AI). To be successful,

though, it must carefully balance utilizing technology and keeping the fundamental human components of education. In the qualitative analysis research of their narratives, Han, Nawaz, Buchanan, and McKay (2023) uncover students' beliefs that Artificial Intelligence in education may disrupt learner autonomy, instructional strategies, linkages and interactions, and roles in education.

5. Challenges

Alghamdy (2023) highlights that implementing artificial intelligence (AI) in education has some benefits, but also challenges that call for a thoughtful and methodical approach. Artificial intelligence applications present several kinds of issues, particularly regarding the traditional responsibilities of human resources. A study found that many institutions are facing a significant challenge due to the emergence of innovative information technologies, which calls for the planning, development, and implementation of digital skills to better prepare professionals who can comprehend the technological environment and shape it to suit their needs (Aldosari, 2020).

Education typically lags when it comes to new technologies, which is another reason why AI hasn't had much of an impact on teaching and learning in educational procedures up to this point. The integration of modern technologies into all facets of education is hampered by people's reluctance to take chances, embrace new inventions, and provide financing for anything other than conventional teaching techniques. When faced with new technologies, the education industry seems to be conservative, according to Bates, Cobo, Mariño and Wheeler (2020), because a significant number of educators must be persuaded that a novel idea may enhance or expand learning objectives as well as interactions. The growing use of text-generating AI in academic contexts, as demonstrated by ChatGPT, Bing, and Microsoft's recent addition to its Office suite, Co-Pilot, has come under increased scrutiny. One of the primary concerns about the application of AI technologies in educational settings is the potential for students to engage in academic dishonesty, such as cheating or plagiarism, using generative AI techniques. To address this issue, instructors should receive training in incorporating AI technologies into their teaching methods. However, there is also a risk that educators and students may become overly reliant on AI-powered tools, which could impede students' critical thinking skills and hinder their learning process. Similarly, teachers may also face this challenge in their practice.

While examining the various types of prejudice and moral dilemmas related to AI implementations in educational environments, Akgun and Greenhow (2022) highlighted many issues in their study, including privacy, surveillance, autonomy, bias, and discrimination. They therefore argued that the ethical issues and difficulties that teachers encounter differ according to the grade level and developmental stage of their students. Although AI can generate lesson plans quickly, speed and quality are not always related. Instead of taking the time to analyze and improve the material for the optimal learning outcome, educators may be more likely to accept the information that AI initially provides. Furthermore, students must undergo training on academic integrity to guarantee that they comprehend the significance of upholding ethical standards in their jobs. The absence of data security and privacy in AI systems is also an issue. Massive volumes of data, including private student and teacher information, are generated and gathered by AI systems. Cyberattacks and security breaches must be prevented on this data. As such, to safeguard this data, it is imperative to implement strong data privacy rules and security protocols (Rodrigues, 2020; Shahriar, Allana, Hazra & Dara, 2023; Xiao, Wu, Chiti, Manshaei & Ateniese, 2022). One of the biggest issues with AI in education is the digital divide, where certain students cannot use AI technologies because they do not have access to technology or the web. For this reason, it is imperative to guarantee that every student, regardless of socioeconomic status, has access to AI tools (Fung & Stein, 2023; Hwang, Xie, Wah & Gašević, 2020). Many country's

spending on education will increase as a result of incorporating artificial intelligence into the educational system. There will be a significant amount of money spent on schools. Those nations who are unable to adjust to the innovation will ultimately fall behind.

Few studies on the effects of AI in education have looked at socio-emotional outcomes; the majority have focused on cognitive outcomes and adaptive learning, according to Chiu, Xia, Zhou, Chai and Cheng (2023). Research on AI's applications in social science, engineering, and law has extensively examined ethical concerns; nevertheless, education has not benefited from this discourse. Therefore, more investigation is required into the moral dilemmas raised by AI in education. Lack of education perspectives on AI in education research, according to Chiu, Xia, Zhou, Chai and Cheng (2023), is resulting from the reality that most artificial intelligence in education researchers have strong engineering backgrounds and, as a result, tend to take an engineering approach to the field, focusing on technological design and development. The viewpoints of educators and educational researchers are not adequately represented by this methodology. Future studies should look into novel research techniques to do multidisciplinary research on artificial intelligence in education that actively engages all academicians as AI is an interdisciplinary field. Because of this, research on AI in education must develop new techniques for assessing the effectiveness of AI systems.

Table 2. Benefits and challenges

Users	Benefits	Challenges
Administration	– AI facilitates administrative tasks such as scheduling, enrollment, and resource allocation. – Chatbots and virtual assistants allow administrative staff to work on more complex chores by providing answers to frequently asked questions. – With AI, organizations can make data-driven decisions by processing and analyzing large amounts of data at a very fast and accurate pace	– When it comes to new technologies, education usually lags. – There is the challenge of Insufficient funds and a reluctance to embrace novel ideas or take risks – Education typically falls behind when it comes to new technological advancements. – One issue is a lack of funding and a reluctance to adopt new ideas or take chances. – Because technology is changing so quickly, educators must constantly learn new things and adjust to the possibility of biases emerging when using algorithms. continuous instruction on the application of AI in the classroom for teachers
Faculty	– Predictive analytics facilitates the early identification of students facing learning difficulties and equips them with the requisite resources for success. – Grading assignments is a time-consuming activity for teachers that can be accelerated with the assistance of AI technologies. AI technology also can grade essays and assignments and	– Educators must constantly learn new things and adjust to the continuously changing landscape of technology – Utilizing an algorithm carries the risk of biases manifesting themselves – Because technology is changing so quickly, educators must constantly learn new things and adjust to the possibility of biases emerging when using algorithms.

	give feedback to students on things like grammar, vocabulary, and content.	– continuous instruction on the application of AI in the classroom for teachers
Students	– One of the greatest benefits of AI in education is that it can be easily adapted to different learning methods and individual learning preferences. – AI can maintain students' attention on the material they are studying and make it fascinating. Chat Bots are one way that educators can employ AI in the classroom	– As students get used to using technology to solve problems, an over-reliance on artificial intelligence (AI) could hinder their capacity for critical thought and problem-solving. – Issues surface about data privacy, moral implications, and the possible influence on interpersonal communication during the learning process.

6. The future with AI

Research on AI in education has not yet kept up with the quick development of AI technology, making it difficult to offer evidence-based recommendations and support for AI applications in the classroom, according to Zhang and Aslan (2021). There are still not enough educational perspectives on AI in education research, despite the field's rapid advancements in educational technologies. Furthermore, it is essential to progress through new techniques including data visualization, text mining, learning analytics, and educational data mining (Zhang & Aslan, 2021). Within the fields of education and artificial intelligence, ambitious and bold predictions have been made.

Schiff (2021) observes that advocates for AI in education firmly believe that AI will revolutionize education, allowing students and groups to learn far more effectively than they could from a single human teacher in global classrooms. Intelligent tutoring systems, the main AI-based educational tool available at the moment, are also expected to play a significant role in education going forward. Akinwalere and Ivanov (2022) argue that AI is bound to foster innovation and boost national competitiveness; hence, countries will continue to compete in this burgeoning and rapidly evolving field. Natural language processing (NLP)-enabled adaptive language instruction allows educational materials created in one nation to be utilized in another. Robotics and artificial intelligence (AI) can be utilized to help kids acquire hard skills and spark their interest in STEM fields

Artificial intelligence (AI) is developing so quickly that it can already mimic and even surpass many of our cognitive abilities. As a result, humans may have less motivation to constantly study and develop. The serious concern is that we would thereafter lose our education and our ability to make decisions about the future. Humanity may lose its ability to reason critically because machine guidance is so excellent – almost like an oracle – that learning and independent thought will become useless. To determine if the benefits of AI outweigh the risks, Chen et al. (2020) contend that we must carefully weigh these risks to determine whether we should stick or twist and lessen the likelihood that we will sleepwalk to an undesirable place from which we will be unable to escape.

There is a growing interest in the application of AI systems and algorithms in education. Consequently, enormous amounts of training data that AI requires will significantly increase the value of data and change the way we think about data protection. Achieving widely shared safety and prosperity with this revolutionary technology will require prudent global governance. Efficiency, benefits, security, and many other factors must be balanced as educational

systems experiment with AI in traditional classrooms, online, and through mobile learning management systems (Zhang & Aslan, 2021).

The implementation of robotic and technological innovations has educators worried that it may leave them more open to cyber-attacks. Additionally, there is generally a lack of flexibility in solutions offered for problems, as well as financial obstacles to achieving those solutions. Many individuals are not happy with the unequal situation that arises from AI-driven power centralizations in education, which appear to be favoring the otherwise privileged and disadvantageous to the otherwise disadvantaged. The importance of artificial intelligence in enhancing learning and process efficiency, however, cannot be ignored by educators.

As with all aspects of the future, Selwyn (2022) believes that the use of artificial intelligence (AI) in education is unclear, unpredictable, and fundamentally unknown. While most colleges and universities still just have a passing interest in artificial intelligence (AI), many arguments should be carefully considered in the coming years due to the ways that early adopters of AI-driven tools and technology have already affected educational procedures and practices. Selwyn (2022) states that five main points of contention could encourage more thorough discussion and decision-making in light of the rapidly expanding popular, political, and professional discourses surrounding artificial intelligence (AI) and education. These include addressing AI and related to (1) hyperbole, (2) limitations, (3) social harms, (4) ideology, and (5) environmental sustainability.

7. Conclusion

The purpose of this article was to examine how artificial intelligence is used in education, including its potential for use in learning processes, its pedagogical consequences, and the challenges. A content analysis was used in the qualitative study to examine literature from peer-reviewed journals and conference proceedings. AI has the potential to revolutionize education by offering numerous benefits, such as improved effectiveness and personalized learning. By leveraging AI, students can develop critical thinking and problem-solving skills, which are essential in the twenty-first century. Furthermore, AI can provide students with unique and engaging learning experiences. However, integrating AI into education also poses risks, including potential biases and data privacy issues. Therefore, it is crucial to balance technological progress with political, ethical, and other emergent considerations to fully utilize AI for enhancing education.

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