



AI and Education: An advanced resource of effective, and revolutionary opportunities for teaching and learning in the future

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Abstract

With the rise in studies about artificial intelligence (AI) in the educational sector, many scholars in the field believe that the role of teachers, schools, and leaders in education will change. Artificial intelligence includes game playing, expert systems, neural networks, natural language, and robotics. Currently, no computer exhibits full artificial intelligence. The best computer chess programs are now capable of defeating humans. Today, the hottest area of artificial intelligence is neural networks, which are proving successful in many disciplines such as voice recognition and natural-language processing. There are many programming languages that are called AI languages because they are used almost exclusively for AI applications. What are the possible scenarios with the advent of AI in education and what kind of implications it can reveal for the future of schools? It is important to know, understand, and keep yourself updated with this field. AI in education refers to the use of artificial intelligence techniques such as machine learning and natural language processing to enhance the learning experience. Privacy and security concerns, lack of trust, cost, and potential bias are some of these challenges. Ethical considerations such as ensuring access, transparency and fairness must also be taken into account in AI-based education systems. Despite these challenges, the potential of AI in education is enormous. AI can provide better data analysis, enabling teachers to make data-driven decisions. Personalised learning is one of the most important benefits of AI in



education, which can lead to better student outcomes, as students can learn at their own pace and in a way that suits their learning style. This review describes the role of AI in enhancing education which describes the impact of AI in the education sector. It involves the use of algorithms that analyse data, identify patterns and make predictions, helping teachers to personalise learning for each student.

Keywords: AI, Education, learning, Chatbot, Society, System, Technology

Introduction

Artificial intelligence (AI) involves the use of algorithms that analyse data, identify patterns, and make predictions, allowing teachers to personalize learning for each student. Educators seek technology-enhanced approaches that address these priorities in ways that will be safe, effective, and scalable. Naturally, educators wonder if the rapid advances in technology in everyday life can help. Like all of us, teachers use AI-powered services in their everyday lives, such as voice assistants in their homes; devices that can correct grammar, complete sentences, and write essays; and automated travel plans on their phones. Many educators are actively exploring AI tools as they have recently been released to the public. Educators see opportunities to use AI-powered capabilities like speech recognition to enhance the supports available for students with disabilities, multilingual learners, and others who may benefit from greater adaptability and personalization in digital tools for learning. They are exploring how AI might be able to write or improve lessons, as well as their process of finding, selecting, and customizing content for use in their lessons. Educators are also aware of new risks. Useful, powerful functionality may also come with new data privacy and security risks. Educators recognize that AI may automatically produce inappropriate or inaccurate outputs. They are wary that associations or automation created by AI may amplify unwanted biases. They have seen new ways in which students can pass off the work of others as their own. They are well aware of teachable moments and pedagogical strategies that a human teacher might address but are not detected or misunderstood by AI models. They worry whether the recommendations suggested by algorithms will be appropriate. Educators' concerns are manifold. These constituents include educational leaders teachers, faculty, support staff, and other educator-researchers; policymakers; advocates and funders; technology developers; community members and organizations; and, above all, learners and their families/caregivers. Recently, through its activities with constituents, the department has seen a sharp increase in interest and



concern about AI. In late 2022 and early 2023, the public became aware of new generative AI chatbots and began exploring how AI could be used to write essays, create lesson plans, draw diagrams, create personalized assignments for students, and more. From public expression on social media, at conferences, and in the news media, the department learned more about the risks and benefits of AI-enabled chatbots. And yet this report will not focus on a specific AI tool, service, or announcement, as AI-enabled systems evolve quickly. Finally, the Department drew on internally available educational policy expertise and its relationships with AI policy experts to shape the findings and recommendations in this report. Ethical considerations such as ensuring access, transparency, and fairness in AI-based education systems must also be taken into account. Despite these challenges, the potential of AI in education is enormous. AI can provide better data analysis, enabling teachers to make data-driven decisions.

Use of AI in Education

The main advantage of AI in education is that it can facilitate learning with more flexibility and convenience as learners can learn in their own time and place using AI-related infrastructure. Personalized learning is one of the most important benefits of AI in education, which can lead to better student outcomes, as students can learn at their own pace and in a way that suits their learning style. Privacy and security concerns, lack of trust, cost, and potential bias are some of the challenges that must be addressed.

AI has the potential to revolutionize education, provide individualized and personalized learning, and deliver better learning outcomes. AI can analyse student data and provide real-time feedback to teachers and students, allowing them to adjust their teaching and learning strategies accordingly. One of the biggest benefits of AI in education is its ability to provide personalized and individualized learning. AI can analyse student data and create a personalized learning plan for each student, taking into account their strengths, weaknesses, and learning styles. The potential of AI in education is enormous, and it is expected to revolutionize the approach to degree and diploma programs in the future. AI-powered technologies can provide real-time feedback to students, help them stay on track with their studies, and provide a more personalized and engaging learning experience.

I strongly believe that stakeholders need to understand the cyclical effects of AI and education. By understanding how different activities interact, we have the ability to support virtuous cycles. Otherwise, we will likely allow vicious cycles to continue." Lydia Liu During the



listening sessions, constituents gave three reasons to address AI now: First, AI may be able to achieve educational priorities in better ways, at scale, and with lower costs. Addressing students' various unfinished education due to the pandemic is a policy priority, and AI can improve the adaptability of learning resources to students' strengths and needs. Improving teaching jobs is a priority, and through automated assistants or other tools, AI can provide teachers with more support. AI can also enable teachers to provide the support they need to individual students when time is running out.

Along with flexibility, AI can also increase access to education as more and more learners can access quality educational resources regardless of their economic background or geographical location. AI systems also provide students with a judgement-free learning environment and can suggest solutions to improve student performance. The use of AI in education is improving student performance overall. One of the benefits of AI includes more support available to students (Baidu-Anu & Ansah, 2023; Tahiru, 2021). AI-based support to students uses chatbots and virtual assistants that are based on intelligent systems and can provide round-the-clock availability, resolve queries, and provide valuable feedback. AI also enables increased student engagement and motivation by providing tools such as gamification of learning or interactive content. This enables greater student engagement and motivation (Zhang & Aslan, 2021). AI systems also enable automated grading, providing tutors with more time for lesson planning and preparation (Adlawan, 2024; Baidoo-Anu & Ansah, 2023).

Teachers can integrate AI lessons as supplementary material to assist weaker students and provide practical experience for students in the form of human interaction. AI can also reduce the costs incurred by educational institutions as it removes unnecessary work and automates processes thereby reducing resource requirements (Adlawan, 2024; Tahiru, 2021). The reduced costs can thus be transferred to other stakeholders such as students. Overall, we can argue that the use of AI in education benefits learners, teachers, and educational institutions in terms of flexibility, enhanced learning, focus on more important tasks, and increased efficiency.

Implications for teaching and learning Real-time instructional feedback can be beneficial when it helps learners and teachers improve. But the common experience often leaves students and teachers with unpleasant feelings toward assessment and thus creates a provocative conflict between the potential benefits of data collected through formative assessment and the practical implications of conducting additional assessment in classrooms and schools. Some AI-enabled systems and tools attempt to address this potential conflict. For example, an AI-enabled reading



tutor listens to students reading aloud and provides on-the-spot feedback to improve their reading. Students reportedly liked the reading aloud, and this approach was effective.

AI-enhanced assessments can also benefit teachers if they provide detailed information about student strengths or needs that may not be visible and if they support instructional adaptation or improvement by suggesting a small set of evidence-based recommendations to help students master the content. Such assessments can also be helpful outside of the classroom if it can provide feedback when the teacher is not available, for example, to complete homework or practice a concept during study hall.

What is important is that students learn about AI, critically examine its presence in education and society, and determine its role and value in their lives and careers. Learning with and about AI As AI is introduced into schools, two broad approaches to AI in education have emerged:

(A.) AI in support of student learning; and

(B.) Support for learning about AI and related technologies. Here, it is important for students to become more aware and understanding of the risks of AI – including the risks of bias and surveillance – as they appear in all elements of their lives. Students can begin learning about AI in elementary, middle, and high school. They can use AI to design simulations and products that they find exciting. And we have seen that students want to talk about the ethics of the products they experience in their everyday lives and have a lot to say about the products they would or would not like to see in school. And later, in the research section, we look at the desire for co-design processes that involve students in creating the next generation of AI-enabled edtech. Overall, it is important to focus on using AI to support learning and giving students opportunities to learn about AI.

Use of AI in Society

AI has played a major role in the digitization of society, as it has enabled us to collect, process, and analyse large amounts of data at a faster pace than ever before. AI-powered technologies such as natural language processing, image and audio recognition, and computer vision have revolutionized the way we interact with and consume media. With AI, we are able to process and analyse large amounts of data quickly, making it easier to find and access the information we need. The use of AI has increased rapidly in recent years. AI-powered personal assistants such as Siri and Google Assistant have become a core part of many people's daily lives. AI-



powered technologies are also being used to improve user experience and provide more personalized recommendations and services.

To bring about positive changes in society, increase productivity, better healthcare and even education, etc., AI-powered technologies can provide convenient avenues to solve complex problems by making our daily lives easier and simpler. While the benefits of AI are clear, it also has important ethical and social implications that must be considered. Issues such as privacy, security, and job displacement are just some of the challenges that come with the increased use of AI. It is important that we proactively address these concerns and work to ensure that AI is used for the betterment of society. As AI continues to evolve and gain importance in our world, it is vital that we continue to invest in its development and advancement. This includes investing in research and development, as well as creating policies and regulations that promote the responsible use of AI. By doing so, we can ensure that AI continues to be a positive force in our world, driving progress and improving lives for years to come. Thereby AI is changing our world, including its use in the digitization of society and advancements in education. We discussed the positive impacts of AI, including its potential to revolutionize various industries and improve our daily lives, as well as the ethical considerations that come with its continued development. As AI continues to evolve, it is clear that it will play a vital role in shaping our future. While there are certainly challenges that must be addressed, such as privacy and security concerns, the benefits of AI cannot be denied.

AI systems

AI systems enable new forms of interaction AI models allow computational processes to make recommendations or plans and also enable them to support forms of interaction that are more natural, such as talking to an assistant. AI-enabled educational systems will be desirable partly because of their ability to support more natural interactions during teaching and learning. In classic edtech platforms, the ways teachers and students can interact with edtech are limited. Teachers and students can choose items from a menu or in a multiple-choice question. They can type short answers. They can draw objects on the screen or use touch gestures. The computer provides students and teachers with output through text, graphics, and multimedia. Although these forms of input and output are versatile, one would not understand this kind of interaction the way two people interact with each other; this is typical of human-computer



interaction. With AI, interaction with computers is likely to become more like human-to-human interaction. A teacher can talk to the AI assistant, and it can respond.

A student can draw a picture and the computer can highlight a part of that picture. Today's email programs can complete our thoughts faster than we can type. Furthermore, the possibilities of automated actions that can be performed by AI tools are growing. Current personalization tools can automatically adjust the sequence, pace, prompts, or trajectory through learning experiences. Future actions may look like an AI system or tool that helps a student with homework or a teaching assistant that reduces a teacher's workload by recommending lesson plans that meet the teacher's needs, and are similar to lesson plans the teacher previously preferred. Furthermore, an AI-enabled assistant may appear as an additional partner in a small group of students who are working together on a collaborative assignment. An AI-enabled tool can also help teachers with complex classroom routines. For example, a tool can help teachers move from a full class discussion to smaller groups of students. AI enables adaptability in learning. Adaptability has been considered an important way technology can improve learning. AI can be a toolset to improve the adaptability of edtech. AI can improve a technology's ability to meet students where they are, build on their strengths, and enhance their knowledge and skills. Because of AI's powers of working with natural forms of input and the fundamental powers of AI models, AI can be a particularly strong toolkit for expanding the adaptability provided to students.

The main limitations arise from the nature of the models at the heart of any specific AI-enabled system. Models are approximations of reality. When important parts of human learning are left out of models or not fully developed, the resulting adaptability will also be limited, and the resulting support for learning may be brittle or narrow. As a result, this section on learning focuses on a key concept: work toward AI models that conform to the fullness of the approach to learning – and don't limit learning to only what AI can currently model well. AI models are demonstrating greater skill due to advances in what are sometimes called big language models or baseline models. These very general models still have limitations. For example, the generative AI models discussed in mainstream news can quickly produce credible essays on a wide variety of topics, while other models can produce credible pictures based on only a few cues. Despite the excitement about baseline models, experts in our listening sessions cautioned that AI models are narrow in their approach to human learning and that it's important to design learning environments with these limitations in mind. Models are also brittle and may not



perform well when the context changes. In addition, they do not have the same common-sense judgment as people, often reacting in ways that are unnatural or inaccurate. Given the unpredictable ways in which baseline models miss the target, keeping humans in the loop is of utmost importance. The department's long-term edtech vision sees students as active learners; students participate in discussions that advance their understanding, use visualizations and simulations to explain concepts as they relate to the real world, and take advantage of supportive scaffolding and timely feedback during learning. Components want technology to align with and build on these and other research-based understandings of how people learn. We must keep a firm eye on the forms of learning that will most benefit learners in their future lives in communities and workplaces.

Challenges of AI in Education

Artificial Intelligence (AI) is rapidly transforming various sectors, and education is no exception. The integration of AI in education is revolutionizing traditional teaching and learning methods, providing new possibilities for personalized learning, enhancing teacher-student interactions, and making education more accessible and efficient. While AI has significant potential to transform education, its integration also presents several challenges. These challenges must be addressed to realize the benefits of AI without compromising the quality and integrity of education.

- ✚ Lack of technological infrastructure: One of the biggest AI in education challenges is the lack of technologies essential for implementing the transformative powers that AI can bring to the field of education.
- ✚ Data Privacy & Security: If this data is not properly protected, it can be vulnerable to breaches, leading to unauthorized access or misuse of sensitive information. Ensuring strong data security measures and complying with privacy regulations are crucial to maintaining the trust of students, parents and teachers.
- ✚ Bias and fairness: AI algorithms are trained on data, and if this data is biased, the AI system may maintain or even amplify these biases. In education, this can lead to unfair outcomes such as biased grading, unequal access to learning resources or reinforcing stereotypes. For example, an AI system may favour students from certain demographic backgrounds over others, creating inequities in educational opportunities. Addressing



bias in AI requires careful selection of training data and constant monitoring to ensure fairness.

- ✚ Lack of human interaction: Education is not just about knowledge transfer; it is also about promoting social and emotional development. Excessive reliance on AI in education can reduce face-to-face interactions between students and teachers, which are crucial for developing communication skills, empathy and critical thinking. While AI can assist in many aspects of education, it cannot completely replace the human elements of teaching, such as mentoring, encouragement, and personalized feedback.
- ✚ Cost and access: Implementing AI in education can be costly, requiring significant investments in technology, infrastructure, and training. This can create a digital divide, where only well-funded schools or institutions can afford to integrate AI, leaving less-funded schools and students from low-income backgrounds at a disadvantage. Ensuring that AI in education is accessible to all students, regardless of their socio-economic status, is a significant challenge. There is a need for policies and initiatives that promote equitable access to AI-powered educational tools.
- ✚ Teacher resistance and training: Many teachers may resist adopting AI due to fears of job loss, a lack of understanding of the technology, or doubts about its effectiveness. Additionally, teachers need proper training to effectively integrate AI tools into their teaching methods.
- ✚ Ethical considerations: The use of AI in education raises many ethical questions, such as the extent to which AI should be involved in decision-making processes that affect students' lives. For example, should AI systems be allowed to determine a student's academic path or make decisions about their future based on predictive analysis? There is also a concern of transparency – students and teachers need to understand how AI systems arrive at their conclusions and recommendations. Clear guidelines, transparency, and accountability are needed in AI applications to ensure the ethical use of AI.
- ✚ Dependence on technology: This reliance can reduce critical thinking and problem-solving skills, as students may rely too much on AI to provide answers and solutions. Additionally, technological failures or limitations can impede the learning process. It is important to ensure that AI complements rather than replaces traditional educational methods, allowing students to develop a wide range of skills.



- ✚ Quality and relevance of content: There is also a risk of homogeneity, where AI may promote standardized content.
- ✚ Technical expertise: Some teachers may lack technical expertise, requiring them to spend a lot of time and effort customizing AI tools to their needs. To design effective prompts for generative AI tools, teachers need to understand how to formulate questions that elicit the desired responses from AI systems which can sometimes require knowledge about the underlying processes. Etc.

Benefits of AI

In this topic, the results obtained from the participants' opinions about the benefits of using artificial intelligence in education are presented. Accordingly, these benefits are:

- ❖ Measuring people or measuring people
- ❖ Correct determination of the individual's need
- ❖ Practical solution to age-old problems
- ❖ No paperwork in schools
- ❖ Preventing time wastage
- ❖ Increasing the quality of education
- ❖ Providing ease of work
- ❖ Helping to make the right decision by fast data analysis
- ❖ Planning teaching according to the student's ability and pace
- ❖ Using or choosing effective teaching methods using learning analytics
- ❖ Ability to train in small groups with effective planning
- ❖ More effective personalized teaching process
- ❖ Helping policymakers, Etc.

An educationist stressed, as the benefits of Artificial Intelligence, monitoring student information, studying the status of students in the evaluation school, making suggestions according to these reports and sharing with the concerned people.' A jurist said, 'Artificial intelligence tools it can help in evaluating exam results, student activities and communication between students.' One teacher said, 'An AI tool can analyse students' voices and measure how much they have learned and provide supportive or regulatory instructions accordingly.' These views of the participants are closely related to the benefits of 'learning analytics' reported in the literature.



Disadvantages of AI

In this topic, potential drawbacks and risks regarding the use of artificial intelligence in education were mentioned. According to the participants, these drawbacks can be listed as follows:

- Mechanical thinking of individuals, suppression of intuitive feelings
- Humanistic values can be replaced by utilitarian or pragmatic approaches,
- Possible bad scenarios with absolute assessment of students, classification of humans based on their IQ, etc.
- Information-oriented human type,
- No need for human intervention in education,
- Negative impact on social relations. Etc.

The participants mentioned potential risks and drawbacks differently in the interviews. Especially among the teacher participants. A teacher believes, “Artificial intelligence will increase its dominance over the world, not requiring much human intervention.” An educationist said, “Some kind of machine-human style, mechanical thinking individuals are waiting for us.” One teacher says, "I think we won't need teachers in the distant future." Burak, a jurist, also has a similar view of teachers, saying, and “Artificial intelligence will take over all educational tasks; even teachers won't be needed." Possible reasons for these concerns include the influence of depressing robot movies and popular media, which some participants believed might be true.

Suggestions

This topic included suggestions from the participants regarding the use of artificial intelligence in education. These recommendations are as follows:

- ✓ Applications or systems developed in relation to artificial intelligence in education should be tested with pilot applications and integrated into the system according to their results.
- ✓ Academic studies should be conducted on the developed systems and analysed.
- ✓ Necessary infrastructure works should be created.
- ✓ An audit mechanism should be established.
- ✓ Human psychology should not be neglected.



- ✓ Preventive and supportive software should be developed.
- ✓ The AI integration process should be carried out in such a way that social relations are not negatively affected.
- ✓ The process should be carried out in an interdisciplinary manner with all stakeholders, not just teachers and engineers. Etc.

At this point, Hatice (a teacher) said, 'A conscious use of artificial intelligence should exist; AI should only be prioritized for areas that are necessary.' Ali (an academician) said, 'We need to be careful in taking steps. Academic studies can be carried out. Running pilot applications is important.' Kubra (an expert engineer) explained the general framework as follows: 'Artificial intelligence should not be at the centre of educational activities; it should act as a supporting element, playing a supporting role for teachers and the human factor. Since it is humanity that is most affected by technology, it is important that this entire process is carried out on a legal basis so that no harm is caused to the individuals concerned, especially the mental analysis, and the measurement of individuals will take the entire life to be exposed. This issue should be addressed in two steps: 1- For the State to establish the necessary infrastructure to fulfil this obligation, providing access to the relevant body through strict protocols. 2- To prevent the violation of privacy, to end this violation as quickly and with the least damage, States should apply preventive penalties.

Conclusions

There are many benefits to incorporating AI into education, but there are also many challenges and concerns that need to be addressed. Institutions should carefully consider the costs and benefits of implementing AI systems in their classrooms and ensure they are taking appropriate measures to protect student privacy and prevent bias. By balancing the benefits and challenges of AI in education, we can create more personalized, efficient, and effective learning experiences for all students. As society continues to embrace this technology, it is important that we are mindful of its impact and work to address the challenges that come with its development. Through artificial intelligence, computers have also defeated humans in chess. So we can say that reaching this far has not been in vain, in some way or the other it is contributing to the advancement in artificial intelligence. At present there is no computer that can fully show artificial intelligence. The focus of research is to create human-like machines or robots. This is because scientists are interested in human intelligence and are amazed at



trying to copy it. The hard work of researchers will probably pay off one day and we will find that machines are doing our work and robots are walking with us. Artificial intelligence is the study of how to create things that can work exactly like humans. We all know that artificial intelligence is a huge challenge, but the process of creating machines like ourselves is still going on.

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