Transforming Education SystemThrough Artificial Intelligence in 21st Century: A Meta Analysis

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Abstract

As we navigate the complexities of the 21st century, the integration of Artificial Intelligence (AI) into education systems has emerged as a promising avenue for enhancing learning outcomes and reshaping traditional pedagogical approaches. This meta-analysis explores the transformative potential of AI in education by synthesizing findings from a wide array of studies, encompassing various educational settings and AI applications. The study is aimed to review and analyse the role of Artificial intelligence in transforming the education system and evaluating its opportunities and challenges associated with it.This study is based on a related literature review. The data has been taken from different databases like Google Scholar, the publication database, Research Gate, and from other publications starting from 2018 to 2023 etc. The review documents were critically evaluated based on their ability to achieve the objectives of study. Results shows us that there are various number of applications of Artificial Intelligence like Personalized learning, Deep learning, Chatbots, Robotics and much more in order to raise the standard and quality of education throughout the world. But at the same time, there are various challenges related to its usage, which needs to be resolved for the complete success of education system in 21st century.

Keywords: Artificial intelligence in Education, AI enhanced learning,Opportunities, Challenges, Pedagogical innovation.

INTRODUCTION

Artificial intelligence (AI), aims to enable computers to perform tasks by simulating intelligent human behaviours, and has rapidly advanced due to the information processing techniques(Duan, Edwards, & Dwivedi, 2019; Topol, 2019). Artificial intelligence (AI) has been widely used in educational practices, thanks to its fully developed techniques and practices which give birth to human-computer interactions, learning analytics dashboards, intelligent tutoring systems, teaching robots, adaptive learning systems, and much more (Chen & Hwang, 2020).Ever since the introduction of AIED almost thirty years ago, artificial intelligence (AI) has been viewed as a potent instrument that can help create new paradigms in technology development, instructional design, and education research that would not be possible to create in conventional learning environments (Holmes&Hwang). AIED has specifically created new possibilities, obstacles, and opportunities for educational innovations, such as the shift to personalized learning, the difficulty of the instructor's role, and the creation of intricate educational systems (Baker et al., 2019; Holmes et al., 2018; Star, 2019). In addition to this, different AIED methods have been used to build intelligent learning environments for behaviour detection, prediction model building, learning recommendation, etc. (Hwang et al., 2020; Rowe, 2019). These methods include natural language processing, artificial neural networks, and much more. AIED is increasingly being used in education field, due to its good potential to transform the system (Hwang et al., 2020).

Artificial intelligence is the term used to describe the intelligence exhibited by machines as opposed to humans. Animal intelligence lacks consciousness and emotions, whereas intelligence displayed by humans and other species possesses these qualities. John McCarthy used the term artificial intelligence (AI) for the first time in 1955, defining it as 'making a machine behave in ways that would be called intelligent if a human were so behaving' In the sections that follow, we offer a framework for elucidating the functions of artificial intelligence (AI) in education, in addition to delineating its characteristics. These studies generally fall into one of four categories:

Cognitive Coach: This AIED application category has various applications which includes recommendation systems, adaptive/personalized learning systems, and intelligent tutoring systems. The usefulness of intelligent tutoring systems in fostering learning outcomes has been shown in a number of meta-analytic studies (Liu et al., 2014; Steenbergen-Hu & Cooper, 2014; VanLehn, 2011).

Smart Learner Companion: Research in this area are uncommon because the majority of AI-based learning environments prioritize student assistance over chances to foster student tutoring or advising. However, putting students in situations where they have to assist others AI tutees in understanding difficult ideas could be a great way to advance their higher order thinking skills and knowledge. While research on purposeful and explicit development of intelligent tutees has not yet been conducted, a number of AI models and techniques are able to acquire knowledge and experience through human interaction.

Enlightened Collaborator: From the standpoint of constructivism, having a partner or intelligent learning tool is crucial. Rather than concentrating on simple tasks like editing and calculation, certain tools can even do 'smart' data analysis and presentation, which encourages learners to think critically and identify important implications hidden in the data.

Policy Analyst: In recent years, AI techniques have been used to inform and guide the development of laws or policies (Gasser & Almeida, 2017). As a result, creating a policy-making advisor for the purpose of developing educational policies is both feasible and possible.

Artificial Intelligence in Education

AI-enhanced digital technology has become indispensable in our day-to-day lives because of its immense ability to alter our thoughts, behaviours, and social interactions. In actuality, while the idea of artificial intelligence (AI) and intelligent machines dates back to the 14th century (Tatar, Roschelle, Vahey, & Penuel, 2003), the concept of AIED is relatively new, having emerged only 25 years ago. AI has been incorporated in education through a various methods and forms (Heffernan & Heffernan, 2014; Koedinger & Corbett, 2006). The advancements and achievements emerging from various disciplines, particularly computer science, have profoundly influenced the methods and approaches we use in education and how to teach learners (Humble & Mozelius, 2019; Kübler et al., 2015; Bayne, 2015). In both K–12 and university settings, educators and students are using more and more AI-powered applications and tools. According to Della Ventura (2017), artificial intelligence (AI) technologies offer the possibility of implementing personalized learning for students based on their unique requirements. But, at the same time, it is challenging to meet the needs of each individual learner using conventional teaching techniques since each learner has different learningskills, and needs. But thanks to AI, teachers can now individually adjust their instruction to each student's needs (Della Ventura, 2017). As a result, students are able to

learn with greater independence, motivation, and engagement (Della Ventura, 2018; Wang, 2017). AI technologies also present opportunities to enhance the participation of students with learning disabilities. As AI technologies are used more widely in education, teachers have the opportunity to eliminate time-consuming and repetitive tasks and respond to students promptly, which enhances the process of adaptive and customized learning (Chan & Zary, 2019).

Challenges in AI

Following a critical evaluation of AIED, a number of challenges have surfaced. These are addressed below and will serve as a guide for researchers conducting additional research in the future.

Insufficient resources for personalised learning: Teachers have expressed dissatisfaction with the excessive homogeneity of the teaching strategies and learning materials suggested by personalized and adaptive learning platforms. Artificial intelligence (AI) agents suggest learning objects, which are any standardized, reusable digital educational resources that are easily modified to meet learning objectives in a range of situations (Cao et al., 2021). More research is required to determine the best ways to design learning objects for personalized and adaptive learning, as well as how to use them in this context.

AI-Teaching Disjunction: New AI technologies aim to support teachers in their pedagogical decision-making by offering instructional support (e.g., through chatbots and robots) and by giving them rich information (e.g., learning analytics; Kim et al., 2022). Nonetheless, educators may encounter difficulties deciphering learning analytics data, be ignorant of the educational benefits of AI technologies, and be unclear about the pedagogical ramifications of utilizing AI in the classroom.

Digital divide and educational inequality: The majority of the AIED studies that were reviewed made clear how AI technologies could encourage student participation and develop 21st century skills. Nonetheless, the most capable and driven students frequently reaped the greatest rewards. However, this finding has two reasonable explanations: AI tools are not well developed for learners, and teachers lack the pedagogical expertise to effectively use the tools.

AI pedagogical Disparity: The majority of educators have been operating with a ‘black box’ in their classrooms because they are unaware of the principles underlying AI technologies, such as the algorithms that recommend resources. They consequently are unable to fully

utilize the technologies for learning, teaching, and assessment, and are unable to respond to inquiries from students about AIED (such as why the AI platforms suggested specific learning resources). Therefore, future research should take into account the necessity of teachers having a working knowledge of AI and how it can be applied to pedagogy.

AI skepticism among students and teachers: When learning with AI, some educators and students have expressed feeling uneasy and less confident. Students may start to worry about their futures because AI technologies have the potential to render their desired careers obsolete. In the meantime, low self-efficacy can result from teacher's ignorance of the systems (Wang et al., 2020). These ambiguities may lead to unfavourable perceptions of AIED, which could impact behavioural 2020; Qin et al., 2020). Research on AIED for students outside of the engineering context, such as K–12 and art students, as well as teacher professional development on AI subjects are both in need of further investigation (Chiu, 2021; Chiu et al., 2022; Xia et al., 2022; Chai et al., 2022).

Education blind-spot in AIED Research: The goal of this review is to better convey the viewpoint of educational research on AIED. Nonetheless, because the majority of AIED researchers have a strong background in engineering, they frequently adopt an engineering perspective when conducting AIED research and concentrate on technological design and development. The viewpoints of educators and educational researchers are not adequately represented by this methodology.

Rudimentary Evaluation: It's possible that the most popular evaluation techniques won't work well for AIED research. The majority of the studies that were reviewed employed current techniques to assess new technologies that employ big data such as massive student populations and poorly organized data in novel ways (Renz & Hilbig, 2020). Consequently, new techniques for assessing the effectiveness of AI systems must be developed for the study of AIED.

Objectives

Education is a continuous process, which is needed for everyone and Artificial Intelligence in education has exposed it to new heights. Following are the objectives of this review type of study:

- To review and analyse the role of Artificial intelligence in transforming the education system of present century.

- To review and analyse the new opportunities of artificial intelligence in education and challenges associated with it.

METHODOLOGY

The study is based on a related literature review. This review systematically synthesizes and evaluates therole of Artificial Intelligence in transforming the education and its opportunities and challenges that are associated with it. The search strategy included academic databases, websites and other sources. The data has been taken from different databases like Google Scholar, the publication database, Research Gate, Eric and Wiley.The information and data sources have been appropriately acknowledged and referenced. The study also maintain some other criteria for selecting the appropriate literature such as publications starting from 2018 to 2023, peer reviewed journals etc. The review documents were critically evaluated based on their ability to achieve the objectives of study. Finally, the content has been carefully studied in order to give systematic look to study and ensure its quality and relevance.

REVIEW OF LITERATURE

Chassignol et al. (2018) explored that, the artificial intelligence tools are already being used in many aspects of education, such as content creation, instructional strategies, student evaluation, and much more. This study adds to the body of knowledge in this area and will be of interest to academics, students, lecturers, and professionals working in the field of technology-enhanced learning as well as anyone interested in the cutting edge of education.

Tao et el. (2019) explored that, the extreme robotics and artificial intelligence present risks and difficulties that need to be taken into account in all fields where they are used, especially in education. Students and instructors claim that a robot is not replicable since it is emotionless, which highlights the potential for emotional disconnection resulting from the use of robots and artificial intelligence tools.

Chen et al. (2020) explored that, the AI in education first appeared in the form of computer systems, and then it moved on to become web-based and online learning environments, which resulted in Robots and Chatbots. As a result, richer or higher-quality instruction has been produced by these technologies, which ultimately resulted in teacher effectiveness.

Vincent & Vander (2020) explored that, the AI has the potential to enhance learning outcomes and procedures both within and outside of the classroom, as well as contribute to the achievement of SDG 4. At the system level, artificial intelligence (AI) in education is still being used sparingly.

Borenstein & Howard (2021) explored that, AI is being incorporated into many facets of human life, and the complicated ethical issues that have arisen from its development,

application, and use serve as a reminder that it is time to review the AI-related lessons that professionals and upcoming developers and designers are learning. So, it's important to prepare stakeholders in order to minimize its possible drawbacks.

Ahmad et al. (2021) explored that the education is one of the many fields that artificial intelligence (AI) has affected. AI is a modern approach to teaching and learning that can address and resolve a variety of learning-related problems so its adoption and implementation is inevitable. There are many other intelligent technologies, such as virtual facilitators, online learning environments, and social robots which also make significant contributions to the field of artificial intelligence.

Zhai et al. (2021) explored that, by the AI's explosive growth, it is critical to comprehend how educators can best apply AI techniques to student's academic success. The difficulties posed by AI in education were also clearly visible in terms of the technique viewpoint, the roles of instructors and students, and social and ethical concerns and in order to bridge the gaps between technique and pedagogy, educators must collaborate with AI engineers.

Majid & Lakshmi (2022) explored that, the future of AIED is unknown, it is predicted that nearly all fields of education, technical, professional, and non-technical will rely more on tools and technologies to provide a comprehensive learning environment for teachers and students. Though AI has started to show its advantages and promise in a variety of educational contexts, it is still unclear how the technology will empower students and enhance their overall learning outcomes.

CONCLUSION

At present, Artificial intelligence (AI) has been widely used in educational practices. With its fully developed techniques and practices, it has given birth to human-computer interactions, learning analytics dashboards, intelligent tutoring systems, teaching robots, adaptive learning systems, and much more in order to facilitate education system. However, since from its introduction, ithas been seen as a potent instrument in creating instructional design for teaching and learning process. In addition to this, it has provided new developments in education system like, deep learning, personalized learning, Chatbots, and much more in order to facilitate the teaching learning process. But, at the same time, it has number of challenges which need to be resolved from the both teacher and student, for the complete success of Artificial Intelligence in education.

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