Contemporary Progress in the Use of Artificial Intelligence Tools in Education

ORIGINAL ARTICLE

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Abstract

The Artificial Intelligent (AI) tools are being used in Education and they are found to have a significant impact on learning experiences and outcomes. This review aims at highlighting the recent advances in artificial intelligence tools and their implications for better practices and future research. Relevant articles on AI in education, specifically those describing the integration of AI tools was extracted from the SCOPUS database. Some of the most recent studies (from 2020 to 2023) were comprehended for subsequent analysis. The result suggests that implementation of cognitive tutors, the interactive learning environments aided by intelligent tutoring systems, improves overall learning outcomes. Although there exists an inherent challenge of equalizing instructional assistance and self-directed learning in AI-driven tools, but overall AI tools in higher education provide numerous advantages at the institutional, social, and instructional levels. Tools like ChatGPT have been regarded as the Disruptive AI tool which incorporates major challenges such as job displacement concerns and the need for constant adaptation. Ethical considerations and competencies related to AI-based tools in education are being assessed, which pin-points the importance of strong ethical frameworks, as well as the critical role of educators and professionals in responsible AI use. A responsible AI use is crucial for maintaining a mutual relationship between human skills and technological advancement. Overall, this review summarizes recent advances in the use of artificial intelligence tools to revolutionize education, emphasizing the importance of ongoing research, cross-disciplinary collaboration, and careful implementation.

Key Words

Artificial intelligence, Cognitive tutors, ChatGPT, AI Literacy, Social Robots.

Introduction

Artificial intelligence (AI) can be defined as the computers, machines, and other objects with human-like intelligence aided by cognitive abilities, learning and adaptability along with the decision-making abilities resulted from the breakthrough inventions in the area of research and development (Chen, Chen, & Lin, 2020). Now, AI has been globally applied in education, reshaping diverse parts of the learning process, and

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is regarded as both eruptive as well as disruptive technology that is amending the educational landscape across the globe.

AI has been used in education in varied forms and ways. With computers and computer-related technologies such as the internet and the World Wide Web, AI began to emerge.. This has led to web-based and online intelligent education systems which offer individualized and adaptable learning experiences. AI has also been amalgamated into embedded computer systems, humanoid robots, and web-based chatbots, which can perform educational functions individually or in-collaboration with instructors (Chen, Chen, & Lin, 2020).

AI in education has yielded favourable outcomes and benefits. Administrative duties like grading assignments and maintaining student records have been aided by AI-powered systems, helping instructors to focus on tailored training and assistance in a better way (Chen, Chen, & Lin, 2020) AI tools have also contributed towards curriculum and content customisation and personalisation, tailoring to individual students' needs and enhancing their learning experiences. AI is also being utilized in intelligent tutoring systems, that gives tailored feedback and adaptive training to students, resulting in better learning outcomes (Azevedo, Bouchet, & Duffy, 2022)

Regardless of all the positive effects, the application of artificial intelligence in the field of education prompts ethical concerns and obstacles. When applied in educational settings, privacy and security of data are the critical concerns (Dignum, 2021). To impart equitable learning opportunities for all students, AI algorithms must be addressed for biasness and fairness (Yue et al., 2022). Likewise, educators must attain skills or gain capabilities to understand and utilize AI tools in their teaching activities effectively (De Gagne, 2023).

Applications of AI in Education: An Overview

The potential to revolutionize the learning experience has allowed AI to gain significant consideration in the educational settings. AI refers to the use of technologies such as machine learning and natural language processing to analyse data, identify patterns, and make predictions, enabling educators to personalize learning for each student (Harry, 2023). The integration of AI in education has the potential to enhance the learning process, making it more personalized, engaging, and efficient. One of the key areas where AI has been applied in education is in the development of intelligent tutoring systems. These systems, known as Cognitive Tutors, provide interactive learning environments that adapt to the individual needs of students (Baker, D'Mello, Rodrigo, & Graesser, 2010). Cognitive Tutors, offer step-by-step feedback, specific messages in response to common errors, and on-demand instructional hints (Koedinger & Aleven, 2007) These features help students navigate through challenging concepts and provide targeted support when needed (Koedinger & Aleven, 2007). The adaptive nature of AI tools allows them to identify areas where students are struggling and provide additional practice or resources to reinforce learning.

Along with the education sector, AI has also been applied in medical and health informatics. The AI training has been integrated into health informatics curricula to meet the evolving needs of the healthcare industry (Doroudi, 2022). AI tools have paved way for the enhancement of education through innovative applications and personalized learning experiences. There have been promising improvements in the education of individuals with neurodevelopmental disorders. These tools can also be used to assess and improve students' clinical skills and decision-making abilities. AI has been used in a variety of applications in higher education. Universities have found that AI tools usage have led to an increase in enrolment, retention rates, and resource management (Lukianets & Lukianets, 2023). At various levels such as institutional, social, and instructional levels, AI has been capable to assist institutions, students, and instructors.

Broadly, the use of AI tools in education has shown vivid progress in recent years. AI has the potential to upgrade the learning experience by providing personalized instruction, better learning outcomes, and streamlining educational processes. Nonetheless, there is a need to ensure responsible and effective use of AI

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tools which can be addressed by overcoming the challenges like ethical considerations, management of data, and the need for skilled resources. Teachers also need to be equipped with the necessary knowledge and skills to effectively integrate AI tools into their teaching practices (Nazaretsky, Cukurova, & Alexandron, 2022)Professional development programs that focus on AI education can help build teachers' trust in AI-powered educational technologies and enhance their ability to leverage these tools in the classroom (Nazaretsky, Ariely, Cukurova, & Alexandron, 2022).

Purpose of the Review Article

The purpose of this review article is to provide a comprehensive overview of the existing and emerging role of AI in education. The review aims to synthesize knowledge from the literature on the integration of AI in education, including its applications, challenges, and potential benefits. By examining the current state of AI training and the use of AI tools, this review article seeks to inform future directions and advancements in the field. Furthermore, the review article will identify gaps in the current literature and highlight areas for future research and development in the field of AI in education. In summary, the purpose of this review article is to provide a comprehensive overview of the existing and emerging role of AI in education. The primary research inquiry of this work pertains to the advancement of artificial intelligence technologies and the obstacles encountered during their integration within the education domain.

Results and Discussion
Research Trends and Important Information from Included Articles

The integration of AI has affirmed a growing presence in educational settings, providing a myriad of benefits and prospects for both the educators as well as the learners. This integration of AI has led to the introduction of various AI tools and their applications. These applications encompass intelligent tutoring systems, personalized learning platforms, automated assessment systems, facial recognition systems and educational chatbots (Adams & Chuah, 2022). These applications aims towards achieving the objective of optimizing students' educational experiences, offer customised assistance, and boost the effectiveness of instructional practices.

A study titled " Developing AI Literacy for Primary and Middle School Teachers in China: Based on Structural Equation Modelling Analysis" (Zhao, Wu, & Luo , 2022) includes empirical findings about the extent of AI literacy among teachers in China, and offers relevant insights into various effective strategies for fostering AI literacy among primary and middle school educators. A sample of 1013 teachers was surveyed and the collected data was analysed with the aim of evaluating their level of AI literacy across four distinct dimensions: Knowing and Understanding AI, Applying AI, Evaluating AI Application, and AI Ethics. It found that there exists a statistically significant and positive relationship between applying AI and the three aspects chosen for the analysis. Educators who endorsed higher levels of competence in utilising AI were also more willing to possess a deeper comprehension of AI, determine its practical implementations, and think of its ethical consequences. These findings indicate that to stimulate AI literacy among educators, it is pivotal to prioritise the development of their capacity to productively utilise AI within educational environments. Such an objective can be facilitated through professional development initiatives and training sessions that prepare educators with experiential learning opportunities and pragmatic understanding towards the utilisation of artificial intelligence technologies. With an increase in AI skilled teachers, there will be deeper comprehension of the prospective applications of AI in the field of education, assess its efficacy, and effectively tackle ethical concerns associated with its implementation. The research also highlights the importance of the governmental responsibility in fostering AI literacy among educators. This review paper recommends that the government should implement measures to actively encourage and aid the development of teachers' proficiency in AI literacy. This can be accomplished by implementing policy efforts, allocating funds for professional development programmes, and incorporating AI education into the curriculum.

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A case study from Al Ain city in Abu Dhabi titled "How do Students Perceive Artificial Intelligence in You tube Educational Videos Selection? (Farhi, Jaljeli, & Hamdi, 2022) aims at investigating the perceptions of students on the utilization of AI while selecting educational films on the YouTube platform. This research focusses on the urban area of Al Ain and examines the perspectives and affection of students with regards to AI-related content available on the YouTube platform. The findings from the study underscore the growing significance of online platforms like YouTube, as educational resources for both educators and learners. The author acknowledged that the social media platforms including You Tube have undergone significant transformations and have had a positive impact on various facets of our lives, including the domain of education. People majorly link social media with communication and pleasure, but it also plays a substantial role as an educational platform. This study focuses on the analysis of individuals' impression of AI as portrayed in educational films available on the YouTube platform. Through the examination of the preferences and views of students residing in Al Ain City, the researchers have provided insights into the manner in which AI is seen within the realm of instructional content. This study holds significance as it offers significant insights into the efficacy and influence of AI-related educational videos available on the YouTube platform. The most useful recommendation of this study is regarding the need to further investigate the role of AI for ensuring content relevancy, which if done effectively can play a significant role in the modern learning and teaching styles.

Another study conducted by P. Limna and others from Rangsit University of Thailand titled as "The use of ChatGPT in the digital era: Perspectives on chatbot implementation" has been analysed for this review article. The primary objective of this study is to investigate the view point of educators and students in regard to the utilization of ChatGPT in the field of education in this digital age (Limna et al, 2023). The results of the study indicate that majority of the educators and students were in favour of using ChatGPT as a tool in the educational settings. The results reveal that this chatbot has been considered as a valuable tool for delivering prompt feedback, addressing inquiries, and offering assistance to the students. Educators have observed that the ChatGPT has the potential to lessen their workload by addressing familiar inquiries thus allowing them streamline their effort towards more advanced and complex responsibilities. Regardless of the positive views there were concerns from the participants regarding the credibility of information dispersed by the chatbot as well as the probable negative affect of interpersonal engagement among the students and the educators. Other prominent issues of concern were privacy and data security. The findings could be utilised globally to assist educators and policymakers in constructing well- informed decisions for proper application of ChatGPT in the educational domain.

Another study titled "Pre-Service Teachers' Concerns about Social Robots in the Classroom: A Model for Development" have been carried out to understand the image of robot incorporation both in the educational areas as well as in the social space (Istenic et al, 2021). This study indicates the need for further research and development regarding the guidelines and frameworks to manage the issues emerging from and the challenges associated with the integration of social robots in educational settings. A mixed feelings and concerns about social robots in the classroom have been observed among the pre-service teachers. Some of them have negative opinion regarding the social robots as they may affect human-human interactions and the role of teachers in the classroom. They perceived the social robots as a technological tool that may replace human teachers and restrict the development of social and emotional skills in students. On the other hand, some pre-service teachers identified the potential benefits of social robots in improving student's engagement and motivation, as well as supporting personalized learning experiences. The study suggests that the pre-service education is crucial in shaping teachers' beliefs and attitudes towards the social robots. Such a platform can provide the pre-service teachers various opportunities to develop a balanced perspective and make informed decisions about the use of social robots for their future teaching practices. The analysis of the study avails a detailed insight into the attitudes and concerns of pre-service teachers, which could aid in better designing and implementation of teacher education programs. Its results could help the policy-makers to frame appropriate policies for effective use of social robots in the classroom.

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AI Tools in Higher Education

The utilization of AI tools in the higher education sector has experienced a distinguished surge in prevalence, presenting the possibility of a transformative impact on the overall learning pattern of students. AI tools have found application in mentorship programs which displays the viability to offer individualized assistance and encouragement to students, assisting their navigation of both academic and professional trajectories (Kobis & Mehner, 2021). These AI systems have the capability to analyse student data and offer customized recommendations, thereby enhancing the overall efficiency of mentoring programs. In order to ensure an appropriate and ethical facilitation of AI in mentoring, it is highly significant to address ethical components such as confidentiality, transparency, and openness to experience.

AI tools have shown promising outcomes with regard to the health-related disciplines. Taking into consideration the health higher education, AI has a great potential to improve the learning process and they yield better outcomes, specifically in laboratory-based instructional settings (Sousa et al, 2021). These tools offer virtual simulations, individualized feedback, and customized learning experiences, which help students in engaging in realistic and interactive practice along with gaining information of their application. Thus, it can be implied that AI technology is an advantageous prospect for health higher education, as it offers numerous opportunities and innovations that can effectively increase the engagement of student in their learning activity.

The artificial intelligence techniques also provide specially designed instruction for various domains of higher education. According to Hannan and Liu, these systems have the ability to examine student data, including learning preferences and performance, through which they could deliver customized content and recommendations (Hannan & Liu, 2023). The AI technology facilitates such a system that could address the specific strengths and weaknesses of each student. Along with all the pros mentioned above, it is equally important to acknowledge that the application of AI techniques presents several obstacles and issues. Hence, for responsible and equitable use of AI in educational environments, it is indispensable to provide careful consideration to ethical issues, including but not limited to data privacy, algorithmic bias, and the effects on human interaction (Kobis & Mehner, 2021). Furthermore, in order to have successful implementation of AI tools it is necessary to provide adequate training and support to the educators so that they can be proficient enough to employ these technologies and optimize their benefits within the educational context (Hannan & Liu, 2023).

Conclusion

Recent progress in the use of AI tools in education has shown promising advancements across various domains. The analysis of researches done so far along with the ongoing efforts have recommended that the integration of AI in education could be done but there is a need to incorporate AI training into curricula. AI has also been introduced to explore its impact on students' learning experiences (Dao et al., 2022). The importance of AI education in middle school technology education has also been recognized, with studies focusing on AI competency development (Park & Kwon, 2023). Overall, recent progress in the use of AI tools in education has demonstrated their potential to enhance learning experiences and improve educational outcomes.

Recommendation

The advancements in AI tools in education presents various implications for future research and practice. First and foremost, further researches are required in different educational contexts to explore the effectiveness and impact of AI tools. This includes investigating the pedagogical approaches and strategies that can maximize the benefits of AI tools in enhancing learning outcomes. Along with this, researches should focus on understanding the ethical considerations and significance of using AI tools, ensuring responsible and equitable use.

Taking the educational practices into consideration, educators and institutions should consider integrating AI tools consciously into their teaching practices and curricula. To attain this aim there is a need for appropriate training and support for educators so that they could effectively utilize AI tools and integrate them into their

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instructional strategies. Accessibility and inclusivity of AI tools are also the focal points, which will help in discarding potential biases and promoting equal opportunities for all learners.

Moreover, collaboration between researchers, educators, and developers is of great importance to drive innovation and improve the design and functionality of AI tools in education. Such collaboration can address the peculiar needs and challenges in different educational contexts and advance the development of AI tools that align with educational goals and values.

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