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Relevancy of Artificial Intelligence in Education: A Conceptual Review

Dr. D. Joel Jebadurai[1], Mr. Dheenadayalan[2], Dr. Lekshmi R. S[3], Dr. Jawahar Rani K[4], Dr. S Chandrasekaran[5]
[1]Assistant Professor, St.Joseph's College of Engineering, OMR, Chennai
[2]Assistant Professor, Mepco Schlenk Engineering College, Sivakasi
[3&4] Professor, St. Joseph's College of Engineering, OMR, Chennai.
[5]Associate professor, Saveetha School of Management, Saveetha Institute of Medical & Technical Sciences, Chennai

Abstract
Artificial intelligence (AI) is a modern technology that has changed several industries, including education. AI has significantly changed the educational landscape. With AI, huge opportunities are available for students to acquire concepts in the technology era without having to rely solely on their lecturers. In order to understand the AI relevancy in educational sectors, this paper is covered the AI application areas towards education and its challenges. AI is applied in the areas of assessment, grading and evaluation, personalized intelligent teaching, smart school, Teaching and learning and Platform for Quiz, Exercises, and Training. Furthermore, the differences between the traditional Vs. AI enabled Teaching also presented. The final sector of the paper covers the challenges of AI in education. The authors concluded that AI is having a greatest scope in the educational sector in future, but it can be utilized in an ethical manner.

Keywords: AI techniques in education, Traditional vs. AI enabled teaching and learning, Challenges of AI in education

INTRODUCTION

Education is important component in every person life. People are spending huge amount of money to educate their child in a techno-oriented schools. It is mainly for the thirst towards the update related with modern technological inventions. In addition, with, the modern era's use of technology has made things easier and more sophisticated for individuals. In the technological revolution, one of the predominant acknowledgeable inventions is Artificial Intelligence. AI is a common application of it in various fields, including education. The educational sector advances, AI tools makes learning much simpler. Stakeholders respect AI and believe it will replace traditional learning methods with more contemporary ones (https://www.oecd.org/). Additionally, COVID-19 brings about a lot of changes in the educational fields due to the requirement for AI adoption. During and after COVID-19, the level of AI adoption is becoming required in all functional areas in an educational sector. Furthermore, since that it is included in the Sustainable Development Goals (SDG) as the fourth criterion, quality education is insisted upon with great importance. It is tried to attain with the help of technological advancement tool of AI (Shaikh et.al.). After using it with technology, people become dependent on it and believe that, the process of teaching and learning is joyful. The outcomes of utilizing AI-learning systems include accessibility to course materials, cost savings, collaboration in learning, improved performance, and feedback from users and effective communication (www.unesco.org).

AI tools are essential to understand and predict the learners' capability and adjust its applications accordingly. AI tools were used in various aspects of education. By automating and robotizing instruction, assessing the answer sheets, and other methods, AI significantly alters the educational landscape. If used in the educational sector, AI has the potential to fundamentally alter how people teach and learn. AI is the outcome of computer systems which makes capable of doing tasks like speech recognition, problem-solving, learning, and decision-making which require human intelligence. AI is applied in education through number of ways to enhance student and instructor learning (Beck et.al.1996). AI can examine large amounts of data on each student's learning preferences, styles, and performance to provide personalized learning experiences.

Intelligent Tutoring Systems (ITM) are capable to make a change the pace, subject matter, and teaching methods to best suit each student's needs, hence boosting learning. AI-powered assessment tools can automate grading; provide students with rapid feedback, and save teachers' time while enabling quick interventions (Nwana 1990). Machine learning algorithms may also evaluate assessment data to uncover patterns and trends, which can then be used to assist instructors in selecting the best teaching strategies based on the data at their disposal (Luan & Tsai 2021). Virtual assistants and Chat bot's powered by AI can provide students with round-the-clock assistance by responding to their questions, deriving concepts, and giving counsel. They can provide instructors more time to have a conversation with students by assisting with administrative work (Terzopoulos & Satratzemi 2019).

Finding the most relevant and efficient learning resources for students can be done by using AI algorithms to search through a massive body of instructional data, including books, articles, and videos. AI can also create educational resources like interactive simulations and pre-written lesson modules. AI may go through educational data including

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student performance, attendance records, and demographic information to uncover trends and insights. This can help teachers identify at-risky students, project dropout rates, and build curricula more effectively. AI is used to create adaptive learning systems that monitor students' progress over time and adjust the learning platform as needed (Owoc et.al. 2021). These systems can change the level of difficulty, offer more resources, and offer tailored recommendations based on each student's abilities and constraints. While AI has fascinating educational opportunities, there are also challenges to be aware of. These include the need for teachers to receive adequate training and support in order to properly integrate AI into their classrooms, as well as moral concerns such algorithmic bias and data privacy.
In the real world example, the Harvard university is planning to adapt AI based robotic lecturer in 2023 (www.indiatoday.in/). It is a great initiative from the university in trial basis. This paper, the authors presented the AI uses in educations, Traditional and AI enabled teaching and challenges of AI in education.

AI techniques in Education

Artificial Intelligence is the utmost needed technologies to show lot of progress in the educational sectors. AI is applied in all the functional components of the education. Stakeholders are finding out lot of ways to utilize its benefits in the educational sectors correctly.

- Personalized Learning:

Adaptive Learning Systems: AI can analyze students' performance and adapt the curriculum to their individual needs. This ensures that each student receives tailored instruction and practice.
Intelligent Tutoring Systems: These systems provide personalized feedback and guidance to students, helping them master specific topics or skills at their own pace.

- Smart Content:

Content Recommendation: AI algorithms can suggest learning materials, such as articles, videos, or books, based on a student's preferences, interests, and learning style.
Content Generation: AI can create educational content, such as quizzes, practice exercises, or even entire textbooks, to support teachers and students.

- Automated Assessment:

Automated Grading: AI can grade assignments, tests, and essays quickly and consistently, saving educators time and reducing grading errors.
Plagiarism Detection: AI tools can identify instances of plagiarism in students' work, promoting academic integrity.

- Virtual and Augmented Reality:

VR and AR technologies, powered by AI, can create immersive learning experiences, allowing students to explore historical events, scientific concepts, or complex environments in a more engaging way.

- Natural Language Processing (NLP):

Language Learning: AI-driven language learning platforms can help students improve their reading, writing, listening, and speaking skills by providing feedback and language practice.
Language Translation: NLP-based translation tools can assist students in understanding foreign language content more effectively.

- Educational Chatbots:

Chatbots can provide students with instant answers to common questions, assist with course enrollment, and offer guidance on assignments or study schedules.

- Predictive Analytics:

AI can analyze students' historical data to predict their future performance and identify at-risk students who may need additional support.

- Administrative Support:

AI can assist educational institutions with administrative tasks, such as scheduling classes, managing finances, and handling student records.

- Gamification:

AI-powered educational games and simulations make learning more engaging and can help reinforce concepts in a fun and interactive manner.

- Accessibility and Inclusion:

AI can be used to create accessible materials for students with disabilities, such as text-to-speech tools, closed captions, and alternative formats for content.

- Continuous Learning:

AI can support lifelong learning by recommending new skills to acquire, courses to take, and career paths to explore based on an individual's goals and interests.

- Data Security and Privacy:

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AI can help educational institutions protect sensitive student data by identifying potential security breaches and ensuring compliance with data privacy regulations.

Assessment

Assessment and feedback are inseparable to give a meaning insight to the students for their growth. The process of assessment involves acquiring data and making decisions based on that data using a set of criteria. Standardized assessment system is essential for understanding the learning level of the students. Assessment is conducted for the purpose of diagnosis the student's capacity, feedback; motivate student's quality control and so on. In a traditional forms of assessments such as Multiple Choice Questions, short answer questions and essay type questions makes the students tired and the educators doesn't get idea about every student. Traditional forms of assessment disadvantageous to unadapt to modern culture of learning, narrow centered and discrete form of assessment and so on. In order to alleviate all the forms of shortcomings in the assessment, AI based assessment techniques of Adaptive learning, writing analytics and Academic analytics were introduced. On the other side, feedback is important for the students to understand their mistakes and errors committed by them (Calatayud et.al.2021) AI-based tools help the instructors, students to give the feedback about their work.

- Adaptive learning: it is also called as personalized learning approach. In this approach, teaching style of tutor will be varied according to the necessities of the individual students (He & Xue 2021). In AI based adaptive learning identify the individual learner's capacity and inability and offer the suggestions for the learning accordingly.
- Academic analytics: Baepler & Murdoch 2010 studied that academic analytics refers to application of statistical, predictive modeling, data mining AI techniques to analyses the overall date about the student's contribution towards various field of study.
- Writing analytics: Its primary goal is to prevent academic dishonest practices like plagiarism in assignments and other forms of content theft (Walker 2019). Turnitin, is an AI-based tool, is used to detect similarities between articles from different sources and prevent plagiarism. In addition, Peerceptiv, an AI-based automated writing feedback tool (e.g., ChatGPT, Grammarly, iWrite, Ginger, and ETS Writing Mentor) which facilitate students to get a comments in their writing. This process is particularly beneficial for students' writing and feedback literacy improvement.
- AI assisted peer assessment: Formally, peer evaluation is "an arrangement for learners to consider and specify the level, value, or quality of a product or performance of other equal-status learners". AI assisted peer assessment process starts with individual reviews, assign grades, feedback on reviews. AI based peer assessment bring the benefits to assessors, assesses and instructors. Assessors have the chance to increase their knowledge of the subjects, grow more responsible and evaluative minded improve their writing, and acquire experience in giving constructive criticism. Peers with different opinions who are seen as less authoritative and more receptive to a reciprocal exchange of views and negotiation give assesses the chance to receive more quick and personalized feedback (Checco et.al., 2021). Last but not least, by reducing the workload associated with student marking, instructors may be capable to either boost enrollment or better allocate their time to improving student learning. There are several tools for peer review activities, including Peer Scholar, Mechanical TA, Aropa, CrowdGrader, and Peergrade.

Grading and Evaluation

Grading and evaluation are crucial activities for gauging how well instructors and students are doing at imparting knowledge. Assessment of students' learning levels through various exams is given the utmost priority by educational institutions. In the conventional method of evaluation, teachers collected, evaluated, and entered student scores after monitoring them with a supervisor and collecting response sheets. But after the COVID-19 epidemic, AI-based technology has taken over this procedure. Exams were administered using AI-based technology under professor supervision. The entire process of the assessment has been conducted and completed with effective and error free manner.

AI is an algorithm based technologies used in the examination process through image recognition, computer vision and prediction system. A Recurrent Neural Network (RNN) that takes into accounts both exam results and student involvement in the classroom is used to estimate the students' scores. Based on the Mahalanobis distance, a Density-Based Spatial Clustering Application with Noise (DBSCAN) is used to extract and categories student performance as being outstanding average, or poor. Threshold-based MapReduce (TMR) applied to identify average and low-scoring students to forecast each student's performance, allowing for more precise suggestions. Students are given precise recommendations by combining AI and reinforcement learning methods. Students receive suggestions from Rule-Based State-Action-Reward-State-Action (R-SARSA) autonomously.

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- **Image recognition:** It is important technology to interpret the decision making process. The main important functions of IR are dealt with the facial recognition, object recognition and text detection (Hsu et.al. 2023). While conducting the examinations, the candidate face is recognized by the computer by using AI-image recognition algorithm techniques. Machine learning image recognition techniques include logistic regression, bag-of-words, support vector machines (SVM), facial landmark estimation, and K-nearest neighbours (KNN). Deep learning IR models include the Conventional Neural Networks (CNN), You Only Look Once (YOLO), Single Shot Detector (SSD) and so on. In the educational sectors, the aforesaid algorithms used to conduct the examinations, identify and fix the students who are trying to do the malpractices.
- **Computer vision :** it is the process of teaching machines to comprehend and interpret visual data and then behave in response. Deep learning is applied to the broad field of computer vision to complete tasks like image processing, classification, object recognition, segmentation, colorization, reconstruction, and synthesis (Bebis et.al. 2023).
- **Prediction system:** AI based algorithm process the huge data of students and predicts the students' performance accordingly. ML algorithms such as Artificial Neural Networks (ANN), Support Vector Machines (SVM), and Decision Trees (DT) have been used to predict the students' performance before his attempt to the exams (Pardamean et.al 2022).

Personalized intelligent teaching

Learning refers the process of enhancing pupils' knowledge and skills through a range of educational resources. Students have a wealth of resources available to them in the modern technology era to refer to and expand their ability and knowledge. Due to kids' learning disabilities and limitations, this technique may not apply to everyone equally. AI modified personalized intelligent teaching in order to solve learning issues. The various algorithms were designed for monitoring the students individually and progress their skills and knowledge (Kong 2020). The followings key points were considered in personalized intelligent teaching.

- **Data mining or Bayesian knowledge interference:** Professor Judea Pearl of the University of California first proposed the Bayesian network in the 1980s.It refers to guided graphic portrayal of a network structure is known as a Bayesian network. It combines artificial intelligence, graph theory, decision theory, and probability theory. It employs a network-structured Directed Acyclic Graph (DAG) to express the degree of dependencies and influences among each piece of information. It is useful to recognize the categorization of the problems with various key points to solve the issues (Scheuer & McLaren 2012). Data mining is the application of ML and DL techniques to give a direction to the raw date gets an expected result. Every student's performance is analyzed with these AI based technologies and instructs them accordingly.
- **Intelligent tutoring system: The** first ITS system, which was developed by Carbonell in 1970. It is Artificial Intelligence-based educational software is referred to as intelligent systems (also known as Intelligent Tutoring Systems). The program keeps on track the pupils' progress while modifying feedback and offering tips along the way (Nwana, 1990). The software may identify a student's strengths and weaknesses and propose more study by gathering data on that student's performance and other cognitive and non-cognitive aspects. In 1970s, Hartley and Sleeman presented a list of needs for intelligent systems. They stated that these systems needed to have three types of knowledge: one about the learner (student model), one about the subject matter (expert model), and one about instructional techniques (pedagogical model).
- **Learning analytics:** Learning analytics (LA) has offered the two different types of learning. Rule driven learning and data driven learning. The goal of LA is to enhance learning outcomes by gathering, monitoring, analyzing, and reporting data on learners as well as their surroundings. To find patterns and trends in learner behavior and performance, this data is then evaluated using several AI techniques, including predictive modeling, machine learning, and data visualization. AI algorithms used to assess and predict student behavior, pinpoint students' strength and weakness, and even create individualized learning plans for each student (Ferguson, 2012). Learning analytics gives teachers acquire to information about how students behave, perform, and engage, which they may use to decide how to frame the curriculum, implement teaching strategies, and provide individualized learning support.

Smart school

Smart school can include digital textbooks, guidelines, bits of instruction, films, and AI technologies design tailored learning environments for educational organizations depending on methods and objectives. The motto of the future worldwide trend in education is to develop it more personalized; it may be done by determining the fields in which AI tools can be useful. For instance, schools can develop accompanying web-based curricula and AR/VR-based environments for instruction. Tools for AI Monitoring and Evaluation can simplify information to accommodate various learning curves and learning styles. Algorithms driven by AI and ML can identify curricular gaps when a high number

of students submit incorrect answers and offer suggestions for modifications to close them. This aids educators in fixing the issue.

- **Face recognition:** In the smart school, a face recognition system powered by AI, deployed to automatically record pupils' attendance as they arrive and exit from the campus. This algorithm created to do rid of the problems with the old-fashioned manual types of attendance systems, including time consumption, proxy attendance, waiting times, long lines, etc. DLib uses for face detection, and ResNet-34 is employed for face recognition. Face recognition technology can track pupils' attendance both individually and in groups. Facial identification and facial verification are used. Here, the admission and exit times of the pupils were determined using two cameras. The captured image of the kids has been compared to previously acquired sample image. AI-based processing is used to process it (Xiang 2022). The adoption of this AI-based technology by colleges during COVID-19 allowed for the detection of fraud in online tests. Universities are now employing face recognition technology to recognize strangers on campus.
- **Speech recognition:** Software-based speech recognition powered by AI, which is made possible by state-of-the-art approaches like Machine Learning (ML) and Natural Language Processing (NLP). Human language processing is another name for NLP, an AI system that studies real-world human speech. Speech AI uses AI for voice-based technologies: Automatic Speech Recognition (ASR), also known as speech-to-text, and Text-To-Speech (TTS). These systems use grammar, structure, syntax and composition of audio and voice signals to process speech. This technology has been adopted for converting the speech to text by online courses (Guo 2023).
- **Virtual labs:** A website or software for interactive learning that simulates real-world events. It enables students for doing research a subject by contrasting and comparing various scenarios, to pause and resume an application for reflection and note-taking, and to conduct real-world experiments online. VLab, also referred as remote lab, is a real-world phenomenon acting online simulation tool for interactive learning. Students can access the platform by 24x7, from any location, at their institution or even from home, thanks to VLab's reliance on internet technology to establish an online environment (Williamson 2020). Access to all tools and equipment on their device (laptop, PC, tablet, or smartphone) is unlimited with VLab. Some well-established VLab vendors are PhET Interactive Simulations by the University of Colorado Boulder, Hayden-McNeil Lab by Macmillan Learning and MERLOT supported by California State University.
- **Augmented Reality:** By using live demonstrations, engaging learning environments, and other techniques, augmented reality in education can assist close geographic boundaries while enabling teachers to design a fully-tailored, collaborative, open-learning environment for students.
- **Virtual Reality:** Virtual reality is a new advancement in education that is being utilised for everything from teaching history to assisting kids with their math skills. In virtual reality, a three-dimensional environment created by a computer can be explored and interacted with by users. Virtual reality (VR) instructors are reinventing what it means to be a student by infusing experiential learning into their teachings. VR is a fantastic tool for encouraging simulated learning among students. While utilising the same virtual reality programme in various classrooms, people can safely communicate even though they are still separated by distance. Students can explore things in virtual reality that they might never get the chance to see or learn about in the real world (Gandedkar 2021).

Teaching and learning

In the past, teaching and learning involved a teacher and students having a discussion. Students must also adhere to a range of limits for to answer their questions. However, the chatbot system of the present technology period eliminated all the limitations. Chatbots are interactive agents or conversational web platforms that can respond to users right away. Mobile applications can easily be created using this technology to improve learning. AI-based chatbots used in educational industry assist students by delivering course information, practice questions and answers, due date alerts, and study materials. Other side, it benefits the teaching community through a variety of educational interactions, including email communication, student-to-student engagement, and student-to-lecturer interaction. However, none of these interactions assist students have more convenient, individualized learning experiences. Students may benefit from a more individualized and interesting learning environment thanks to chatbot technology.

- **Chatbots:** Chatbot is the interactive platform used by the educational institutions to clear student’s questions related with the academic 24x7. For academic support, educational institutions for answering the student’s queries related with fees structure, scholarship status and hostel facilities and so on. Chatbot tutors might be able to teach pupils more than simply new ideas; they might even be useful when analysis is required. (Essel et.al, 2022).
- **Robotics:** Robotics is a novel technique used to transform the educational practices and support students' learning in many settings. Students' problem-solving, self-efficacy, creativity, teamwork/cooperative abilities, and computational thinking can all be improved with the assistance of educational robots. Robots that lack AI (AI-robots) can only be used for assist students in assembling and configuring commands for programmes; in contrast, conventional robots (such as LEGO robots) can speak to and recognise people using natural language (Chu et.al

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2022). Through interactions with learners, personalised assistance and feedback, and student guidance integrated with an ITS, this aspect of AI-robots diversifies learning scenarios.

Traditional Vs AI based teaching and learning

The traditional method of teaching fosters all facets of a student's development, but today's students have a different mindset and believe that faculty members are just there to educate and not to foster any other areas of a student's development. They introduced AI technology in accordance with their philosophy. Students benefit from excellent learning thanks to AI. They may excel in academics, but their humanitarian skills are in doubt. However, introducing AI technologies into education is a must for educational institutions if they want to keep up with technology. The comparison of conventional and AI-based teaching and learning are as follows

	Traditional	**AI-Based**
Personalization	When teaching in a traditional classroom, teachers frequently use a one-size-fits-all approach, giving all pupils the same material regardless of their unique learning requirements and preferences.	By evaluating each student's skills, limitations, and learning preferences, AI can offer individualized learning experiences. The pace and content are adjusted appropriately, allowing students to learn at their own pace and in the method that works best for them.
Accessibility	The ability of traditional education to meet the requirements of children with disabilities and other diverse learners may be limited.	To make learning more accessible for all students, AI technology can offer accessibility capabilities like text-to-speech, closed captioning, and customizable interfaces
Feedback and Assessment	Teachers in typical classrooms frequently have to wait for students to complete assessments and receive feedback.	With the help of AI, students may quickly discover their deficiencies in assignments and examinations and take immediate action to improve. Additionally, it can automate grading procedures, saving teachers' time.
Flexibility	Traditional education frequently adheres to a set time and place, which makes it less accommodating for students who might have other obligations.	Online learning environments driven by AI give students flexibility in terms of when and where they can access course content. This is especially advantageous for lifelong learning and distant learning.
Engagement	Students who have diverse learning styles or who find the subject matter boring may have trouble becoming engaged by traditional teaching approaches.	Gamification, interactive simulations, and adaptive content that fits students' interests can all be used by AI to increase engagement and motivate students to study.
Teacher-Student Interaction	The direct face-to-face interactions that take place in traditional classrooms between teachers and students allow for on-the-spot conversations and clarifications.	Through chatbots and virtual tutors, AI can offer some amount of contact, but it lacks the personal touch and emotional connection that face-to-face instruction offers.
Cost and Accessibility	Traditional education is frequently more expensive for some people and communities because of expenditures for textbooks, transportation, and physical facilities	Particularly for online or distant learning, AI-based education may be more affordable and accessible, thus lowering barriers to high-quality education
Ethical Considerations	Biases, preconceptions, and subjectivity in grading and teaching methods may be present in conventional teaching approaches.	If not properly built and controlled, AI can also introduce biases, posing ethical questions about fairness and transparency.

Challenges of AI in education

In developing countries like India, these are the AI based technologies are new and they faced lot of infrastructural problems to conduct the examinations by using AI. Still it is infancy in terms of implementation in the developing and under developed countries. Borenstein & Howard 2021 studied the followings challenges of AI in educational sectors.

- Huge investment
- Lack of availability of AI experienced professors
- Lack of infrastructural problems (Internet connectivity, data speed and so on.)
- Lack of preparedness from authorities to implement AI
- Lack of knowledge about AI in education.
- Insufficient research of AI in education
- Ethics and transparency issues

Conclusion

AI is having a great scope in the educational sectors of all over the world. It is going to make lot of changes in the educational sectors. Teachers might eventually be supplanted by AI-enabled teaching and learning techniques. Only those teachers who are better at creating the algorithms for the things they teach will remain in their field. Therefore, technologically advanced schools may get a lot of attention from future generations.

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