

ARTIFICIAL INTELLIGENCE IN EDUCATION: PROSPECTS AND CHALLENGES

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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 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 education. 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 education and assess their effectiveness in teaching and learning. Furthermore, it will also address the challenges and risks of incorporating IA 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 intelligence in education opens new opportunities, potentials and challenges in educational practices” opines Ouyang & Jiao (2021). Artificial intelligence and adaptive learning are the two most prominent developments in educational technology. Educators all over the world are exploring the pedagogical potential of AI in higher education and AI is undoubtedly the future of higher education. AI can provide humongous support to both teachers and learners by facilitating effective teaching and learning. Though Artificial intelligence is considered to be the future of education, teachers are not aware of its scope and potential in education. Also, despite the advantages that AI provides to teaching and learning, there is a huge risk that comes along with the application of AI in higher education. In this backdrop, this research paper intends to discuss the various AI tools used in education, analyse the potential of artificial intelligence applications in education. This paper will also discuss the challenges associated with the use of AI in education and give recommendations to overcome these challenges.

AI Tools used in Education

Game-Based Language Learning

Educational games make learning interesting and fun for students. AI has great potential in aiding language learning. Voice-interactive systems can play the role of a teacher as well as a conversational partner to provide umpteen opportunities to learners to practice conversation and give immediate feedback to the learner regarding the quality of speech. It can also be used for pronunciation and intonation training for non-native speakers of a language. However, the major concern is that the voice-interactive system is technological constrain that hinders comprehension of non-native speech.

Wang and Seneff (2007) developed a web-based voice-interactive translation game for second

language learner that provides a fun-environment to practice speaking of a foreign language i.e Chinese. However, research in second language learning has revealed that learning a new language through translation hinders fluency.

Mathew et al. (2011) tested the effects of game-based and tutor-based assistance on learning and interest and found that tutor-based assistance was more effective in teaching concepts to students. They recommended that smart-tutors must be incorporated in educational games. Games-based education create more interest in students and tutor-assistance increase learning. Hence, to amalgamate interest and learning, tutor-assistance must be incorporated in educational games assistance.

Intelligent Tutoring System

Intelligent Tutoring System is an educational softwares that works on artificial intelligence to do a number of tasks. In a big classroom, the teacher cannot give individual attention to each student. Nonetheless, this disadvantage can be overcome by using Intelligent Tutoring Systems (ITS) that can promote one-to-one personalized tutoring of each student based on their needs. Thus, ITS provides cognitive scaffolding to students and caters to their educational needs and requirements. It collects information about the student's academic performance along with various cognitive and noncognitive variables and based on this information, it makes inferences about a student's area of strengths and weaknesses and suggests suitable tasks and gives appropriate feedback. It effectively diagnoses the student's errors and delivers instructions based on the diagnoses. These tutors are designed to have the knowledge of the learner, subject and pedagogical strategies.

Virtual Reality and Augmented Reality

Virtual Reality (VR) and Augmented Reality (AR) have immense potential in the field of education. Both these technologies enrich learning experience by bringing together the virtual world and the real world.. Virtual Reality (VR) is a technology that creates a virtual immersive user experience that feels real. It is a computer generated simulation that stimulates a new reality which enables students using it to interact in a virtual world that seems real to them. Augmented Reality (AR) is an amalgamation of digital content and physical environment in real-time. Special headsets with sensors are used in Virtual Reality that transforms the real- world into modelled reality (TeamViewer), whereas AR can be accessed in regular smartphones and headsets. Both AR and AV provide interactive and meaningful learning experiences for the students.

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 participants using expert tutor on a number of tests. We can conclude that immediate feedback is not always very effective; at times, students need to be guided to correct their mistakes on their own using AI.

Researchers have suggested interesting and effective ways of providing feedback to students; one such method is proposed by Kunichika et al.(2003) who developed a method that generates animation from English sentences composed by the learner. The young learners are provided with a story in English with animation and when they write the story in their own words, animation is generated based on the sentences written by them. If there are any errors, it gets reflected through animation and students get a chance to reflect on their errors and correct them. This method was used for primary-level students for simple sentences in English. More research has to be done for giving feedback to students of higher grades.

Tutoring and support outside the classroom

AI can assist students round the clock unlike teachers who are available only during the school or college hours. AI not only provides supports inside the classroom but also outside the classroom.

Learning Analytics

AI helps in identifying the strengths and weaknesses of students. AI-driven analytics can also identify latest trends in education and draw key markers that can help educators to design and develop most effective classrooms that derive digital transformation (Joshi et al. 2021). Artificial Intelligence algorithms can help teachers to systematically monitor the performance of the students in a specific course and design appropriate learning materials and decide suitable pedagogical methods to improve the performance of weak students. AI can also capture visual, auditory and physiological data of the students and teachers and help both teachers and learners to make important academic choices.

Automation

The potential envisioned for AI in education focuses on reducing time spent by teachers on tedious administrative and other non-teaching tasks so that teachers can use their time for more meaningful tasks like preparing for the class or interacting with the students. AI can automate simple tasks for teachers like evaluation, grading, organising classes and classifying online resources. It also automates administrative tasks for teachers.

Artificial Intelligence in Assessment

AI can be used to fully or partially automate the assessment process. It has been effective in grading exams using an answer key. In addition to this, it can automate the grading of students' writing; a more complex assessment type such as grading essays. It can aid in automated question generation as well. Rivera et al (2007) have proposed an **Assessment-Based Learning Environment (ABLE)** for English grammar that makes use of student assessment information to guide instruction. In this model, there is a virtual student (Carmen or Gorge) whose mistakes the learners have to correct. There is also a virtual teacher (Dr. Grammar) who provides instructional material for specific grammatical structures, in addition to this, Dr. Grammar also offers immediate verification and adaptive instructional feedback.

AI for Student with Special Needs

AI can be of great help for students with special needs. Features like narrator and other accessibility softwares can help visually challenged students to read online resources and softcopy of the textbooks. Voice-to-text features can help physically-challenged students to write through dictation. Thus, the assistive technology helps specially-abled students and give them the right to equitable education.

Challenges in Using AIED

Application of AI in education presents myriad challenges that must be carefully considered before implementing them in education, some of the challenges are as follows:

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 touse.

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 the same time, AI brings along with it a new set of challenges that must be diligently considered while implementing AI in Education.

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