

## Current Progress and Future Prospects of Artificial Intelligence in Education: A Review

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### ABSTRACT

A rapidly emerging branch of technology called artificial intelligence (AI) has the power to completely change how we interact with one another. AIED is one of the currently rising disciplines in Educational technology, according to the 21st International Conference on Artificial Intelligence in Education, held in 2020. In the field of education, Artificial Intelligence has begun to produce novel teaching and learning solutions, which are being evaluated in several contexts. For educators, it is currently unclear how to apply AI for instructional purposes on a larger scale. This research investigated how artificial intelligence can be used in teaching and learning process, as well as the significance of using AI in field of education. AI applications provide a solution in many ways to the exponential growth of contemporary difficulties that obstruct learning and education. This recent paper, written for education policymakers, forecasts the impact of Artificial intelligence on the educational sector so that effective policy responses can be made.

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### Introduction:

Artificial Intelligence is essential for automating numerous procedures in all sectors, such as manufacturing, healthcare, e-commerce, and education. By offering each student a customized approach, artificial intelligence tools contribute to the transformation of education. E-learning is becoming a vital

component of the educational system. The successful and efficient teaching of content-based curricula through the use of technology fosters student confidence. Customized learning systems priorities learning behaviour and interest, tailoring the curriculum to the skills and foundational knowledge of the students. It is a flexible teaching approach to accommodate each student's unique demands. The needs of every learner are maximized by the personalized learning strategy. An effective educational institution must comprehend its pupils and design a plan that caters to their individual interests and learning needs. An intelligent tutor system is a professional instrument that provides individualized education and monitors students' progress. E-learning tools comprise computer-based learning, web-based learning, digital collaboration, and virtual classrooms. Learning chores including creating lesson plans, training programmes, evaluating student performance, and putting innovative teaching strategies into practise can all be automated with artificial intelligence. The newest e-learning trend in higher education and the business sector is artificial intelligence. Using data analytics, AI assists in making personalized decisions for each student, improving education through streamlined instruction. Artificial intelligence holds great promise for revolutionizing distance learning while saving students time and money. Learners will not be burdened by this because the AI-based e-learning platform will automatically give all education-related information. Through e-learning, students are encouraged to learn new content, hone their decision-making skills, and solve urgent problems.

Future education is closely tied to the advancement of new technologies and the computing power of increasingly sophisticated machines. Technological developments in artificial intelligence have the potential to drastically change the internal architecture and governance of education, presenting new opportunities as well as difficulties for teaching and learning. One of the most prominent applications of information technology in the modern era is artificial intelligence, a field of study concerned with exploring and comprehending the nature of human intelligence. Its simulations seek to create a new class of intelligent computers that are teachable to carry out a variety of tasks requiring a high degree of perception, deduction, and inference—all qualities that humans find desirable. Artificial intelligence (AI) applications in education are growing in popularity and have gotten a lot of press in recent years. The 2018 Horizon study (Educause, 2018) highlights AI and adaptive learning technologies as major advancements in educational technology, with a time to adoption of two to three years. Between 2018 and 2022, experts predict a 43% increase in the use of AI in education. The Horizon Report 2019 Higher Education Edition (Educause, 2019) predicts that AI applications for teaching and learning, however, will advance even more quickly considering the findings. The establishment of an Artificial Intelligence

Systems Institute with 50 new professorships devoted to AI research and education was recently announced by the Technical University of Eindhoven in the Netherlands.

Because of the digital revolution, there are more and more Indians using the internet every day. Not only does internet technology penetrate urban areas, but it also penetrates rural areas. As a result, e-learning is very popular in India. According to the Global Industry Analysis, the e-learning market is expected to reach a valuation of \$325 billion by 2025. The statistical analysis indicates that a few private colleges offer online courses for both their undergraduate and graduate degrees. E-learning is portrayed on websites maintained by the ministry of electronics and information technology as an essential tool for dynamic education. Furthermore, research and development initiatives in e-learning that focus on creating curriculum for faculty training, improving human resources, etc., are funded by the government. The India-2021 online education study indicates that students are depending more and more on the internet for their education, which is opening up a lot of opportunities for the e-learning industry and associated job opportunities.

The knowledge and skill requirements of learners are always evolving due to new developments in the learning curve that abruptly mirror e-learning techniques. Peer-to-peer communication is facilitated between tutors and learners through it. E-learning is quickly becoming an essential component of business education since it allows employees to receive professional training without the need for human intervention. The organisation promotes the development of customised, specialised e-learning applications so that employees can obtain training. It saves money and time for the organization. Employees with remote work options and e-learning are more suited to use e-learning to solve problems. A variety of formats, including graphs, info graphics, audio-video lectures, discussion boards, and more, are displayed by e-learning software. Many e-learning courses can be accessed on customer service platforms, which include iOS and Android devices, laptops, tablets, and mobile phones. To monitor learners' behaviours and guarantee their effectiveness, learner analytics will largely rely on big data and AI technologies by 2020. Machine learning algorithms can be used to collect, analyse, and monitor student data as well as performance in order to improve the efficacy of the e-learning system. Asynchronous and synchronous learning trends are the two categories into which e-learning technologies fall. Real-time learning using online chat, video conferencing, webinars, instant messaging, and virtual classrooms is known as synchronous e-learning. Delivering e-learning content via the internet, email, message boards, video lectures, online PowerPoint presentations, discussion forums, and other means is known as asynchronous e-learning.

Artificial intelligence is the process of building a machine with human-like thinking capabilities to solve problems. The field of artificial intelligence in computer science aims to build intelligent machines capable of reasoning and acting human-like in order to tackle difficult problems. It is powered by a variety of techniques, including natural language processing, artificial neural networks, rule-based systems, heuristic searching, machine learning, and deep learning. Two varieties of AI exist. Weak AI, also known as narrow AI, is a type of artificial intelligence that mimics human intellect but only functions in certain contexts. Narrow AI is always concentrated on successfully completing a particular task. These devices are intelligent systems that perform even better than primitive human intelligence in the face of numerous limitations. The kind of artificial intelligence utilised in robots, movies, and other media is known as strong AI, or artificial general intelligence (AGI). It is a general intelligence computer that possesses human-like thought and behaviour patterns and can use such patterns to solve any kind of problem. Artificial intelligence finds application in many different domains. For example, smart assistant systems such as Alexa, Siri, and Cortana—intelligent voice recognition systems that aid in information provision and improve human decision-making—are examples of artificial intelligence in action.

### **Artificial Intelligence & Education:**

Artificial Intelligence is essential for automating many operations across all industries, such as manufacturing, healthcare, e-commerce, and education. Artificial intelligence tools contribute to the transformation of learning by offering pupils a personalised approach. The true potential of artificial intelligence lies in its ability to store and analyse vast amounts of learner data, thereby enabling personalised instruction tailored to each student's needs. In topic areas like knowing each learner's talents and interests, artificial intelligence has the potential to fill in the knowledge gaps left by teachers lacking specialist expertise.

Term deep learning a subfield of machine learning. With the aid of machine learning techniques, an artificial neural network can examine how the brain functions. An innovative way to work more efficiently with a large amount of data is through deep learning. Rather than requiring artificially created human qualities, it is utilised to develop intelligent computer systems that can learn complex function mapping and produce output directly from data. A customised e-learning platform can be made using artificial intelligence techniques like fuzzy rule-based systems and artificial neural networks.

### **Review of related Literature:**

**Huang & Chen (2006)** suggested an e-learning system that uses a genetic algorithm (GA) and case-based reasoning (CBR) to create the best learning path for each unique student. These methods offer assessment analysis, summative evaluation, and customised curricular sequencing. In order to develop course materials that meet the needs of students and help them learn more efficiently in a web-based environment, researchers employ empirical research.

**Pipatsarun & Jiracha(2010)** has discussed the significance of implementing fuzzy logic while creating an online learning system in order to recommend appropriate online resources and boost students' interest in the system. Learners' recommendations are found using the frequent pattern analysis technique of data mining, and their classification into simple, medium, and high levels is done using fuzzy logic. Information on suggestions made by regular users, data access patterns, search themes, and preferred e-learning sites is stored in the database for computer science students. The systems were developed by the researcher using Java and MongoDB technology.

**Hammer & Toussaint (2015)** suggested using fuzzy-based recommendations to deliver e-content according to learners' domain expertise. Intelligent teaching systems use the Fuzzy Cognitive Map (FCM) approach for reasoning and knowledge representation (ITS). The system is designed to dynamically identify the expertise of learners of C programming. FCM is utilised in e-learning materials to determine idea dependencies. The suggested system keeps track of e-learning performance and gives e-learners adaptive guidance.

**Seo, Tang, Roll, Fels, & Yoon(2021)** Carried a study on the impact of artificial intelligence on learner–instructor interaction in online learning. According to participants, the researcher discovered that the use of AI systems in online learning can enable scaled-up, personalised learner-instructor interaction, but there is a risk that social standards will be violated. Even though AI systems have been positively recognised for increasing the quantity and quality of communication, for providing just-in-time, personalised support for large-scale settings, and for enhancing the feeling of connection, there have been concerns regarding responsibility, agency, and surveillance issues.

**Chen, Chen, & Lin (2020)** Carried a study on Artificial Intelligence in Education: A Review. According to the report, artificial intelligence (AI) has been increasingly embraced and used in the field of education, particularly by academic institutions. Intelligent education systems that are web-based and online are an evolution of what started out as computers and computer-related technology. Eventually, web-based chatbots, humanoid robots, embedded computer systems, and other technologies were

employed to perform educational functions either alone or in tandem with instructors. By utilising these platforms, instructors have been able to complete their instructional duties with higher quality and more successfully and efficiently handle a variety of administrative responsibilities, like evaluating and grading students' work.

### **Significance of the study:**

Artificial intelligence's real potential is found in its capacity to give individualised education based on the needs of each student and store and evaluate massive volumes of learner data. When it comes to subject areas where teachers lack specific expertise, like knowing each learner's abilities and interests, artificial intelligence has the ability to close the knowledge gaps. Information technology will undoubtedly have an impact on education in a variety of ways as long as it is applied or used. AI has an effect on the administration, management, and teaching/learning processes in education. The goal of the study is to ascertain if AI has, all things considered, enhanced the efficacy and efficiency of teaching and learning in the classroom as well as the performance of administrative tasks within the educational system.

### **Objectives of the Study:**

1. To find out the present status of artificial intelligence in the field of education
2. To explore the challenges associated with AI in Education.

### **Methods of the Study:**

The researcher used descriptive method for the present study and secondary data was used from research blogs, journal articles, books, YouTube etc. for analyzing the data.

### **Use of Artificial Intelligences in Education:**

We use AI apps and technologies in our daily lives, whether we realise it or not. Some of the most popular AI applications are used in the field of Communication, Travel, Social networking, Online Shopping and education as well.

#### ➤ **Provide Individualized Support:**

AI will provide kids with personalised tutoring outside of the classroom. When students need to review concepts or strengthen skills before an exam, AI will be able to provide them with the

extra tools they need to succeed. Beyond the classroom, there will be an increase in the use of visual and dynamic learning channels that can accommodate different learning styles and frequently asked questions that parents, instructors, TAs, and tutors are not equipped to answer. Prior to this, students enrolling in blended learning programmes, online learning courses, and Massive Open Online Courses (MOOCs) would not have access to customised, customised learning paths.

➤ **Teachers' Assistance:**

Beyond only helping with grading, AI will help instructors in many other ways. AI can manage some routine chores and student interactions. For instance, a college lecturer used an AI chatbot as a teaching assistant for the entire semester without the students' knowledge.

➤ **Students' Interaction:**

Students and teachers will be able to converse with one another in real time, as well as link with other AI systems across the world. Students are linked with peers right away, allowing them to develop their own personal learning networks with more tailored and real relationships that cater to their interests and requirements at any given time. Consider the advantages of being able to communicate with AI or a virtual peer who has been found based on a student needs assessment and error analysis.

➤ **Machine Learning (ML):**

Artificial intelligence, as a broad phrase, has sub-branches such as machine learning. As **Rob (2017)** puts out on his blog, AI is a concept that points to where we're going, not where we've already arrived; as a result, we need to define it more accurately, using terms like machine learning. "Mobile devices and embedded computers allow vast volumes of data to be obtained about individuals, and machine-learning algorithms may learn from these data to personalize their services to the requirements and circumstances of each individual, according to **Jordan and Mitchell (2015)**. (p. 257).

➤ **Smart Voice Assistant:**

Smart assistants like Siri, Alexa, and Cortana are 21st-century technology. The desire for intelligent assistance is growing every day as people's daily lives become increasingly hectic.

This intelligent aid enables the user to complete important duties without devoting additional time to them. The adoption of these intelligent helpers has an impact not just on people's daily lives, but also on education. It is gradually altering the teaching-learning setting. Students can now engage with these AI-enabled gadgets, which allows for deeper learning, rapid delivery of essential information, and access to online study materials. These AI-enabled devices can be used by teachers and educators to prepare classes and obtain crucial information.

➤ **Grammarly:**

Grammarly is an online editing tool that assists authors in detecting and improving unneeded problems in grammar, sentences, and phrases in their writings. Grammarly, an AI-powered grammar checker, is extensively used throughout the world and is recognised as one of the best (Marr, 2018). Grammarly helps students, young researchers, and scientists improve their academic writing by identifying structural flaws, explaining why they occurred, and offering changes. Students, researchers, and scientists gained confidence in writing research articles for publishing in a variety of refereed, peer-reviewed national and international journals because to Grammarly's AI capabilities.

Few argue that artificial intelligence would transform and improve the whole education system, making education worldwide, based on its advancements (Lynch, 2018). Artificial intelligence aids education by allowing students to learn at any time and from any location.

**Challenges:**

➤ **Issues about data privacy and integration:**

One of the key concerns is technical challenges and security concerns. AI systems necessitate a great deal of data synthesis and analysis, therefore they've inherited practically all data-related challenges including biased/discriminatory data, misrepresented data, data privacy concerns, and so on. Who owns this information, and what can be done to keep it from being misused? The solutions, like the technology, are not simple. According to the Education Cybersecurity Report, 2018 "While hackers have gotten increasingly adept at obtaining school and student data," the report stated, "the education industry is no better prepared to deal with these hostile threats." In recent years, a slew of institutions have been hacked." About 10,000 patients' records were



compromised in July 2020 at the University of Utah Health, according to the US Department of Health and Human Services. **(Dhawan & Batra, 2021)**

➤ **Expensive:**

➤ One of the trendy topics right now is artificial intelligence (AI), which is the latest buzzword in town. AI development comes at a high and prohibitive cost. According to Handa (2019), the quantity, format, and algorithm tuning (mathematical code) of the data all affect how much artificial intelligence costs. Because of this, AI is rather expensive, but this is changing as the cost of building numerous open-source and inexpensive systems goes down.

➤ **Illiteracy in the Digital World:**

➤ It will be difficult for students who are not familiar with technology or who only have a basic understanding of it to adjust to AI-powered systems. According to the Annual Status of Education Report (Rural) 2018, which was conducted in 596 government schools across multiple districts in India, just 21.3% of students had access to computers in their classrooms.

➤ **Expertise gap:**

Artificial Intelligence will render a lot of professions obsolete, which will force the creation of new skill sets. This will be the main problem facing higher education since students will need to acquire new skill sets to get employment or start their own businesses **(Ma and Siau 2018)**. Students need to be prepared for concerns like automation, globalisation, and the growing complexity of the workplace at educational institutions. In the future, employers will be looking for workers with softer skills like communicating, listening, problem-solving, decision-making, conceptualising, synthesising, and so forth. **(Sudlow & Joseph, 2017)**

One of the most difficult difficulties for educational institutions is figuring out how to incorporate AI. It is challenging to incorporate AI-based technologies into the educational system. With so many digital experts, it can be difficult to integrate digital talents and create a good technical environment. Because AI-based systems demand space, speed, and storage, effective logistics are required to operate them. As a result, "user-friendly" interfaces and a well-defined implementation approach for AI systems are essential.

### **Current Progress of Artificial Intelligence in Education:**

➤ **Instruction and AI:**

Learners have long desired individualized instruction in the field of education. One such technology is the Intelligent Tutoring technology, or ITS for short, which can mimic human professors to accomplish one-to-one intelligent teaching. Three key components make up a typical intelligent tutor system: the learner model, the tutor model, and the domain model. Basic ideas, regulations, and techniques for resolving issues in the learning domain are contained in the domain model, sometimes referred to as expert knowledge. Production rules, ontology, frameworks, hierarchies, and semantic networks are frequently used to represent it. Its primary responsibility is to finish knowledge computation and reasoning. The tutor model chooses the lessons and instructional techniques that are best for the student.

➤ **Automated Assessment and AI:**

An essential component of educational activity is evaluation. The use of automated assessment techniques has resulted in significant modifications to assessment forms and procedures. The automated assessment system makes it possible for assessment findings to be objective, consistent, efficient, and highly available. It also gives teachers quick feedback, significantly lessens their workload, and offers a solid foundation on which to base instructional decisions. Studies on automated assessment now in existence address a variety of application areas, including speech assessment, essay and short response assessment, and automated evaluation of ICT skills. Among these, the automated evaluation of ICT proficiency can help students' computational thinking skills grow. With accurate evaluation and real-time feedback, the automated programming assessment can help students become more proficient programmers and encourage their understanding of programming languages.

➤ **STEM Education and AI:**

In the subject of educational technology, STEM (science, technology, engineering, and mathematics) education is a developing research hotspot. Furthermore, instructional robots are crucial to STEM education. Educational robots have the potential to enhance students' computational thinking abilities. A growing number of educational institutions are implementing educational robots as a cutting-edge teaching tool to enhance and develop students' critical thinking abilities. The skills are complementing tools that assist pupils handle complex problems and increase their motivation to acquire abstract concepts.

**Future Prospect of AI in Education:**

There are new educational prospects due to the development of artificial intelligence. But the uncertainty surrounding artificial intelligence in education has grown, and there will be new difficulties for education in the future. In the age of artificial intelligence, the learning environment must achieve a cohesive architecture of technical and cultural features. A new relationship between the learner and the technical environment is established by artificial intelligence. For instance, brain-computer interface technology can interpret psychological processes in humans and directly influence the brain systems underlying volition, emotion, and cognition. It does, however, also cover the issues and difficulties that this intricate partnership presents. The learning environment is increasingly exposed to real-world problem-solving scenarios, which makes instruction more complicated and implementation more challenging. Even while the educational system in schools still has its own framework, learning is starting to move outside of the classroom and into the workplace. In this case, certain cultural standards apply and the learning environment is progressively incorporated into the social context. From a cultural point of view, learning occurs through a certain social mechanism. Artificial intelligence-supported intelligent education must be impartial, all-encompassing, and forward-thinking to consider all the potential implications of technology, particularly any bad ones. The modern feature of educational practise activities in the age of artificial intelligence has been the coexistence of authenticity, complexity, and difficulty. Indeed, a new wave of artificial intelligence has sped up the move in education research from natural science to science, and the future of educational innovation looks bright thanks to breakthroughs in brain science. The transformative effects of artificial intelligence technology extend beyond its capabilities of intelligence, automation, and synergy when it is smoothly incorporated into the educational system. Wise technology serves as inspiration for the higher value. Knowledge, curiosity about the unknown, conceptual framework and structural order, exploration and reconstruction of the knowledge system, complete personality development and liberation, and even the creation of new values are all highly desired by people. Robotics, AI, and machine learning are examples of the rapidly advancing technologies that have an impact on all industries, including education. That much was stated by Gabor Melli, vice president of artificial intelligence and machine learning at Medable and a former senior director of engineering at Sony PlayStation. Some educators are concerned that, in the future, AI technology may completely replace the function of the instructor.

In the age of artificial intelligence, education's purpose needs to change. Examining the evolution of artificial intelligence in education, from the first knowledge-reasoning machines, expert systems, and programmatic teaching, to the current intelligent tutoring systems, automated assessment, educational

robots, etc., artificial intelligence demonstrates the potent benefits of computers in computing and storage and makes them even more intelligent. These days, machine learning in artificial intelligence continuously enhances logical reasoning skills. With the advancement of computer hardware and software, educational intelligence keeps growing, extending the scope and profundity of knowledge. This presents a problem for human knowledge and learning. Simultaneously, artificial intelligence is increasingly permeating and changing human learning habits. It works on our culture to hasten the advancement of contemporary society. One could say that around artificial intelligence, the relationship between "human" and "knowledge" is shifting. The conventional understanding of knowledge is being challenged. Individuals are developed according to new values that are fostered. In the age of artificial intelligence, the focus of educational objectives has started to change from producing a social workforce through a rigid knowledge system to encouraging and assisting students to develop their capacity for adaptation and become lifelong learners. The vital work of disseminating and creating the knowledge view and values in the intelligent age will be carried out by the technological features and cultural connotations of smart education.

### **Conclusion:**

Artificial intelligence is a popular topic in education, and it will become an important element of the teaching-learning process in the near future. Though there are a variety of artificial intelligence-enabled products on the market and initiatives in the education sector, the true picture of widespread use of these devices in India's educational institutions is not encouraging. The widespread application of artificial intelligence in education in India necessitates the hiring of tech-savvy teaching and non-teaching personnel, which is lacking in most Indian educational institutions, particularly in distant and disadvantaged areas. An interdisciplinary field encompassing information, logic, reasoning, systems, and biology is artificial intelligence. Knowledge processing, pattern recognition, machine learning, and natural language processing have all made use of it. Artificial intelligence will touch all elements of education in the near future, from curriculum creation to teaching to student evaluation, and so on. To support teaching and learning, students, instructors, and other stakeholders will need to be tech-savvy in the coming days.

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