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Emerging Trends in Artificial Intelligence Education: Advancements, Opportunities, and Impact on Educational Technology

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Abstract

Artificial intelligence (AI) has recently gained prominence in the field of educational technology as an emerging area. It encompasses the study and advancements that have led to the creation of intelligent computers, machines, and other artifacts that possess cognitive abilities, learning capacity, adaptability, and decision-making skills similar to those of humans. The demand for training and platform development for artificial intelligence education may be seen by analyzing the development trends in artificial intelligence education across various countries. Technology diversity, individualized training, and clever student assessment are features of artificial intelligence education. As a complement to human teachers, virtual tutors and chatbots powered by artificial intelligence offer personalized guidance and support. The continued advancement of AI in education offers students an opportunity to gain practical experience, make data-driven decisions, and stay abreast of new developments. AI-powered educational tools enable efficient administrative tasks, freeing up valuable time for educators. AI algorithms can automate grading processes, analyze student performance data, and generate insightful reports, allowing teachers to focus on instructional planning and individualized instruction.

Keywords*:* Artificial intelligence; Emerging technology; Education; AI algorithms; AI tools

INTRODUCTION

Everyone believes that education is important and that having a good education is essential to living a successful life [1]. The educational system undergoes frequent and ongoing transformations with the aim of improving the learning experience for students. These changes encompass various aspects such as teaching methods, curriculum content, and other elements that contribute to the overall enhancement of education [2]. AI is being utilized in diverse educational settings to create novel methods of teaching and learning. Colleges and universities worldwide are now implementing AI in their academic environments, exploring its potential to enhance educational practices. The use of AI in education has offered parents, instructors, students, and, of course, educational institutions an entirely new way to see education. AI in education refers to the use of computer intelligence to assist instructors and students and improve the effectiveness of the educational system [3]. It does not pertain to the substitution of human teachers with humanoid robots for education. Instead, the future of education will be influenced by the integration of various artificial intelligence (AI) techniques into the existing system. In this topic, we'll talk about the effects and uses of artificial intelligence in education. For a better understanding of this topic, we should be well aware of AIED (Artificial Intelligence in Education) [4].

Artificial intelligence (AI) is the process of replicating human intelligence within a computer program, allowing the computer to mimic human thinking and behavior. It is a technological advancement that empowers computers to engage in human-like thought processes. Human behavior is what artificial intelligence tries to replicate [5]. AI finds applications in various domains, including the field of education. In the 1970s, a specialized area called Artificial Intelligence in Education (AIED) emerged to encompass the integration of new technological advancements into teaching and learning processes, particularly in higher education. The main goal of AIED is to offer learners not only automated tasks but also flexible, personalized, and engaging learning opportunities. Intelligent tutoring systems, adaptive learning, smart classroom technology, and pedagogical agents are among the prominent developments in the field of AIED. Artificial intelligence involves utilizing computers, software, hardware, devices, and machines to simulate human perception, decision-making, and various other processes. The nature of AI can be understood in a variety of ways [6].

There are two fundamental types of AI: rule-based AI and machine-learning-based AI. Rule-based AI utilizes decision-making rules to generate or propose suggestions or solutions. An example that exemplifies this is an intelligent tutoring system that offers students feedback on their grammar and provides specific corrections [7]. Machine learning-based artificial intelligence is significantly more powerful, particularly when working with extensive, complex datasets, as machines have the ability to genuinely learn and improve over time. In the field of education, AI techniques rooted in machine learning can be employed for various purposes, such as monitoring student activities and constructing models that accurately predict student behavioral outcomes. Natural language processing is another subject of AI that involves using computer programs to comprehend, extrapolate from, translate, and record text. Natural language processing is a technique used in automated essay scoring to evaluate written essays [8].

There are voice-recognition-based AI systems. These systems are employed by Siri and Alexa, two voice command tools. Researchers have been investigating how to assess reading and other academic difficulties using voice-based AI [9]. Researchers have been investigating how to assess reading and other academic difficulties using voice-based AI. Artificial intelligence (AI) based on machines is currently being implemented in the education sector. For example, testing organizations like Pearson are utilizing natural language processing to assess and grade essays. Massive open online courses with open enrollment that are offered by organizations like Coursera and Udemy have also incorporated AI scoring to evaluate essays as part of their curriculum [10].

As per Nabiyev (2010), artificial intelligence pertains to the ability of a machine to perform tasks in a manner similar to that of a human. Here, brain functions like reasoning, deriving meaning, creating generalizations, and recalling information from the past are considered to be human-like abilities [11]. AI is referred to as machine intelligence, or computational intelligence, by Norvig and Russell (2003). AI makes it possible to carry out common and specialized jobs, such as playing games, resolving mathematical puzzles, writing material, speaking, diagnosing illnesses, etc. AI, according to Nilsson (2014), is an algorithmic architecture meant to mimic human intelligence [12]. Alternatively put, AI is a collection of tools, software, hardware, and machines that perform similarly to or better than human intellect. However, we cannot ignore the reality that AI is also a byproduct of human intelligence [13].

The rapid advancement of technology and the interconnectedness of the world have led to substantial transformations in society, economics, and the environment. These collective changes are commonly referred to as megatrends. These megatrends are anticipated to persist as the twenty-first century develops (Haluza & Jung Wirth, 2023) [14]. In recent years, there have been notable advancements in artificial intelligence, resulting in the emergence of groundbreaking technologies such as ChatGPT by Open AI. Cutting-edge technologies such as the ChatGPT language model have the capacity to bring about a transformative shift in the field of education. However, as ChatGPT becomes increasingly integrated into educational environments, it is crucial to ensure its utilization aligns with ethical and responsible standards. ChatGPT remains the most advanced chatbot ever created. The advent of this technology has generated significant attention and raised concerns regarding student assessment in higher education, among other challenges. Unlike previous chatbots, this particular technology has the remarkable ability to generate high-quality written content within seconds (Rudolph et al., 2023), contributing to the buzz and doomsday predictions surrounding its implications. The Generative Pretrained Transformer (GPT) model of languages from OpenAI was modified to create ChatGPT, a state-of-the-art language model.

It has the ability to communicate with users in a way that appears to be very straightforward and uncomplicated [15]. Given its importance, AI has gained popularity as a research topic in various fields, including education, where it is still in a developing stage. Numerous algorithms have been developed to align with the objectives of AI, as it holds a strong connection to both academic and administrative responsibilities. AI can be utilized to gather and offer support in a wide range of assessments and behavioral analyses, among other factors. Providing individual attention to each student can be a challenging task, particularly in institutions and countries with limited resources and inadequate faculty, where students exhibit varying talents and intellectual levels within a single classroom. AI applications address this significant gap by providing personalized tutoring and other benefits. This study intends to investigate artificial intelligence (AI) apps and how they influence and help with various administrative and academic tasks. The study of the use and implementation of AIE (Artificial Intelligence in Education) is beneficial for educational institutions, policymakers, instructors, and other support personnel. Applications for artificial intelligence shouldn't be confused with those for information technology. The study's scope and emphasis are strictly managerial rather than technical and are restricted to AI applications alone [16].

APPLICATIONS OF AI IN EDUCATION

Intelligent Tutoring Systems (ITSs)

Tutoring systems that utilize intelligent algorithms have been shown to be highly effective at motivating and improving the performance of students. In spite of their outward appearance, intelligent tutoring systems often appear to be composed of many interdependent parts, which makes them easier to conceptualize and design. The technology enables us to offer real-time instruction and feedback to learners, usually without involving humans. The AI tutors used in these systems promote interaction by collaborating with learners, engaging in turn-by-turn conversations, and adapting to their needs. As a major application of AI in education, intelligent tutoring systems can help faculty improve teaching quality and can support and optimize student learning [17].

Personalized Learning Platforms

A personalized system of education recognizes and analyzes individual learning abilities, learning needs, and study goals in order to tailor content delivery accordingly. A customized curriculum can include revisions, reorientations, and even reconstructions. AI algorithms construct learner profiles by analyzing multiple data points, such as learning styles, preferences, skills, limitations, and prior knowledge. These profiles gather critical information about each student, allowing the platform to identify their individual features and tailor the learning experience accordingly.

Collaborative Learning

Through the utilization of artificial intelligence, learners can enhance their educational experiences and promote successful collaboration with the help of collaborative learning. With AI-powered tools and platforms, learners can collaborate on group projects, have conversations, and share knowledge no matter where they are located. A tool that uses artificial intelligence in education could automatically recommend groups of students for specific collaboration tasks based on their individual student profiles and intelligently connect them [18]. Here are a few examples of AI-based educational platforms in India that promote collaborative learning: ClassPlus, Simplilearn, UpGrad, and TalentSprint. These platforms integrate AI technologies into their educational offerings.

Adaptive Assessment and Feedback

Adaptive learning attempts to incorporate all aspects of testing, teaching, learning, and practice into the adaptive learning system to facilitate students' learning [19]. The adaptive learning system can collect student learning behavior data [20], plan the optimal learning path for students based on the analysis of student abilities, and complete the closed-loop learning process by pushing learning content as online teaching videos. Using artificial intelligence algorithms, learner performance is analyzed, and questions are adapted accordingly. Learning is appropriately challenged and engaged with this adaptive approach since assessments are dynamically adjusted to learners' abilities. Some key aspects of adaptive learning in AI are: personalized learning paths, intelligent content recommendation, adaptive assessments, and real-time feedback and support. In India, there are numerous adaptive learning applications that utilize AI technologies to deliver customized and individualized learning experiences. Some notable examples include BYJU'S, Toppr, Vedantu, Embibe, and Doubtnut. Each of these applications offers unique features and specializes in specific subjects or examination preparations.

BENEFITS OF AI

Numerous research studies highlight the significance of artificial intelligence in higher education for both teachers and students. These technologies empower students to learn with increased flexibility and adaptability. Due to increased flexibility and speed, universities across the globe are enrolling increased numbers of students thanks to artificial intelligence. Artificial intelligence has the potential to be utilized in the education system to automate the grading process, enabling teachers to streamline and automate the assessment of students' work. Students' needs can also be met using AI in adaptive and individualized learning. It enables teachers to provide appropriate clues to students based on the understanding capacity of their students during their lectures. It functions as an instructor for students, facilitating their comprehension of concepts in a more accessible manner. Students' learning

characteristics and processes can be facilitated in a supportive environment. By utilizing new software and hardware methods, artificial intelligence can make up for the inefficiency of conventional teaching and learning methods in explaining intuitive and clear material. Compared to other learning methods, teaching in the classroom has more potential with AI programs.

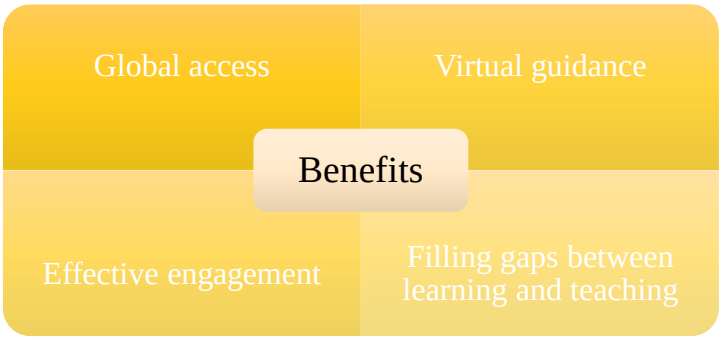

Figure 1. Benefits of AI in Education

POTENTIAL CHALLENGES OF AI

The education sector has been revolutionized by AI over the last few years, which performs exceptionally well in a variety of applications. The integration of AI in education will offer numerous advantages, yet it will also present novel challenges that have not been encountered before. Artificial intelligence in education has both technological and social limitations. Education's technological pitfalls are either due to limitations in conceptual or algorithmic design or data quality. The following are some of the pitfalls [21].

- Failure in the generation of course content
- The teaching approach of virtual teachers (robots) often lacks clear guidance and adaptability.
- Lack of training data
- High risk due to biased data

Apart from the constraints of AI algorithms, there are also disadvantages associated with the use of AI in education that pertain to their adverse societal effects rather than the limitations of the algorithms themselves.

Cost: Within educational systems, the initial expenses for software and cloud support are considerably high. Moreover, if there are changes in organizational processes, the ongoing training of the AI system can be costly, along with the continuous training of employees. Culture clash: Any changes might have been considered suspicious by the organizations. Due to the variety of technology options available, limiting the potential options and determining the most appropriate implementation path can be challenging [22].

CONCLUSION

The incorporation of artificial intelligence (AI) in education possesses significant potential to transform the methods of teaching and learning. By leveraging AI technologies, educational institutions can enhance the learning experience, promote personalized instruction, and streamline administrative tasks. AI-powered systems can provide access to quality education in remote areas, bridge language barriers, and support students with diverse learning styles and abilities. AI-driven tools like intelligent tutoring systems, virtual assistants, and adaptive learning platforms have exhibited their capability to provide tailored and dynamic content, addressing the distinct requirements and preferences of individual learners. AI has the potential to revolutionize education, empowering learners and educators alike.

CONFLICT OF INTERESTS

The authors confirm that there is no conflict of interests associated with this publication.

REFERENCES

[1] Mijwil MM, Ali G, Sadıkoğlu E. The Evolving Role of Artificial Intelligence in the Future of Distance Learning: Exploring the Next Frontier. Mesopotamian Journal of Computer Science. 2023 May 21;2023:98-105.

[2] Talan T, Kalinkara Y. The role of artificial intelligence in higher education: ChatGPT assessment for anatomy course. Uluslararası Yönetim Bilişim Sistemleri ve Bilgisayar Bilimleri Dergisi. 2023 Jun 6;7(1):33-40.

[3] Khalaf SS. The Role of Artificial Intelligence Applications in Developing Educational and Educational Skills in The Arab World and Their Implications for Traditional Education Systems-A Field Study. Journal of Al-Farahidi's Arts. 2023;15(52| Second Part).

[4] Lutfiani N, Wijono S, Rahardja U, Iriani A, Aini Q, Septian RA. A bibliometric study: Recommendation based on artificial intelligence for ilearning education. Aptisi Transactions on Technopreneurship (ATT). 2023;5(2):109-17.

[5] Helm JM, Swiergosz AM, Haeberle HS, Karnuta JM, Schaffer JL, Krebs VE, Spitzer AI, Ramkumar PN. Machine learning and artificial intelligence: definitions, applications, and future directions. Current reviews in musculoskeletal medicine. 2020 Feb;13:69-76.

[6] Awasthi S, Soni Y. Empowering Education System with Artificial Intelligence: Opportunities and Challenges. Shodh Samagam. 2023;6(1).

[7] Mane, D.T., Sangve, S., Upadhye, G., Kandhare, S., Mohole, S., Sonar, S., Tupare, S., Detection of Anomaly using Machine Learning: A Comprehensive Survey (2022) International Journal of Emerging Technology and Advanced Engineering, 12 (11), pp. 134-152.

[8] Tapalova O, Zhiyenbayeva N. Artificial Intelligence in Education: AIEd for Personalised Learning Pathways. Electronic Journal of e-Learning. 2022;20(5):639-53.

[9] Malvin, Dylan, C., Rangkuti, A.H., WhatsApp Chatbot Customer Service Using Natural Language Processing and Support Vector Machine, (2022) International Journal of Emerging Technology and Advanced Engineering, 12 (3), pp. 130-136.

[10] Ouyang F, Jiao P. Artificial intelligence in education: The three paradigms. Computers and Education: Artificial Intelligence. 2021 Jan 1;2:100020.

[11] Chen L, Chen P, Lin Z. Artificial intelligence in education: A review. Ieee Access. 2020 Apr 17;8:75264-78.

[12] Baker MJ. The roles of models in Artificial Intelligence and Education research: a prospective view. Journal of Artificial Intelligence and Education. 2000; 11:122-43.

[13] Awasthi S, Soni Y. Empowering Education System with Artificial Intelligence: Opportunities and Challenges. Shodh Samagam.2023;6(1).

[14] Firat M. How chat GPT can transform autodidactic experiences and open education. Department of Distance Education, Open Education Faculty, Anadolu Unive. 2023.

[15] Biswas S. Role of Chat GPT in Education. Available at SSRN 4369981. 2023 Feb 25.

[16] Ahmad SF, Alam MM, Rahmat MK, Mubarik MS, Hyder SI. Academic and administrative role of artificial intelligence in education. Sustainability. 2022 Jan 19;14(3):1101.

[17] Conati C, Porayska-Pomsta K, Mavrikis M. AI in Education needs interpretable machine learning: Lessons from Open Learner Modelling. arXiv preprint arXiv:1807.00154. 2018 Jun 30.

[18] Alberola JM, Del Val E, Sanchez-Anguix V, Palomares A, Teruel MD. An artificial intelligence tool for heterogeneous team formation in the classroom. Knowledge-Based Systems. 2016 Jun 1;101:1-4.

[19] Alam A. Possibilities and apprehensions in the landscape of artificial intelligence in education. In2021 International Conference on Computational Intelligence and Computing Applications (ICCICA) 2021 Nov 26 (pp. 1-8). IEEE.

[20] Cui W, Xue Z, Thai KP. Performance comparison of an AI-based adaptive learning system in China. In2018 Chinese automation congress (CAC) 2018 Nov 30 (pp. 3170-3175). IEEE.

[21] Daries JP, Reich J, Waldo J, Young EM, Whittinghill J, Ho AD, Seaton DT, Chuang I. Privacy, anonymity, and big data in the social sciences. Communications of the ACM. 2014 Sep 1;57(9):56-63.

[22] Hamid, M.S., Manap, N.A., Hamzah, R.A., Kadmin, A.F., Stereo matching algorithm based on hybrid convolutional neural network and directional intensity difference, (2021) International Journal of Emerging Technology and Advanced Engineering, 11 (6), pp. 87-97.