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Research Article

RECENT ADVANCES IN ARTIFICIAL INTELLIGENCE (AI) IN EDUCATION, ETHICAL CONCERNS AND IMPLICATIONS

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Abstract

Artificial intelligence (AI) leverages mathematical algorithms to emulate human cognitive abilities, leading to a transformative impact on the education sector. Educators are at the front lines of implementing AI in the classroom. Recent scientific studies demonstrate the capacity of AI, particularly generative models like ChatGPT, to reshape various aspects of education. In a recent study, we showcased that the integration of both artificial intelligence, specifically ChatGPT, and interactive learning activities significantly enhances the engagement levels of STEM students enrolled in a General Biology course. Furthermore, this combined approach not only boosts student engagement but also demonstrates an improvement in their overall performance within the course. Building on preliminary studies, the objective of this review article is to delineate the diverse applications of generative AI in education. To achieve this objective, we conducted a thorough search across scientific databases, including Google Scholar, Science Direct, government websites, and other resources, to collect relevant papers. Our findings underscore the contributions of generative AI, exemplified by ChatGPT, in enabling students to generate innovative text for written assignments, providing personalized feedback, facilitating adaptive learning, enhancing accessibility to education by eliminating barriers for individuals with disabilities, and supporting research endeavors.

Keywords: Artificial intelligence, Education, ChatGPT, AI ethical concerns and implications.

INTRODUCTION

Artificial Intelligence (AI) utilizes mathematical algorithms to replicate human cognitive functions, revolutionizing the landscape of the education sector. The strategic importance of AI in education is increasingly acknowledged (Perrotta *et al.,* 2021; Chiu *et al.,* 2022). Scientific reports emphasize AI's capacity as a potent learning tool, easing the burdens on educators and learners, thereby enhancing the overall educational experience (Walczak & Cellary, 2023; Sumakul *et al.,* 2022; Kamalov *et al.,* 2023). Educators are at the forefront, leveraging AI tools, including generative models like ChatGPT, to reshape various facets of the educational process. However, the integration of AI in education presents many challenges. Ethical and societal considerations include concerns related to privacy, bias, lack of human interaction have been highlighted in the literature. Furthermore, successful incorporation of AI demands a profound understanding of both the technology and the intricacies of the learning process. Despite these challenges, the potential of AI to personalize and enhance student learning experiences is evident.

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In a recent study, we showcased that the integration of both artificial intelligence (AI), specifically ChatGPT, and interactive learning activities (animations, video analysis, computerized homework, innovative group discussions, study partners, and practice tests) significantly enhances the engagement levels of STEM students enrolled in a General Biology course. Furthermore, this combined approach not only boosts student engagement but also demonstrates an improvement in their overall performance within the course (Tchakoua *et al.,* 2023). Another study from our research laboratory demonstrated that interactive learning activities such as video analysis, animations, innovative group discussions, and computerized Home Works significantly enhances the engagement levels of STEM students enrolled in an anatomy and physiology course (Yedjou *et al.,* 2022). We currently employ "Lumen5" for crafting innovative videos showcasing various class activities, including video announcements, presentations, and recorded lessons. Lumen5 stands out as an AI-driven platform, enabling businesses and content creators to generate compelling and polished video content. Its user-friendly interface and powerful features streamline the video creation process, enabling users to effortlessly convert written content into captivating visual narratives. Emerging areas of AI in education, including virtual reality education and educational game design, hold substantial promise for enhancing student engagement and improving

learning outcomes(Vijay Kumar Vyas, 2023), (Wang *et al.,* 2023). Building on preliminary studies, the objective of this review article is to delineate the diverse applications of generative AI in education, acknowledging both its transformative potential and the critical considerations required for responsible implementation.

Approaches

This review delves into articles published between 2020 and 2023 in the Web of Science database, specifically focusing on the advancements of AI in education. Systematic literature searches were executed on peer-reviewed publications using key terms such as artificial intelligence, education, ChatGPT, and ethical issues. These searches spanned scientific databases, including Google Scholar, Science Direct, government websites, and other resources, to gather pertinent papers. The research aims to address the following questions: (1) What has been the recent evolution of AI in the field of education? (2) What advantages does AI offer in educational settings? (3) What ethical considerations surround the use of AI in education?

RESULTS AND DISCUSSION

The results of this review article highlight the contributions of generative AI, as exemplified by ChatGPT, in empowering students to create innovative text for written assignments, offering personalized feedback, facilitating adaptive learning, improving accessibility to education by removing barriers for individuals with disabilities, supporting research efforts and data analysis. Figure 1 highlights the potential benefits of AI in education.

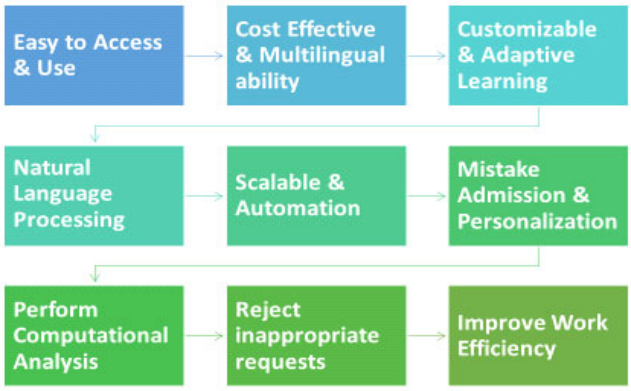

Figure 1. Potential benefits of AI in education

Recent evolution of artificial intelligence in the field of education

In recent years, natural language processing (NLP) has achieved notable progress in diverse practical applications, including speech and entity recognition, summarization, language translation, and text generation (Aljanabi, 2023; Rahman & Watanobe, 2023). Representing a groundbreaking large language model (LLM), ChatGPT excels in generating text while maintaining a human-like conversational style (Xiao *et al.,* 2023). Developed by OpenAI, ChatGPT, the AI text-generating chatbot, has gained global acclaim. Initially designed to boost productivity in tasks like essay and code writing through concise text prompts, it has evolved into a versatile tool adopted by over 92% of Fortune 500 companies to address a wide range of needs (Minelle & Stolfi, 2023; Darkhabani *et al.,* 2023).This state-of-the-art artificial intelligence chatbot employs advanced deep learning techniques, undergoing extensive training on a vast corpus of online text data(Kung *et al.,* 2023), (Rudolph *et al.,* 2023). GPT, or Generative Pre-trained Transformer, empowers the chatbot to comprehend human-provided inputs and generate response text closely resembling human language. This capability renders it exceptionally challenging to distinguish between text generated by a human and that produced by the AI (Kung *et al.,* 2023), (Thorp, 2023).

Advantages of AI in Educational Settings

A recent scientific study demonstrated the programming capabilities of ChatGPT for solving numerical problems by generating code, debugging and improving code written by humans, completing code, and rewriting code in different programming languages(Malinka *et al.,* 2023). Other studies demonstrated the effectiveness of ChatGPT to handle programming assignments, exams, and homework using collected data (Kashefi & Mukerji, 2023), (Jaber *et al.,* 2023).Presently, ChatGPT plays a pivotal role in supporting teaching and learning. It guides learners through their educational journey in a timely manner, generates interactive learning materials such as computerized tests, engaging tasks, videos, and animations (Kasneci *et al.,* 2023). Additionally, it assists teachers in evaluating student work and providing constructive feedback (Gonsalves, 2023). Moreover, ChatGPT facilitates online discussions and collaborations between instructors and students (Ali *et al.,* 2023). Furthermore, it contributes to the establishment of individualized instructional resources and study plans tailored to each learner's unique requirements and interests (Baidoo-Anu & Owusu Ansah, 2023). Many benefits of using AI in education are listed in figure 1.

AI Ethical Concerns and Implications in Education

There is still a lot to learn about the capabilities and limitations of AI in education. Therefore, careful consideration should be given to the ethical implications of employing generative AI, like ChatGPT, in education. The ethical challenges arising from AI are a significant worry for researchers and educational practitioners alike. Although AI has notably progressed recently, primarily due to more affordable processing and increased data accessibility, there remains a significant risk of individual student data being exposed, shared, or misused. This ongoing concern necessitates constant vigilance from AI engineers as they navigate the access, evaluation, and sharing of big data and the outcomes of data analysis (Pilot, 2020), (Alam & Mohanty, 2022), (“Chinese Higher Education Entering the Age of Artificial Intelligence: Opportunities, Challenges and Prospects,” 2023). Moreover, AI in education presents additional challenges, encompassing issues related to bias, privacy, potential job displacement due to automation, security risks from hacking, and a lack of human-like creativity and empathy. For example, if the training data show bias towards a particular group of the population, the resulting model may produce unfair and discriminatory outputs. Hence, ensuring diversity and balance in the training data is imperative. It's important to be aware that AI language models, like ChatGPT, can have the capacity to generate fake news, hate speech, and other harmful content. Table 1 summarizes the major ethical concerns of AI in education.

Table 1. Summary of AI ethical concerns in education

AI ethical concerns	Examples of ethical concerns
Data Collection and Storage	Use of AI in education can collect and store large student data. If these data are not properly secured and protected, the privacy of individuals will be exposed.
Informed Consent	Students and parents may not always be fully aware of the extent of data collection and how it will be used. Therefore, obtaining informed consent is essential to ensure that individuals understand the implications of sharing their data.
Bias and Discrimination	If AI systems in education are trained on biased data, they can exacerbate existing inequalities and biases.
Profiling and Tracking	AI systems can track and analyze students' behavior or create student profiles that could have unintended consequences
Security Risks	Educational institutions need to implement robust security measures to protect the data collected by AI systems in order to avoid unauthorized access to individual's information.
Lack of Regulation	The absence of clear guidelines and standards can create a legal and ethical concerns which may cause damage to people privacy.
Transparency	AI algorithms used in education are often complex and may lack transparency.
Long-term Impact	The data collected by AI systems over time can create comprehensive profiles of individuals. Concerns arise about the potential long-term impact on students' privacy if the data are used beyond the educational context.

Addressing AI Ethical Concerns in Education

The integration of AI in education introduces a range of ethical and societal considerations that necessitate careful examination. Addressing these ethical concerns requires a collaborative effort involving various stakeholders that should include policymakers, scientists, educators, developers, and other participants in the AI ecosystem. To navigate the complexities, all stakeholders should collectively explore the potential implications of AI in education and formulate guidelines that prioritize crucial aspects such as student privacy, regulation, security, fairness, and transparency. Crucially, involving students in the development and implementation of AI-assisted systems is paramount to ensuring alignment with community values and needs. Several actionable steps that can be taken to address these ethical concerns include the following: (1) Stakeholders should collaborate to establish comprehensive ethical frameworks and guidelines. These should encompass a shared vision, principles, and values, serving as a foundation for the ethical design, deployment, use, and impact of AI in education. (2) Implementing ethical practices and standards. This can be done by translating ethical frameworks into tangible actions, stakeholders should establish and adhere to ethical practices and standards. This operationalization ensures that AI systems in education consistently exhibit ethical performance and behavior. (3) Conducting rigorous testing and evaluations of AI-assisted systems are essential to guarantee their fairness, lack of bias, and overall effectiveness. This process should be ongoing to address emerging issues and refine system performance continually. (4) Enhancing ethical governance and regulation: This can be done by providing a robust legal and institutional framework, stakeholders must focus on strengthening ethical governance and regulation. This approach ensures the accountability and responsibility of all AI actors involved in education. By adopting these measures, stakeholders can foster the responsible and ethical use of AI in education, safeguarding the well-being of students and maintaining the integrity of educational processes.

Conclusion

This review article centers on ChatGPT, a recently launched large language model by OpenAI. The exploration within delves into the manifold applications of generative AI, focusing particularly on ChatGPT in the field of education. Our investigation reveals that ChatGPT empowers students by enabling them to create innovative text for written assignments, provides personalized feedback, facilitates adaptive learning, removes barriers for individuals with disabilities, and contributes to research initiatives.

This study highlights that the integration of AI in education has the potential to personalize and enhance student learning experiences, as indicated by a variety of AI-assisted systems developed for personalized learning, adaptive testing, intelligent tutoring, learning analytics, and content creation (Black, 2023), (Rahm & Rahm-Skågeby, 2023). These systems leverage AI to tailor the learning experience to the unique needs of each student, ultimately aiming to improve learning outcomes (Li & Yang, 2022), (Mendapara *et al.,* 2021). However, further research is imperative to fully comprehend the capabilities and limitations of AI in education. Addressing ethical and societal implications, such as concerns about privacy and bias, implementing ethical practices and standards, enhancing ethical governance and regulation are crucial for the responsible integration of AI in educational settings(Ali *et al.,* 2023), (Cotton *et al.,* 2023), (Michel-Villarreal *et al.,* 2023).

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REFERENCES

Alam, A., & Mohanty, A. (2022). Foundation for the Future of Higher Education or 'Misplaced Optimism'? Being Human in the Age of Artificial Intelligence. *Communications in Computer and Information Science*, *1737 CCIS*. https://doi.org/10.1007/978-3-031-23233-6_2

Ali, J. K. M., Shamsan, M. A. A., Hezam, T. A., & Mohammed, A. A. Q. (2023). Impact of ChatGPT on Learning Motivation: Teachers And Students' Voices. *Journal of English Studies in Arabia Felix*, *2*(1).

Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in

Promoting Teaching and Learning. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4337484

Black, J. (2023). Past, Present and Tackling the Future of Artificial Intelligence (AI) in Education: Maintaining Agency and Establishing AI Laws. *Open Journal of Social Sciences*, *11*(07). https://doi.org/10.4236/jss.2023.117031

Chinese Higher Education Entering the Age of Artificial Intelligence: Opportunities, Challenges and Prospects. (2023). *International Journal of New Developments in Education*, *5*(17). https://doi.org/10.25236/ijnde.2023.051708

Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*.https://doi.org/10.1080/14703297.2023.2190148

Gonsalves, C. (2023). On ChatGPT: what promise remains for multiple choice assessment? *Journal of Learning Development in Higher Education*, *27*. https://doi.org/10.47408/jldhe.vi27.1009

Jaber, M. A., Beganović, A., Almisreb, A. A., & Info, A. (2023). Methods and Applications of ChatGPT in Software Development: A Literature Review. *Southeast Europe Journal of Soft Computing*, *12*(1).

Kashefi, A., & Mukerji, T. (2023). ChatGPT FOR PROGRAMMING NUMERICAL METHODS. *Journal of Machine Learning for Modeling and Computing*, *4*(2). https://doi.org/10.1615/jmachlearnmodelcomput.2023048492

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. In *Learning and Individual Differences* (Vol. 103). https://doi.org/10.1016/j.lindif.2023.102274

Kung, T. H., Cheatham, M., Medenilla, A., Sillos, C., De Leon, L., Elepaño, C., Madriaga, M., Aggabao, R., Diaz-Candido, G., Maningo, J., & Tseng, V. (2023). Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digital Health*, *2*(2). https://doi.org/10.1371/journal.pdig.0000198

Li, P., & Yang, J. (2022). PSO Algorithm-Based Design of Intelligent Education Personalization System *Computational Intelligence and Neuroscience*, *2022*. https://doi.org/10.1155/2022/9617048

Malinka, K., Peresíni, M., Firc, A., Hujnák, O., & Janus, F. (2023). On the Educational Impact of ChatGPT: Is Artificial Intelligence Ready to Obtain a University Degree? *Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE*, *1*. https://doi.org/10.1145/3587102.3588827

Mendapara, H., Digole, S., Thakur, M., & Dange, A. (2021). AI Based Healthcare Chatbot System by Using Natural Language Processing. *International Journal of Scientific Research and Engineering Development*, *4*(2).

Michel-Villarreal, R., Vilalta-Perdomo, E., Salinas-Navarro, D. E., Thierry-Aguilera, R., & Gerardou, F. S. (2023). Challenges and Opportunities of Generative AI for Higher Education as Explained by ChatGPT. *Education Sciences*, *13*(9). https://doi.org/10.3390/educsci13090856

Pilot, A. (2020). Book Review of Robot-Proof: Higher Education in the Age of Artificial Intelligence. *Journal of the European Honors Council*, *4*(1). https://doi.org/10.31378/jehc.131

Rahm, L., & Rahm-Skågeby, J. (2023). Imaginaries and problematisations: A heuristic lens in the age of artificial intelligence in education. *British Journal of Educational Technology*, *54*(5). https://doi.org/10.1111/bjet.13319

Rudolph, J., Tan, S., & Tan, S. (2023). War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education. *Journal of Applied Learning and Teaching*, *6*(1). https://doi.org/10.37074/jalt.2023.6.1.23

Tchakoua, C. T., Latinwo, L., Tchounwou, M., Yedjou*, C. G., & Liu, H. (2023). Leveraging Artificial Intelligence and Interactive Learning Approaches for Enhanced Student Achievement and Perspectives in a Biology Course. *International Journal of Science Academic Research*, *04*(12), 6.

Thorp, H. H. (2023). ChatGPT is fun, but not an author. In *Science* (Vol. 379, Issue 6630). https://doi.org/10.1126/science.adg7879

Vijay Kumar Vyas. (2023). Exploring the Potential of Metaverse Technology. *International Research Journal of Infinite Innovations in Engineering and Technology*, *10*(04 SE-Articles).

Wang, J., Chen, S., Liu, Y., & Lau, R. (2023). Intelligent Metaverse Scene Content Construction. *IEEE Access*, *11*. https://doi.org/10.1109/ACCESS.2023.3297873

Yedjou, C. G., Latinwo, L. M., Alo, R., Odewumi, C. O., & Reaves, P. Y. (2022). Technology-enhanced student learning, improved engagement, and performance in an anatomy and physiology course. In *Experiences and Research on Enhanced Professional Development Through Faculty Learning Communities*. https://doi.org/10.4018/978-1-6684-5332-2.ch008

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