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To cite this article:

Noroozi, O., Soleimani, S., Farrokhnia, M., & Banihashem, S.K. (2024). Generative AI in education: Pedagogical, theoretical, and methodological perspectives. *International Journal of Technology in Education (IJTE), 7*(3), 373-385. https://doi.org/10.46328/ijte.845

International Journal of Technology in Education
2024, Vol. 7, No. 3, 373-385 https://doi.org/10.46328/ijte.845

Generative AI in Education: Pedagogical, Theoretical, and Methodological Perspectives

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Article Info

Article History

Received:
12 January 2024
Accepted:
06 May 2024

Keywords

Artificial Intelligence
AI
ChatGPT
Education
Generative AI
GenAI
Learning

Abstract

Recently, ChatGPT, a cutting-edge large language model, has emerged as a powerful Generative Artificial Intelligence (GenAI) tool with the capacity to influence education. ChatGPT provides ample opportunities for learners, researchers, educators, and practitioners to achieve the intended learning outcomes in various disciplines. This special issue examines the diverse applications and implications of GenAI tools including ChatGPT in education, highlighting their potential to enhance teaching and learning across various contexts. Key findings from seventeen studies collected in this special issue demonstrate that GenAI tools can significantly improve educational outcomes by providing personalized feedback, facilitating language learning, and supporting both qualitative and quantitative research methodologies. The findings emphasize GenAI's capacity to increase learner engagement and motivation, yet also underscore the need for robust ethical guidelines and human oversight due to potential issues with privacy, bias, and accuracy. This special issue also highlights the challenges GenAI faces, such as limitations in contextual understanding and its impact on critical thinking skills. In addition, it provides a foundational framework for exploring effective and responsible GenAI integration, aiming to enrich educational experiences. We conclude that future research should focus on the longitudinal effects of GenAI tools on learning outcomes, developing ethical frameworks for their use, and ensuring their adaptability to diverse learner populations to promote inclusive educational practices.

Introduction

One intriguing avenue within the realm of Artificial Intelligence (AI) is Generative AI (GenAI), which delves into crafting models adept at generating fresh content spanning images, text, and music, imbued with a semblance of human-like creativity and diversity. The human-like productions of GenAI have made it possible for end-users to generate content for educational purposes as well (García-Peñalvo, 2023). GenAI has the capability to create course content and teaching strategies tailored to learners' learning data and behavior patterns, and offer personalize learning experiences like adapting the course difficulty and content based on learners' learning progress and performance or enhancing their effectiveness and efficiency in the learning process (Huang, 2021). Furthermore, GenAI can offer educators efficient, accurate, and impartial assessment services by automating the

grading of homework (González-Calatayud et al., 2021). Other studies have shown the potential of GenAI to be employed as a feedback source in education (Banihashem et al., 2024; Steiss et al., 2024).

While advocates of GenAI praise its ability to support education for instance in terms of providing adaptive and personalized environments and improving retention of knowledge (Kadaruddin, 2023), there are some concerns about the ethical considerations of GenAI, as well as its potential negative effects on assessment practices, scientific integrity, and learners' higher-order thinking skills (Farrokhnia et al., 2023). In addition, the reliability and validity of the generated content have always been debated among both educators and learners (Wach et al., 2023). Both educators and learners have little knowledge of how to determine the reliability level of the content they are dealing with in their education. Furthermore, there is concern regarding the use of GenAI in terms of ethical regulations and codes of conduct in different contexts (Jones & Wynn, 2023; Kurni et al., 2023). Moreover, there is no solid empirical evidence of whether GenAI sparks inspiration, promotes creative thinking, increases collaboration (Putjorn & Putjorn, 2023) in the learning process, or whether GenAI decreases learners' critical thinking and academic integrity (Farrokhnia et al., 2023). Furthermore, it is not clear to what extent and how GenAI can be applied in educational settings to improve students' higher-order skills such as argumentation, critical thinking, reasoning which are essential objectives in education (Bayat et al., 2022; Noroozi et al., 2012, 2018; Valeroharo et al., 2019, 2022)

Considering all these conflicts implies that the use of GenAI in education can be a complex issue. This complexity presents a big challenge for the learning sciences community as they try to understand how to efficiently and effectively use GenAI to help learners learn better and regulate their learning. Despite progress in the theory and concept of GenAI, the field lacks a unified perspective on recent advancements in this innovative tool. The rapid advancement of GenAI in education, and the swift growth of its tools such as ChatGPT, Gemini, and CoPilot offer ample opportunities to enhance learners' learning through collaborative learning, computational thinking, educational psychology, and learning analytics. Taking all this into account, it is essential to explore how to best utilize AI tools in education to enhance current practices.

This special issue pushes the boundaries of our understanding of GenAI by displaying its diverse applications and transformative potential in educational settings. The articles within this issue offer a comprehensive exploration of GenAI from both theoretical and practical perspectives, aiming to foster international dialogue and collaboration in the field. This collection includes a variety of conceptual, theoretical, methodological, and empirical studies that highlight GenAI's impact on pedagogical strategies, curriculum development, educational assessment, and language learning. This special issue provides insights into both the benefits and challenges of GenAI, including its role in enhancing personalized learning experiences and its limitations related to ethical concerns and the accuracy of AI-generated content. The findings presented aim to chart future research directions and practical applications, ensuring that GenAI integration in education is both effective and responsible.

Contributors to This Special Issue

This special issue begins with a paper by Theelen, Vreuls, and Rutten (Theelen et al., 2024) who investigated the

capabilities of LLMs, such as ChatGPT, in conducting qualitative data analysis concentrating on open, axial, and selective coding, as well as the identification of patterns and the assessment of inter-rater reliability. The goal is to explore whether ChatGPT can effectively code both structured and unstructured qualitative data and assess inter-rater reliability by providing researchers with valuable insights to enhance their qualitative analysis using AI techniques. They argue that while AI enhances qualitative analysis, LLMs like ChatGPT have coding limitations. To evaluate ChatGPT's coding capabilities compared to human coders, they used three datasets with varying contexts (an unstructured interview, structured learners' evaluation, and a generated dataset on listening levels). ChatGPT demonstrated competence in tasks ranging from free to guided labeling, inter-rater reliability, and classification accuracy across datasets focused on curriculum development, learner evaluations of educator behavior, and listening levels in a hypothetical meeting. The findings underscore ChatGPT's potential in text coding, stressing the need for clear prompts and definitions to maximize its performance.

The study by Gokcearslan, Tosun, and Erderim (Gökçearslan et al., 2024) employed a systematic literature review on the educational use of AI chatbots, focusing on methodological aspects and the evaluation of their benefits and drawbacks for learners and educators. They identify a growing interest in AI chatbots across educational sectors, prompting an analysis of 37 articles from Web of Science's SSCI-indexed journals. This analysis categorizes articles by several criteria, including subject, methodology, and sample details. The review process involved initial classification by researchers, expert resolution of uncertainties, and cross-checks for accuracy. Key findings reveal: (1) Learners benefit from AI chatbots through increased motivation, improved language skills, and better learning outcomes. (2) Educators appreciate chatbots for cost savings, workload reduction, and enhanced learner engagement, though challenges include interaction limitations, potential inaccuracies, and personalized feedback concerns. (3) Publication trends show a yearly increase in AI education research, with "chatbot," "education," and "AI" being common keywords. (4) Quantitative, mixed, and qualitative methodologies are prevalent, with various research designs employed. (5) Data analysis often uses frequency tables, mean calculations, and graphical methods. (6) The primary research subjects are undergraduate learners, with studies also covering other educational levels.

Giray, Jacob, and Gumalin (Giray et al., 2024) conducted a SWOT analysis for utilizing ChatGPT in scientific research. They argue that AI has significantly impacted academics and education. They add that although scholars, researchers, and learners use LLMs like ChatGPT for various tasks, such as writing essays, speeches, summarizing texts, and brainstorming, its role in supporting research is still debated. This debate includes concerns about privacy, bias, and the importance of human judgment. Despite ethical issues, there is a suggestion that guidelines for using AI tools in scientific work should be developed, focusing on their accuracy and reliability. As a result, the aim of this issue is to explore the SWOT of using ChatGPT in academic research, highlighting its contribution to modern research methods. The analysis shows that the strengths of using ChatGPT in research are a vast knowledge base, language proficiency, information retrieval, and continuous learning. While, the weaknesses are a lack of contextual understanding, overreliance on training data, Inability to verify information, and constrained critical thinking abilities. In addition, opportunities are assisting literature reviews, improving collaborative brainstorming, enabling language translation and interpretation, and knowledge dissemination. Finally, the threats are plagiarism, ethical issues, misinformation, disinformation, increase in higher-order cognitive thinking.

Polat, Topuz, Yildiz, Taslibeyaz, and Kursun (Polat et al., 2024) adopted a bibliometric and network analysis of 212 Scopus-indexed academic articles to track educational research progress on ChatGPT. They explore collaboration patterns, citation trends, and evolving research interests, positioning ChatGPT as a versatile educational tool aiding in language learning, research, administration, assessment creation, essay writing, and language translation. It also facilitates personalized learning and reduces educator workload. Despite its growing application, earlier analyses lacked a comprehensive framework. This study aims to outline the research landscape, spotlight influential work, and forecast future trends. It shows a predominance of multi-authored studies and significant journal contributions, particularly in medical education, focusing on ChatGPT's pros and cons. The research has strong roots in the US and the UK, with noteworthy citation impacts also in Belgium, Korea, and Canada. The study categorizes key research themes into computational intelligence, human learning, language processing, and conversational agents, with "Artificial intelligence," "Human," "ChatGPT," and "Natural language processing" as common keywords. This highlights ChatGPT's integral role in global educational development, especially in healthcare and conversational AI.

Das and J.V. (2024) explored how higher education learners perceive utilizing ChatGPT in academics, analyzing the factors that affect its acceptance and exploring its advantages, limitations, and ethical issues. Their study on undergraduate, postgraduate, and doctoral students revealed that learners mainly use ChatGPT for a short time for research, and do not rely on it too much. They like how it helps them save time, understand hard topics, and feel more confident in their studies. However, they are worried about whether the information is accurate and how it might stop them from thinking creatively or critically. Learners also have concerns about cheating and fairness with using ChatGPT. They find ChatGPT easy to use and helpful, but they are not sure about its reliability. These views are the same across different genders and study areas, showing that learners are generally careful, but see the value in using ChatGPT for learning.

Karaman and Goksu (2024) examined whether the academic achievement of primary school students in math increases when the lesson plan is designed by ChatGPT. To do so, they conducted a quasi-experimental design and measured the results with a multiple-choice quiz. The results show that although the score difference in post-tests between the control and experimental group was not significant, the academic achievement among learners taught with the ChatGPT’s lesson plan was higher. Furthermore, this research provides valuable insights for educators and practitioners in designing effective lesson plans with ChatGPT and similar AI models for educational use. ChatGPT and similar language models are identified as potentially facilitative and beneficial tools in the educational process for both educators and learners. However, given ChatGPT's limitations as a machine, including the risk of disseminating outdated or incorrect information and issues related to bias and ethical concerns, the study suggests that educational outcomes could be enhanced if experts regularly review and refine the AI-generated content before implementation.

Mabuan (2024) investigated the perception of English language educators on the integration of ChatGPT as an instructional tool with the aim of vocabulary expansion, writing practice, and fluency and communication skills in speaking. A mixed-method approach has been conducted to study educators in public and private elementary schools, high schools, and colleges. Findings demonstrate that some potentials of ChatGPT are translating texts,

language comprehension, and development, doing conversational practices, and making language learning accessible for a wider range of learners. In addition, it can be utilized as an educational device to enhance learners' comprehension, find vocabulary definitions, and generate ideas. However, risks and limitations in using ChatGPT in English language teaching are the possibility of cheating and plagiarism, low contextual comprehension, dependency and decrease of creative thinking, and reliability and validity of the information. Considering both benefits and concerns regarding the role of ChatGPT in language learning classrooms, and the general positive attitude of educators in this field, highlight the importance of educators' technological proficiency and knowledge in teaching practices.

Hammoda (2024) applied an effectual logic to implement ChatGPT for a founding team activity within an entrepreneurship course through a personalized and interactive approach. To do so, three student groups, each with unique business concepts, interacted with ChatGPT by inputting varied keywords and detail levels in their promptings to receive advice on critical team roles, responsibilities, and equity distribution. The aim of prompting ChatGPT was to obtain recommendations from its database regarding vital founding team members, their competencies, and the division of equity among them, tailored to diverse startup business models with unique features. Following their presentations, the class participated in a group discussion. A survey was conducted afterward to evaluate the learners' perception and the effectiveness of this teaching approach. We conclude that GenAI, including ChatGPT, can be successfully integrated into the educational framework, positioning it as a potentially crucial bridge between entrepreneurship education and entrepreneurial practice.

Famaye, Bailey, Adisa, and Irgens (Famaye et al., 2024) examined high school students' attitudes towards either incorporating or prohibiting ChatGPT in educational settings, using the Technology Acceptance Model as a framework. This investigation utilized discussions from a well-known media platform to gather insights. The research highlighted that learners' views on ChatGPT in schools were shaped by their evaluation of the technology's utility, their personal interactions with it, current technology trends in society, and ethical concerns. The study revealed that learners believe ChatGPT could be introduced into classrooms in ways that are both safe and effective. They recommended the development of specific usage guidelines, as well as measures for monitoring its use and providing proper training for both learners and educators on how to use ChatGPT responsibly. Furthermore, some learners expressed concerns about fairness, particularly regarding the reliance on ChatGPT for completing homework, suggesting the need for clear regulations and oversight mechanisms. The perspectives of the learners were generally in line with those of educators and policymakers, yet they also reflected distinct views that addressed their particular requirements and experiences. The study underscores the importance of including learners in the decision-making process concerning AI integration in schools, alongside other stakeholders. It also suggests that educators may need to consider new methods of assessment that equitably judge the performance of learners who use AI tools and those who do not.

Adeyele and Ramnarian (2024) explored the extent to which educators are familiar with ChatGPT and its application within the inquiry-based learning (IBL) 5E model, as well as educators' perceptions and experiences of integrating ChatGPT into this educational framework. The purpose of their research is to understand the complex dynamics of adopting new technologies in educational settings. Their findings reveal that while some

educators have successfully incorporated ChatGPT into the IBL 5E model, benefiting from its use, others remain at different levels of awareness and implementation. The enthusiasm and curiosity some educators show towards ChatGPT indicate a potential for its wider acceptance as they become more acquainted with its functionalities within IBL. This observation supports the notion that the adoption of technology in education typically follows a gradual, phased approach, where pioneering users lead the way for its expanded integration.

Sapkota and Bondurant (2024) conducted a self-reflective investigation to analyze the quality and cognitive challenges of ChatGPT-generated tasks on fraction multiplication using the area model approach. The researchers practiced reflexivity to align their identities with the research setting, discovering that the tasks generated by ChatGPT were predominantly procedural and lacked cognitive depth. Despite providing ten different prompts, ChatGPT failed to produce any tasks that employed the area model for fraction multiplication, instead of generating procedural tasks. These tasks often contained conceptual inaccuracies and were sometimes vague in instruction. Furthermore, ChatGPT operated under the assumption that learners already had a basic understanding of fraction addition before tackling multiplication. The findings suggest that educators cannot depend solely on ChatGPT for creating tasks that are cognitively demanding using the area model approach. The study ultimately concludes that while ChatGPT cannot replace human educators, it can serve as a useful auxiliary tool or a cognitive partner in educational settings.

Rahimi and Aghabarari (2024) investigated the effects of incorporating 360° monoscopic VR videos as preparatory activities for listening tasks among learners of English as a Foreign Language (EFL). This study included both control and experimental groups following a comprehension-based model, which involved a cycle of activities before, during, and after listening. The findings suggest that using immersive VR environments as a pre-listening exercise can significantly enhance the efficacy of listening instruction. Moreover, such innovative methods in EFL learning foster greater listening skill development, increase learner motivation, decrease anxiety, and heighten learner interest and participation in listening activities.

Kim, Majdara, and Olson (Kim et al., 2024) explored the effects of using ChatGPT on the lab report writing skills of undergraduate engineering students, focusing on areas such as rhetorical knowledge, critical thinking, composition, knowledge of conventions, and writing processes. Their findings indicate that ChatGPT significantly enhances audience awareness, primarily due to its strong genre awareness, which helps during lab report revisions. Additionally, the study found improvements in the learners' use of the IMRDC macrostructure, adherence to genre conventions, and stylistic enhancements in their lab report revisions. However, the area of critical thinking, along with reading and composing, showed minimal improvement. The research also suggests that employing ChatGPT as a revision aid can not only elevate the quality of lab reports among engineering students but also deepen their grasp of the lab report genre.

Mutammimah, Rejeki, Kustini, and Amelia (Mutammimah et al., 2024) focused on exploring the viewpoints of English educators regarding the potential adoption and integration of ChatGPT into their teaching practices. Utilizing the Technology Acceptance Model (TAM) as a theoretical basis, the study demonstrates that this adapted TAM model effectively predicts the acceptance of ChatGPT in English language education. The findings reveal

that educators' perceived usefulness of ChatGPT, the ease of its use, and their attitudes towards its adoption significantly enhance their intention to use the technology. Moreover, both the attitude towards using ChatGPT and the intention to use it have a strong and positive impact on its actual implementation in the classroom. These insights underscore the importance of educators' attitudes in the adoption of new technologies in language education and emphasize the necessity to foster positive views and intentions among educators towards technological advancements.

Yurt and Kasarci (2024) presented a new tool, the Questionnaire of AI Use Motives (QAIUM), specifically developed to assess motivation levels in individuals using AI applications. This instrument is grounded in the Expectancy-Value Theory. The research conducted aims to deeply analyze the motivational aspects influencing learners' use of AI and to identify how these motivations relate to their overall attitudes toward AI technologies. To this end, a measurement scale based on the expectancy-value theory was specifically created for this study. The researchers focused on examining the relationships between the reasons individuals use AI and their overarching views on this technology. In their evaluation of QAIUM, they assessed its factorial structure, reliability, ability to distinguish between different levels of motivation, and its correlation with the General Attitudes to Artificial Intelligence Scale (GAAIS). The findings confirm that QAIUM not only adheres to the Eccles and Wigfield motivation model but also exhibits robust reliability, effective discriminatory capability, and a meaningful correlation with the GAAIS. This validation underscores QAIUM's utility as a reliable tool for exploring the motivational factors that influence the use of AI in educational settings and interventions.

McGuire, Qureshi, and Saad (McGuire et al., 2024) introduced a novel model that utilizes GenAI for providing personalized, formative feedback through peer simulations in graduate courses. By analyzing learner reflections and ChatGPT-generated feedback in an organizational behavior course, the research highlights the educational benefits and ethical considerations of such technological integration. Learners noted significant learning advancements due to the individualized and dialogic nature of the feedback, which supports mastery of learning outcomes and promotes independent learning. Moreover, the study emphasizes the importance of addressing the ethical use of GenAI tools and advocating for transparent teaching practices that guide learners in ethical and responsible usage. The findings suggest that when implemented thoughtfully, GenAI tools like ChatGPT can substantially contribute to digital pedagogy, enhancing digital literacy and supporting the overall educational experience, while still acknowledging the essential role of human oversight in the learning process.

Solak (2024) conducted a phenomenological study examining the use of ChatGPT among English language learners and educators with varied teaching experiences. The study revealed several benefits: ChatGPT was engaging for young learners accustomed to technology, supported shy learners by encouraging communication, and offered instant responses and translations 24/7. Educators found ChatGPT useful for accessing authentic materials and customizing activities to different learning levels, thereby personalizing the teaching process. Despite its advantages, the tool was noted to overlook cultural and linguistic nuances in translations. Nonetheless, both learners and educators valued ChatGPT's feedback on homework and assignments, particularly for its ability to detect linguistic errors. The study also addressed privacy and ethical concerns, underscoring the importance of incorporating AI literacy into the language teaching curriculum and enhancing educators' technological and

pedagogical skills to fully utilize AI tools like ChatGPT in educational settings.

Discussion

The current special issue collates a spectrum of studies that delve into the integration of GenAI tools such as ChatGPT into various educational frameworks. The discussions herein synthesize findings from these studies under three overarching categories: GenAI in qualitative and pedagogical research, GenAI-driven educational tools in practical learning, and ethical and privacy concerns in GenAI application in education.

AI in Qualitative and Pedagogical Research

Theelen et al. (2024) and Polat et al. (2024) contribute significantly to understanding the role of LLMs like ChatGPT in qualitative research and educational analysis. Theelen and colleagues highlight the potential of ChatGPT in coding qualitative data with varying degrees of structure, emphasizing the necessity for clear instructions to enhance GenAI performance. Supporting this, Polat and colleagues provide a bibliometric perspective, showing the growing body of literature that positions ChatGPT as a versatile tool in educational settings. These findings are congruent with Harry (2023) who demonstrates that AI can significantly enhance data analysis accuracy and efficiency enabling educators to make data-driven decisions, provided that there are severe guidelines to address AI's limitations in understanding context.

AI-driven Educational Tools in Practical Learning

This category groups studies by Karaman & Goksu (2024), Mabuan (2024), and Giray et al. (2024), which explore the practical applications of ChatGPT in enhancing learning outcomes and pedagogical practices. Karaman and Goksu demonstrate GenAI's potential in designing lesson plans that marginally improve student performance in mathematics. Similarly, Mabuan notes the benefits of ChatGPT in language learning, especially in enhancing vocabulary and fluency. Giray et al. (2024) discuss the supportive role of ChatGPT in scientific research, pointing to its vast knowledge base and continuous learning capabilities. These insights are echoed in earlier research by Banihashem et al. (2022), Maghsudi et al. (2021), Noroozi et al. (2019), and Tapalova and Zhiyenbayeva (2022) that validate that AI tools can effectively support personalized learning and improve student engagement, regulation, and understanding.

Ethical and Privacy Concerns in AI Education

Lastly, several studies on this issue, including those by Giray et al. (2024) and Solak (2024) raise critical concerns about the ethical use and privacy implications of GenAI tools in education. These studies reflect a growing apprehension about GenAI's role in potentially perpetuating biases and violating privacy. This is supported by findings from ethical studies by Bond et al. (2024) and Holmes et al. (2022) who stress the importance of developing robust ethical frameworks for AI use in education, and by Akgun & Greenhow (2022) that underscore the potential privacy risks associated with AI in educational settings.

Conclusions and Future Studies

This special issue on the use of GenAI tools including ChatGPT in education encompasses a wide array of studies that collectively demonstrate the multifaceted role of these tools across different educational contexts and disciplines. The contributions within this issue reveal several major thematic findings that reflect both the potential and challenges of integrating GenAI into educational settings.

Firstly, the capability of GenAI to support and enhance learning processes is notably emphasized. Several studies underscore the effectiveness of GenAI in facilitating personalized learning experiences, such as providing individualized feedback, enhancing language skills, and supporting specific academic tasks like writing lab reports or creating lesson plans. GenAI's capacity to deliver instant, accessible, and consistent feedback is particularly valued in fostering learner autonomy and enhancing learning outcomes. This is paralleled by findings that highlight the utility of AI in administrative and curricular development roles, where it aids in the design of educationally robust and contextually relevant materials.

Secondly, the impact of GenAI on educational methodology and pedagogy is critically examined. Research within this issue explores GenAI's role in both reinforcing and challenging traditional educational practices. GenAI is shown to offer new methods for engaging students, such as through interactive and personalized teaching tools, and for facilitating more effective communication among learners and between learners and educators. However, these studies also bring to light the limitations of GenAI, such as its occasional failure to grasp contextual nuances and its tendency to rely on existing data, which may perpetuate inaccuracies or outdated information.

Thirdly, ethical and practical concerns related to GenAI use in educational settings are a recurring theme. Issues of privacy, data security, and the potential for bias in AI-generated content are significant. Many contributors discuss the need for clear ethical guidelines and robust training for educators and students to navigate the complexities of GenAI integration responsibly. The importance of human oversight in GenAI applications is stressed, advocating for a balanced approach where AI complements rather than replaces human judgment and interaction. Ethical considerations remain paramount, with a need for robust guidelines to govern GenAI use, addressing issues of privacy, bias, and data security. Research should also focus on educational equity, exploring how GenAI can be adapted to diverse learner populations, including those with specific learning needs.

Lastly, the future trajectory of GenAI in education is envisioned with cautious optimism. There is a strong sense that as educators and learners become more familiar with GenAI technologies, their integration into educational systems will continue to evolve. The potential for GenAI to transform educational access and effectiveness globally is recognized, suggesting a shift towards more AI-inclusive curricula and teaching methods. However, this optimism is tempered by the acknowledgment of the need for ongoing research to address the challenges and limitations identified.

Although the studies presented in this issue collectively underscore the transformative potential of GenAI in education, there is still a need for further research on how to adapt GenAI across various educational settings and

diverse data sets. Investigations could extend beyond specific databases or geographical areas, incorporating sources like theses and books to broaden the scope and depth of research. This approach should include longitudinal studies to capture the evolving perceptions and long-term impacts of GenAI on pedagogical methods and learning outcomes.

Further studies are also encouraged to examine the integration of GenAI into teaching models and curriculums, such as the inquiry-based learning model and entrepreneurship education. This includes evaluating GenAI's role in formative assessments and its effectiveness across instructional settings like language learning or STEM education.

In addition, as GenAI tools like ChatGPT become more prevalent in educational contexts, it is crucial to investigate their pedagogical and cognitive impacts, particularly in supporting critical thinking and academic integrity. This research will ensure that GenAI use aligns with educational values and goals, fostering a responsible and effective integration of GenAI technologies in education.

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