



ARTIFICIAL INTELLIGENCE IN EDUCATION: PATHWAYS TO THE FUTURE OF LEARNING

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Abstract: Nowadays, technology is a big part of our daily lives, and artificial intelligence (AI) is seen as a practical tool and use of modern technology. Artificial intelligence has enormous potential and could lead to revolutionary changes. Artificial Intelligence (AI) in education is more than just a new technology; it's a whole new way of teaching and learning that is changing the face of education. AI enables educators to customize learning experiences and open up a world of new educational opportunities. This paper's goal is to investigate the uses and potential future developments of artificial intelligence in education. Using a qualitative research approach, the paper's investigation is theoretically presented. Various research findings from books, journals, periodicals, and websites have been analyzed in this paper. The findings have been presented along with the discussion of concept, application, current use and future prospects of artificial intelligence in Education. AI in education has the potential to completely transform how we teach and learn in the future. AI's active participation in data analytics, virtual classrooms, adaptive assessments, and personalized learning can result in more effective and efficient educational experiences. Ultimately, to fully realize the technology's potential to improve education globally, developers, educators, and legislators must work together to implement AI in education.

Keywords: Artificial Intelligence, AI, Education, Applications, Future Prospects

Introduction:

The definition of artificial intelligence, or AI, is "man-made thinking power," where "artificial" means "man-made" and "intelligence" means "thinking power" (Choudhury, 2022). Artificial intelligence is the capacity to learn from experience, solve real-world problems, adapt to new circumstances, and acquire and apply knowledge. Artificial intelligence is defined as anything made or manufactured by humans, usually as the opposite of natural occurring things (Legg & Hutter, 2007). Artificial intelligence, a branch of computer science, enables us to create intelligent computers that behave, think, and make decisions similarly to humans (Pannu, 2015). Three types of artificial intelligence can be distinguished based on their respective capabilities: artificial general intelligence (AGI), artificial super intelligence (ASI), and artificial narrow intelligence (ANI). ANI is designed to perform a specific task or a set of related tasks. (Kuusi and Heinonen, 2022) Apple's Siri virtual assistant and Google Assistant are two instances of ANI. It is anticipated that AGI will make well-informed decisions based on past experiences and domain expertise. The development of this type of AI is still in its infancy. ASI stands for surpassing human potential in terms of creativity, analysis, and task-completion skills (Barney & Wigmore, 2023).

In education, artificial intelligence benefits students in a number of ways. It is crucial for assisting students in gathering data, making practical decisions, resolving issues in real life, and developing their abilities in a variety of subject areas (Chen, Jensen, Albert, Gupta & Lee, 2023). AI helps teachers and students with the teaching-learning process and bridges gaps in the classroom (Hooda, Rana, Dahiya, Rizwan & Hossain, 2022). Learners' interest and proficiency in the field of education are improved by artificial intelligence. Teachers, students, librarians, and other institution personnel use AI. Artificial intelligence has made it possible for students to learn around the clock (de Oliveira Fornasier, 2021).

Artificial intelligence in the future will enable students to create more engaging learning environments and enriching content by offering each learner a truly personalized experience (Tedre, Toivonen, Kahila, Vartiainen, Valtonen, Jormanainen & Pears, 2021). Artificial intelligence is being used more and more in education both now and in the future. Personalized education will have a much greater impact in the future. The potential of AI to improve individualized learning is one of its primary functions in education.

The AI global market grew to USD 279.22 billion in 2024 and is forecast to grow at a CAGR of 35.9% from 2025 to 2030 (Grand View Research). Driving the next technology revolution, private AI investment globally has consequently grown substantially in the last decade as countries position themselves for the future.

Historical background

John McCarthy coined the phrase "artificial intelligence." He is regarded as the father of artificial intelligence. He is recognized as one of the pioneers of artificial intelligence, alongside Alan Turing, Herbert A., Marvin Minsky, Allen Newell, and others (Elliot & Onuodu, 2019).

□ Artificial intelligence has come step by step first 1941, the concept of artificial intelligence as we know it today has not yet been formally defined. During this time renowned mathematician and logician Alan Turing played an important role with his concept of a theoretical computing machine, known as the Turing machine, in his 1936 paper (Steel & Brooks, 2018).

□ In 1943, the term artificial intelligence had not yet been coined. This era laid the groundwork for later development in artificial intelligence (Fleck, 2018).

□ In 1949, Donald Hebb proposed a theory known as Hebbian learning, which suggested that neural pathways are strengthened when neurons are activated together (Kuriscak, Marsalek, Stroffek & Toth, 2015).

□ In the 1950, the field of artificial intelligence emerged. Alan Turing and John McCarthy laid the foundation for the development of machines that could simulate human intelligence (Amudha, 2021).

□ In 1952, Authur Samuel, a computer scientist developed a program to play the checkers, which was the first time.

□ In 1955, John McCarthy organized a workshop on artificial intelligence at Dartmouth, UK, which was the first to use the term.

□ In 1966, Joseph Weizenbaum created ELIZA, an early natural language processing computer programme. ELIZA simulated conversation by processing user input and providing responses based on pattern-matching techniques (Singh & Thakur, 2020).

□ In 1972, the development of the Stanford cart marked a notable event in the history of artificial intelligence (Stone, 2018).

□ In the 1980, Expert systems gained popularity during this period, focusing on knowledge representation and rule-based reasoning.

□ In 1997, IBMs Deep Blue defeated world chess champion Garry Kasparov in a historical match, showcasing the capabilities of artificial intelligence in a Strategic game. This marked a significant milestone in artificial intelligence (Pfeifer & Scheier, 2001).

□ In 2002, the field of artificial intelligence experienced growing interest in machine learning and data-driven approaches (Wong & Wang, 2003).

□ In 2006, Geoffrey Hinton and his team published groundbreaking research on deep learning (Minar & Naher, 2018).

□ Then in 2011, Watson demonstrated the ability to understand and respond to complex questions in natural language, marking a significant achievement in the practical application artificial intelligence (Ferrucci, 2012).

□ In 2016, AlphaGo, an artificial intelligence program developed by deep mind and defeated the world Go player Lee Sedol (Halina, 2021).

□ In 2018, artificial intelligence continued to impact various industries. This time artificial intelligence development of chatbots and virtual assistants.

□ Artificial intelligence development trends that will have a big impact in 2023. The latest artificial intelligence development in 2023 is Automated Machines learning (Auto ML), Generative AI, Natural language processing (NLP), Ethical AI, Accessible artificial intelligence to all.

Objectives

The objectives of this paper are:

1. To investigate how artificial intelligence might be used in education
2. To investigate artificial intelligence's potential applications in education

Methodology

The study used a qualitative approach to investigate the goals. The study has examined a number of research findings from books, journals, periodicals, and websites that are accessible online.

Discussion

Application of Artificial Intelligence in Education : Artificial intelligence plays a significant role in education. Artificial intelligence is being used extensively in education today. Learning is made more interesting and engaging by artificial intelligence. Artificial intelligence can provide immediate feedback, engage students, and dynamically change the course material (Anis, 2023). One of the main advantages of artificial intelligence in education is the growing popularity of personalized learning as a means of inspiring and involving students (Aldhaen, 2022).

Artificial intelligence is transforming the educational landscape. For individualized learning, artificial intelligence is crucial. It automates administrative work and offers real-time feedback to improve student performance. A few examples of how artificial intelligence benefits the education sector include chatbots, smart content, adaptive and personalized learning, learning management systems, administrative tasks, real-time feedback, and making learning more engaging (Pokrivcakova, 2019).

The term "smart content" describes digital content that is dynamic, customized, and suited to each user according to their preferences, actions, or demographics. It frequently makes use of cutting-edge technologies like artificial intelligence. Artificial intelligence is crucial for chatbots. Chatbots are computer programs that mimic human-user conversations and are frequently driven by artificial intelligence (Singh & Thakur, 2020). Chatbots are crucial to the education industry. The ability of artificial intelligence to improve individualized learning is one of its advantages in education. Personalized learning with artificial intelligence involves tailoring educational experience to the individual need, preferences, and progress of each learner. This approach aims to optimize learning outcomes by adapting the pace, difficulty, and format of educational materials to suit each learner. Personalized learning artificial intelligence can be implemented in various educational settings, from traditional classroom to online platforms, fostering a more engaging and effective learning experience.

For learning management systems, artificial intelligence is crucial. A software program used to organize, carry out, and evaluate a particular learning progress is called a learning management system. Using artificial intelligence in learning management systems can also increase overall efficiency in educational settings by automating administrative tasks. Artificial intelligence is essential to adapting educational experiences in adaptive learning (Pedro, Subosa, Ravas, & Valverde, 2019).

In adaptive learning systems, artificial intelligence seeks to provide personalized learning experiences that increase the effectiveness and influence of the learning process as a whole. It promotes more efficient and customized learning journeys by dynamically modifying content, difficulty levels, and learning paths to meet individual needs. By forecasting trends, controlling spending, and pinpointing areas for development, artificial intelligence assists educational institutions in allocating resources as efficiently as possible. By providing individualized learning, artificial intelligence aids in their professional development. Artificial intelligence is constantly abreast of the most recent advancements in technology and teaching methodologies.

The significance of artificial intelligence has expanded in the field of education, and it is not limited to India. By removing geographical boundaries and facilitating opportunities for a diversity of viewpoints and cultural exchange, artificial intelligence promotes connectivity and cooperation between students and educators around the world. Students may interact with educational content at their own pace and convenience thanks to artificial intelligence-powered educational platforms that provide anytime, anywhere access to educational resources (Sharma, 2023). AI can be used to create interactive virtual assistants and tutorials. Artificial intelligence in virtual assistants refers to the application of sophisticated algorithms and natural language processing to allow machines to comprehend and react to user commands or inquiries. Systems for virtual assistants frequently use machine learning to get better over time. So artificial intelligence is very important for virtual assistants in education.

Current use of Artificial Intelligence in Education

1. In recent years, artificial intelligence has been used to teach knowledge and skills by simply determining the students' current skill level and developing a guided instruction program to help them become proficient.
- 2) The audio-visual equipment in classrooms is now controlled by artificial intelligence.
- 3) Students are now using AI to aid in their language learning. In actuality, artificial intelligence powers hundreds of different languages.
- 4) Artificial intelligence plays a critical role in lesson planning. The lesson plan explains to students what they will learn and how they will be evaluated.
- 5) Chatbots for student support are currently being developed using artificial intelligence.
- 6) Students are currently learning to code using artificial intelligence.
- 7) Educational games are currently managed and facilitated by AI.
- 8) Interactive games that teach kids basic needs are currently powered by artificial intelligence.

Future Prospects of Artificial Intelligence in Education:

The current state of affairs emphasizes the importance of laying out possible directions for education. The current acceleration of technological advancements, especially in the field of artificial intelligence (AI) and its extensive use in education, has a substantial impact on the direction of education in the future. The majority of people believe that artificial intelligence (AI) has the power to drastically alter things. Artificial intelligence

has bright future prospects in the field of education. Artificial intelligence will play a significant role in our everyday lives in the future. Artificial intelligence will have a greater impact on education (Sharma, Tomar, Bhardwaj, Sakalle, 2021). Artificial intelligence has the ability to give real-time feedback, customize learning experiences, and adjust to the needs of each individual student. It helps teachers concentrate more on instruction by automating administrative duties. This customized approach has been shown to improve learning outcomes and increase student engagement.

The future of Artificial Intelligence in education:

- 1) Excellent video lectures available online.
- 2) Make use of a variety of apps and websites for online learning.
- 3) Gamification will result in experiential learning.
- 4) Artificial intelligence boosts teaching methods.
- 5) Greater tolerance at work.
- 6) A learning environment similar to that of a conventional classroom.
- 7) Not likely to take the place of traditional education.
- 8) The growing popularity of mixed mode courses.
- 9) There is a lot of room to expand ground courses.

With adaptive learning and the creation of unique student needs, artificial intelligence is anticipated to provide personalized learning experiences. Personalized learning, adaptive learning platforms, educational robotics, predictive analytics, blockchain for credentials, and intelligent content creation are some of the advancements anticipated in the field of artificial intelligence in education (Daniel, Godwin, & Joseph).

The use of intelligent tutoring systems is another revolutionary development in artificial intelligence in education. With the use of artificial intelligence, these systems give students individualized instruction and feedback, spotting knowledge gaps and providing focused support to help them meet their learning objectives. Artificial intelligence is used, for instance, by platforms such as MATHia by Carnegie Learning to evaluate student performance and offer tailored recommendations, comments, and clarifications based on each student's needs (Boser, 2021).

Algorithms using artificial intelligence will customize educational materials to meet the needs of each individual student, maximizing learning paths according to strengths and weaknesses. In the future, robotics in education will greatly benefit from artificial intelligence. There are a number of fascinating prospects for robotics in education.

Assistive learning is a very crucial role for robotics in education. Robots can assist teachers by providing one on one support to students, helping with tasks, and reinforcing learning concepts in a personalized manner. Educational robots can be used to teach coding and STEM (Science, technology, engineering and

mathematics) concepts, making these Subjects more interactive and engaging for students. Robots are very helpful for future generations in the education sector. Robots can help with physical tasks in educational settings, such as distributing materials, organizing classrooms, or assisting students with special needs. Robots can facilitate collaboration, learning tasks and hands-on experience. Educational robots can provide hands-on experiences in subjects like science and engineering, allowing students to experiment and learn in a tangible way. Robots can be employed to enhance remote learning experience by providing interactive lessons, conducting experiments, or facilitating discussions through virtual platforms. Robots can contribute to inclusive education by providing additional support to students with diverse learning needs, ensuring that educational resources are accessible to all (Pedro, Subosa, Rivas, & Valverde, (2019)

Students can improve their content development with the aid of artificial intelligence. Teachers can also create more interesting and useful content for their students with the aid of artificial intelligence technology. Dream box learning in education platforms is a key component of artificial intelligence for the next generation. Artificial intelligence is used by this adaptive online math program to modify lessons according to each student's strengths and weaknesses, guaranteeing a genuinely customized educational experience.

Conclusion

Artificial intelligence (AI) has enormous potential and could revolutionize the field of education. Personalized learning, adaptive learning platforms, tutoring and homework help, automated grading, early intervention, virtual classrooms and remote learning, language learning, educational content creation, etc. are just a few of the ways artificial intelligence is having an impact.

Artificial intelligence in education has a bright future ahead of it. Artificial intelligence in education has a bright future ahead of it, providing individualized instruction and improving academic results. Future cooperation with artificial intelligence will guarantee a fair and advantageous integration into the educational system. How we teach and learn is being altered by artificial intelligence. Education has an exciting future thanks to artificial intelligence. If future teachers want to use artificial intelligence in the classroom, they must accept it as a supplementary tool rather than a replacement.

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