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Review of ChatGPT tools in education systems based on literature

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ABSTRACT

Artificial intelligence (AI) has rapidly reshaped modern education, with ChatGPT emerging as one of the most influential generative AI tools supporting teaching, learning, and academic administration. This review synthesizes evidence from 65 peer-reviewed studies published since 2022 to evaluate ChatGPT's educational applications, benefits, constraints, and ethical implications. Findings indicate that ChatGPT enhances personalized learning, academic writing, digital literacy, and instructional efficiency, while offering scalable support for large classrooms. Comparative analyses reveal that ChatGPT demonstrates superior linguistic coherence and reasoning compared to Gemini, Bing Chat/Copilot, and Claude. However, concerns persist regarding hallucinations, academic dishonesty, data privacy, infrastructural disparities, and faculty readiness. The review highlights need for responsible governance frameworks, AI literacy programs, and equitable institutional policies. Future directions include longitudinal research on learning outcomes, inclusive AI design, cross-cultural adoption patterns, and evolving teacher–student dynamics in AI-augmented environments.

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1. INTRODUCTION

Artificial intelligence (AI) has become a cornerstone of digital transformation across global educational systems, reshaping approaches to content delivery, assessment, and academic support. ChatGPT, built on transformer-based large language models, has received significant academic attention due to its ability to generate coherent explanations, constructive feedback, and human-like conversational responses. Its adoption in higher education has grown rapidly since 2022, driven by its accessibility, adaptability, and effectiveness in supporting academic tasks. Recent studies highlight ChatGPT's ability to improve student engagement, reduce learning gaps, and promote self-directed learning, while also assisting educators in designing instructional materials and assessment tools [1]. Although these developments present substantial opportunities, they also introduce ethical, pedagogical, and psychological challenges. Scholars emphasize the necessity of understanding ChatGPT's educational impact through a comprehensive, evidence-based synthesis that covers its affordances, constraints, and long-term implications for higher education systems

[2]. The present review integrates insights from high-quality Scopus and SCI-indexed research to provide such a synthesis.

2. METHOD

A systematic keyword-based search was carried out across major scholarly databases to gather relevant peer-reviewed literature. The databases used included Google Scholar, Scopus, and Web of Science, ensuring broad coverage of interdisciplinary studies. To ensure relevance and maintain review quality, a set of inclusion and exclusion criteria was applied to the retrieved studies. Duplicate records were removed before screening. Two reviewers independently assessed the titles, abstracts, and full texts to minimize selection bias and enhance objectivity. Included studies published from 2022 onwards, reflecting the release and educational adoption of ChatGPT.

3. RESULTS

3.1. Transformative role of ChatGPT in learning

Recent literature consistently recognizes ChatGPT as a transformative educational tool capable of delivering personalized learning pathways and adaptive support. Its ability to tailor explanations, simplify difficult concepts, and provide structured guidance allows learners to progress at their own pace, making education more flexible and inclusive [3]. Students benefit from ChatGPT's instant responses and capacity to break down complex ideas into digestible components, which enhances comprehension and conceptual mastery [4]. The model's multilingual capabilities further support international students and learners from diverse linguistic backgrounds, reducing barriers to participation in globalized academic settings [5]. ChatGPT also offers valuable assistance to students with cognitive or learning challenges by providing paraphrased content, simplified explanations, and accessibility-friendly formats that traditional teaching methods may not adequately deliver.

3.2. Pedagogical enhancement and academic writing support

Beyond content delivery, ChatGPT significantly contributes to pedagogical enhancement and writing development. Several studies highlight its effectiveness in improving sentence structure, coherence, clarity, and overall academic writing quality [6]. Students frequently use ChatGPT to generate outlines, rephrase difficult passages, and strengthen argumentative flow, which helps them understand academic conventions more effectively. As a formative feedback tool, ChatGPT provides immediate and detailed comments on student writing, enabling iterative improvement and promoting self-regulated learning. Its dialogic nature also encourages inquiry-based learning, as students engage with the model to test hypotheses, explore alternative viewpoints, and refine their reasoning processes [7]. Educators benefit from ChatGPT's ability to produce instructional materials, generate examples, and design lesson structures, thereby reducing workload and allowing more time for student interaction.

3.3. Institutional readiness, policy needs, and infrastructure

Despite the educational advantages associated with ChatGPT, institutional readiness remains uneven. Studies emphasize the importance of developing clear policies defining ethical use, academic integrity boundaries, and data privacy expectations to guide responsible adoption [8]. Many institutions struggle to implement appropriate governance due to ambiguities in how AI-generated content should be regulated or cited, leading to inconsistencies in academic practice. Faculty training is essential because numerous educators lack sufficient knowledge or confidence to integrate AI effectively into their teaching. Institutions that offer structured AI-literacy programs report improved adoption and better pedagogical outcomes. However, significant infrastructural disparities persist globally. Institutions with limited connectivity, outdated hardware, or insufficient funding face challenges in providing equitable access to AI-powered tools, which may widen existing educational inequalities if unaddressed [9].

3.4. Challenges for educators and learners

While ChatGPT enhances learning, it also presents several challenges that require careful consideration. Educators express concern that students may rely excessively on AI, leading to decreased originality, reduced critical thinking, and diminished cognitive effort [10]. Overreliance on ChatGPT may result in superficial engagement with academic material, undermining deep learning processes. Another challenge is hallucinated or fabricated content, which remains a documented issue in generative AI systems and can mislead students who are unaware of how to verify AI outputs [11]. As ChatGPT becomes more integrated into student workflows, ensuring that learners possess sufficient AI-literacy skills to evaluate accuracy and detect errors is essential. Social and collaborative aspects of learning may also be affected, as students might choose AI-based interaction over peer or instructor dialogue, weakening human-centered components of education.

3.5. Comparative performance of ChatGPT and other AI systems

A growing body of comparative research has assessed ChatGPT alongside other advanced AI models such as Google Gemini, Microsoft Copilot/Bing Chat, and Anthropic Claude. Findings indicate that ChatGPT continues to outperform competitors in long-form academic writing, reasoning tasks, conceptual synthesis, and linguistic coherence [12]. While Gemini offers strong real-time search-based retrieval capabilities, it struggles in extended reasoning or narrative construction. Copilot's strength lies in its integration with productivity software, making it suitable for document creation and summarization tasks, but its generative capability is typically rated below that of ChatGPT. Claude provides strong safety alignment and long-context processing, making it effective for summarizing large documents, but its ecosystem and global availability remain more limited [13]. Overall, ChatGPT's architectural refinement and reinforcement learning approaches contribute to its superior performance in higher education contexts requiring depth, nuance, and coherence.

3.6. Ethical concerns, bias, and academic integrity

The rapid rise of ChatGPT has intensified ethical debates surrounding AI in education. Data privacy and surveillance concerns are among the most frequently cited issues, as large language models may store or process sensitive user information without full transparency [14]. Bias embedded in training datasets can lead to distorted responses that reinforce stereotypes or introduce inaccuracies in culturally sensitive topics. Academic integrity concerns are particularly prominent because students can use ChatGPT to generate essays, reports, or assignment solutions that bypass authentic learning. These risks necessitate updated assessment strategies, including oral examinations, monitored writing tasks, and assignments that require process-based documentation rather than product-based evaluation [15]. Educators and institutions must collaboratively design frameworks that address fairness, transparency, and ethical responsibility in the use of generative AI.

3.7. Implementation barriers and technical limitations

Several practical barriers hinder the widespread adoption of ChatGPT in educational institutions. Financial constraints limit access to premium AI tools, cybersecurity infrastructure, and required training programs. Educator resistance remains common, often stemming from fears of technological displacement or uncertainty about pedagogical integration. Technical limitations, including hallucinations, outdated knowledge, and unreliable citation generation, mean that ChatGPT cannot operate as an independent knowledge authority. Instead, it requires human oversight and critical evaluation at every stage of use [16]. Furthermore, the absence of unified global standards for AI use in education creates disparities in implementation, leaving institutions to independently determine their own rules and guidelines.

4. DISCUSSION

The current body of evidence positions ChatGPT as one of the most influential technological innovations shaping contemporary higher education, yet scholars consistently emphasize that its pedagogical benefits cannot be examined in isolation from the ethical, cognitive, and institutional complexities it introduces. A major contribution highlighted in the literature is ChatGPT's ability to personalize learning at scale. By generating adaptive explanations and adjusting linguistic complexity to match learner needs, ChatGPT supports conceptual mastery in ways that conventional lecture-based models often cannot achieve [3], [4]. This aligns with broader pedagogical trends favoring differentiated instruction and competency-based learning. However, several researchers caution that this highly personalized scaffolding may also reduce cognitive struggle, a process integral to deep learning, particularly when students rely excessively on AI instead of engaging directly with challenging content [10]. Thus, while ChatGPT enhances accessibility and comprehension, it simultaneously risks weakening the productive discomfort essential for conceptual growth.

Another dominant theme concerns ChatGPT's influence on academic writing development. Several studies demonstrate that ChatGPT can significantly improve coherence, sentence fluency, argument structure, and academic vocabulary, especially for students from linguistically diverse backgrounds [5], [6]. These benefits extend to formative assessment, where ChatGPT provides immediate feedback that can accelerate iterative revision cycles. Yet, the pedagogical tension here is clear: although AI-generated feedback promotes autonomy and supports writing development, the same generative capacity allows students to outsource cognitive labor by producing complete essays with minimal personal effort [15]. This raises questions about authorship, originality, and the integrity of learning outcomes. Review-based evidence suggests that institutions must rethink assessment strategies shifting from purely product-based evaluations toward process-oriented approaches that include oral defenses, in-class writing, and reflective components to ensure authentic student engagement [16], [17].

The literature also converges on the issue of institutional readiness, which remains uneven and fragmented across higher education systems. While some universities have proactively developed governance

frameworks, AI-use policies, and faculty-training programs, others continue to operate without guidelines, resulting in inconsistent practice and heightened academic risk [8], [9]. Institutions lacking digital infrastructure face additional barriers, as limited connectivity, outdated hardware, and insufficient cybersecurity capacity restrict equitable access to AI tools. This infrastructural disparity risks deepening existing educational inequalities, contradicting the promise of AI as a democratizing force. Scholars argue that successful integration requires a systemic approach involving technological investment, faculty capacity-building, transparent policy development, and student training to promote critical AI literacy [18], [19]. The applications are illustrated in Figure 1 and the advantages and disadvantages of AI in education is listed in Table 1.

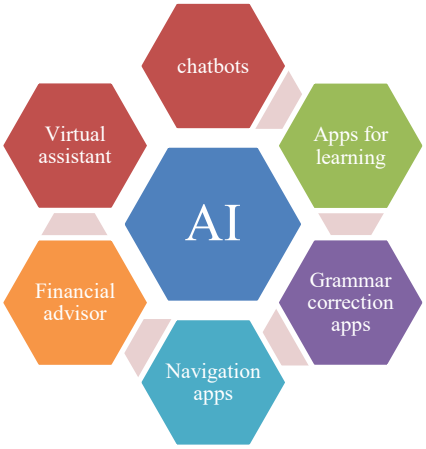

Figure 1. Artificial intelligence uses

Table 1. Advantages and disadvantages of artificial intelligence in education

Advantages of AI in education	Disadvantages of AI in education
Personalized learning: AI systems adapt instruction to individual needs, improving engagement and supporting differentiated learning pathways [3], [4].	Reduced critical thinking: excessive reliance on AI may weaken creativity, reasoning, and independent problem-solving [10].
Immediate feedback: AI platforms provide real-time formative feedback, helping students correct misconceptions instantly [6], [7].	Academic integrity concerns: AI-generated content can facilitate plagiarism or unauthorized academic assistance [15].
Enhanced accessibility: AI supports learners with disabilities through text-to-speech, translation, and simplified content [5], [20]	Inaccuracy and hallucination: AI may generate incorrect or misleading information, affecting student understanding [11], [16].
Teacher support and workload reduction: AI automates grading, resource creation, and routine tasks, reducing teacher workload [1], [8].	Data privacy risks: AI systems may store or misuse sensitive student data, raising ethical and cybersecurity issues [14].
Diverse learning materials: AI enables access to simulations, interactive modules, and virtual labs that enhance experiential learning [2], [7].	Digital divide: unequal access to devices or internet connectivity may widen educational inequalities [9].
Improved learning efficiency: AI assists in summarising, organizing notes, and structuring academic tasks more efficiently [6].	Teacher skill gap and resistance: many educators lack AI literacy or resist adoption due to insufficient training [8], [9].
Multilingual support: AI translation tools assist international and multilingual learners by removing language barriers [5].	Loss of human interaction: heavy AI usage may reduce teacher–student engagement and peer collaboration [1], [2].
Research and writing support: AI helps in literature synthesis, conceptual organization, and improving academic writing quality [6], [12], [13].	High cost and infrastructure needs: effective AI integration requires investment in hardware, software, and training [9], [21]
Scalability: AI tools respond to multiple learners simultaneously, making them effective in large-class environments [1], [3].	Algorithmic bias: AI systems trained on biased datasets may generate culturally insensitive or discriminatory outputs [14].

A recurring debate in the reviewed literature concerns the accuracy and reliability of AI-generated content. While ChatGPT's reasoning depth and linguistic coherence surpass many competing models, studies also document hallucinations, fabricated citations, and outdated information issues that can mislead students, particularly those lacking advanced evaluative skills [11], [16]. This unreliability underscores the importance of integrating critical information literacy into curricula so that students learn to verify AI-generated responses using authoritative sources. Without systematic AI-literacy development, generative models may inadvertently contribute to the circulation of misinformation within academic contexts.

Comparative research provides further nuance to the discussion. Studies consistently show that ChatGPT outperforms other AI systems such as Google Gemini, Microsoft Copilot, and Anthropic Claude in long-form academic reasoning, narrative coherence, and interdisciplinary synthesis [12], [22]. However, each system demonstrates distinct strengths. Gemini excels in real-time retrieval due to its integration with search engines; Copilot performs well in productivity-oriented academic tasks; Claude offers enhanced safety alignment and long-context processing. This suggests that a multi-tool ecosystem, rather than a ChatGPT-centric approach, may yield more robust educational outcomes. Reviewing these comparative trends, it becomes evident that the question is no longer which AI model is superior overall, but how various tools can be orchestrated effectively to complement each other within pedagogical ecosystems.

Ethical concerns remain central to scholarly discourse. Issues surrounding data privacy, algorithmic bias, and surveillance shape the debate on responsible AI integration. Several studies emphasize that data processed through AI systems may be stored or used in ways that lack transparency, raising risks of privacy breaches or unauthorized data use [14]. Bias embedded in training datasets can influence responses, affecting fairness and representation particularly for minority groups. Academic integrity constitutes perhaps the most prominent ethical concern, as ChatGPT enables rapid generation of polished academic work that students may submit without meaningful engagement [23]. The reviewed literature consistently argues that ethical integration must rely on institutional transparency, mandatory disclosure policies, and assessment redesign that prioritizes critical thinking over rote reproduction.

A final and overarching issue raised across studies is the changing role of educators. As AI becomes increasingly capable of explaining, summarizing, and generating content, instructors are transitioning from knowledge transmitters to facilitators of analytical reasoning, ethical judgment, and disciplinary thinking [1], [24]. This shift demands new competencies, including AI literacy, digital pedagogy, and critical oversight of algorithmic systems. Without adequate professional development, educators may feel displaced or underprepared, leading to resistance or inconsistent AI adoption. Review-based scholarship suggests that sustainable AI integration must reinforce not diminish the value of human expertise, situating AI as an augmentative tool that supports relational, creative, and metacognitive dimensions of teaching [25].

Taken together, these findings highlight that ChatGPT's impact on higher education is profoundly multidimensional [26]. The literature portrays ChatGPT not merely as a technological innovation but as a catalyst prompting fundamental reconsideration of pedagogy, assessment, academic ethics, and the educator's role. Its transformative potential can be realized only through comprehensive policy frameworks, equitable access initiatives, teacher training, and ongoing critical evaluation of its cognitive and ethical implications. The discussion therefore positions ChatGPT as a powerful but nuanced tool whose effectiveness depends on responsible integration grounded in human-centered education [27].

5. CONCLUSION

ChatGPT represents a transformative development in higher education, providing unprecedented opportunities for personalized learning, academic writing support, and instructional innovation. Its superior reasoning capabilities make it a preferred tool among current AI systems. Nevertheless, its adoption must be approached with caution, addressing concerns related to academic integrity, accuracy, ethics, and digital equity. Future research must explore long-term cognitive effects, cross-cultural adoption patterns, and inclusive AI design principles that ensure accessibility for all learners. With appropriate safeguards and policies, ChatGPT can contribute meaningfully to high-quality, human-centered education.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
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R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest regarding the publication of this article.

INFORMED CONSENT

Informed consent was not applicable for this study, as it did not involve any human participants.

ETHICAL APPROVAL

Ethical approval was not applicable for this study, as it did not involve human or animal subjects.

DATA AVAILABILITY

All data generated or analyzed during this study are included within the article. Additional materials or clarifications can be provided by the authors upon reasonable request.

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