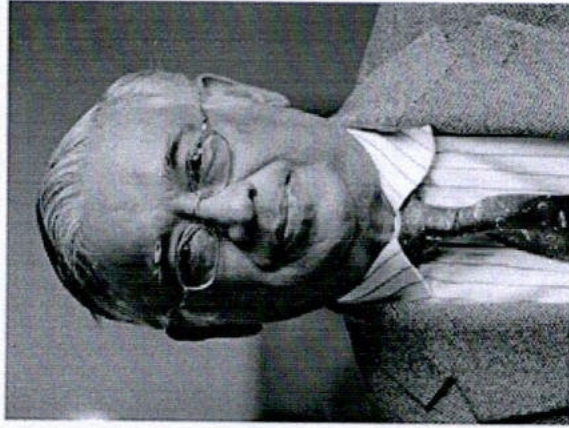


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The Great Indian Mathematician
Abel Prize Winner (2007)



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Role of Artificial Intelligence in Teaching and Learning: An Exploratory Study

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ABSTRACT

Artificial Intelligence (AI) has the potential of revolutionizing and transforming the education system by addressing the major challenges in education today. AI can be an effective education tool for teaching and learning that would benefit both teachers and students. However, considering the digital divide and the risks associated with technology, it is imperative that the challenges of using AI in education (AIE) are evaluated before incorporating it in the teaching and learning process. Also, an attempt should be made to harness the human-element in AI, especially when implemented in education. Hence, the objective of this paper is to explore and analyze the various AI tools that are used in teaching and learning process and assess their effectiveness in improving the teaching and learning process. Furthermore, it will also address the challenges and risks of incorporating AI in education. This paper will give recommendations to overcome the challenges of AIED and reflect on the implications of using AI in education.

Keywords : Artificial Intelligence in Education, Technology, Challenges and Prospects.

INTRODUCTION

The term artificial intelligence was used for the first time by McCarthy in 1956. Baker and Smith (2019) define artificial intelligence as computers that perform cognitive tasks associated with human minds. Artificial Intelligence is a branch of computer science that makes machines replicate or stimulate human intelligence, however, AI is not synonymous with machine learning. Though machine learning and artificial intelligence are often used interchangeably, they are two different terms. Artificial intelligence includes an array of technologies and methods such as machine learning, data mining, language processing, neural networks etc. Thus, we see that machine learning is an application of AI where computer systems automatically learn and improve themselves. "Artificial





Learning Management Systems

Learning Management System is a software tool that is used to create, deliver, track and report educational courses and outcomes. It helps teachers to develop courses, deliver instruction, evaluate students' performance and track learner's progress and activities. It provides a centralized learning platform for teachers where they can do multiple tasks conveniently like sharing instructional materials with the students, make important class announcements, collect assignments, grade them and also communicate with students etc. It also helps in the professional development of teachers.

Chatbots

Chatbots are computer programs that stimulate human conversation and allow humans to interact with digital devices. It uses conversational artificial intelligence technology to respond to real-time user interaction. Chatbots tutors are designed to help students in their studies and help them learn new concepts easily. Teachers are not available round the clock to interact with the students, whereas chatbots are accessible to students whenever they want.

Educational Robotics

Educational Robotics can create immense interest and motivation among students to acquire new skills in an interesting engaging manner. Researchers see robotics as a new promising tool in the field of education. Robots and educational robotics have great potential in education and can be used as great learning tools to help both teachers and students in the teaching and learning process. Robotics Mubin et al (2013) in their research concluded that robots can be used as stimulating, engaging and instructive aids in the classroom. can be used to foster creativity in the classroom. Sanchez *et al.* (2019) said that "educational robotics can improve interdisciplinary learning environments where students and teachers can structure their research and solve problem situations in a concrete way; developing new skills and abilities in people...contributing to the development of student's creativity and cognitive capability. Robotics can be a blessing for children with special needs.

Potential Benefits of AI in Education

Support Inquiry-based Learning.

In a traditional classroom, most of the questions are asked by the teachers and students get very few opportunities to ask questions. Technology-assisted teaching systems use virtual-reality to present concepts in an interesting way. However, this kind of interaction is, no doubt, interesting and helps students understand the concepts but it fails to develop inquiry-based learning as students don't get an opportunity to question and inquiry, they are often mute recipients of knowledge. Wood *et al.* (2003) have developed an *inquiry tutor - Rashi* that they say has the potential to scaffold students to use inquiry-based approach to posit theory to explain the situation. AI tools are used to guide students through ill-structured problem spaces, supporting student knowledge and scaffolding reasoning and diagnostic skills. Thus, it engages students in long-term investigations and cognitive problem solving.

Personalised Learning or Adaptive Learning

In a large mixed-ability classroom, the students have different skill levels and different levels of learning ability. It is quite difficult for a teacher to assess the skill level of the learner and design instructions based on their skill level and learning needs. However, an Intelligent Tutor or Adaptive tutor can assess the skill level of students and design personalized learning experiences for each student. Thus, it can help in adaptive learning.

Feedback using AI

Some students are either very shy or not very sportive in receiving critical feedback in the class, hence, they often don't respond or interact in the class because of the fear of making mistakes. However, mistakes are necessary for learning and feedback is crucial for improvement. AI provides meaningful and immediate feedback to students directly and discretely so students don't shy away from trying and making mistakes. Mathan and Koedinger (2003) in their research discuss the pros and cons of immediate and delayed feedback and described an experimental comparison between an intelligent novice version of a spreadsheet tutor and an expert version consistent with an immediate feedback tutor. They found out that participants using intelligent novice tutor outperformed the



**Noor Nigar**

AI is a double-edged sword, one one hand it provides innovative educational solutions and on the other hand, it puts our personal data at risk. Data stored online can be easily manipulated or misused by people with bad intentions. Ethical use of AI is still a far cry as there are no set guidelines to use AI ethically. Machines are not humans, hence, they are not good at making ethical and moral decisions. In addition to this, they cannot apply socio-emotional intelligence in making decisions. However, these challenges can be overcome if children are taught AI ethics from early childhood. As discussed earlier in this paper, AI helps in automating assessment, however, this rips the assessment of professional expertise of a teacher specialised in the subject matter. Moreover, evaluation by machines, though objective, fails to take into consideration the socio-economic background, educational experiences and personal values of the individual being assessed. AI-assisted evaluation also discourages teachers getting involved in the process of evaluating their students which is very crucial for providing appropriate strategies for scaffolding students in their process of learning (Swieck 2022).

High cost of AI is a major deterrent in implementing it in education. Humanoid Robots and Virtual Reality are very expensive for developing countries or small educational institutions to use. AI enables continuous and comprehensive assessment round the clock which leads to a kind of pedagogical surveillance that is more administrative and less pedagogical. This might create a sense of anxiety among learners who feel overwhelmed by this invisible monitoring that amplifies everything they do online. Though AI is a very effective tool in education, teachers, especially in developing countries, are not very tech-savvy and mostly prefer traditional mode of teaching. Making these teachers adapt to AI will be a major challenge.

Recommendation

1. Blended learning or the hybrid-mode of learning must be used, it takes away the fear of teachers losing their jobs and AI gets a human touch.
2. Teachers must be trained on how to make best use of AI in their teaching. Kazi rightly suggests "As Research into AI and its application to the education sector expands, we need to consider the readiness of current teachers, and prepare future teachers for this new reality."
3. There is a need for interdisciplinary research in AI in education where teachers of various disciplines can collaborate with computer or IT faculty to develop softwares that will assist them in their area of specialization. Also, cross-disciplinary collaboration among computer scientists, educators and ethicists is required to overcome the challenges that AI poses for students.
4. AI technology for education must be made more cost-effective so the developing countries and small educational institutions can all use them.
5. All the stakeholders must come together to set up standards and design ethical guidelines on the use of AI in education.
6. As the children's interface with AI is more, from a very young age, teachers must nurture ethical decision making skills and the use of social-emotional intelligence in children while using AI. Monitoring students while they use AI is very crucial to train them how to use it ethically.

CONCLUSION

Artificial Intelligence in Education is a contentious topic today. Recent years have seen a significant growth in research on IA. Nonetheless, the research on AI in education is very limited and done mostly in developed countries. In developing countries like India, research on IAE is still in a nascent stage and incorporating IA in the Indian educational context is a challenge. However, despite the challenges associated with artificial intelligence, the advantages it provides cannot be ignored. Instead of looking at it as a threat for the teachers, it should be used to complement the teachers to help them in effective teaching. IA makes educational content both engaging and interesting and it is also pedagogically very effective. AI can help students in understanding the concepts better, create motivation and interest towards learning new or difficult concepts. Thus, it can be concluded that AI can help improve the quality of education and help in achieving educational goals and must be incorporated in education. At



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