



Research Article

Grand challenges for ChatGPT usage in education: psychological theories, perspectives and opportunities

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Article Info

Received: 12 March 2024

Accepted: 25 June 2024

Online: 30 June 2024

Keywords:

ChatGPT

Conversational AI

Educational technology

Huma-AI collaboration

Abstract

The integration of conversational artificial intelligence (AI) systems like ChatGPT into educational settings presents significant opportunities and challenges. This paper examines the potential impacts of ChatGPT usage in academics through the lens of established psychological theories and perspectives, including constructivist learning theory, cognitive load theory, sociocultural learning theory, and human-AI collaboration theory. It explores the benefits of ChatGPT as a personalized, interactive, and responsive educational aid, capable of fostering engagement, writing skill development, and accessibility. However, concerns are raised regarding academic integrity, factual accuracy, critical thinking development, plagiarism, equity, privacy, and bias mitigation. The paper emphasizes the need for proactive risk management and evidence-based guidelines to responsibly leverage ChatGPT's advantages while safeguarding student well-being and learning outcomes. It advocates for maintaining teacher and learner agency, fostering appropriate trust calibration, and defining supplemental roles for ChatGPT that enhance rather than replace human teaching and knowledge construction. Ultimately, the paper calls for further research to develop optimal design principles and policy frameworks that uplift both educators and learners through ethical, compassionate human-AI partnerships in education.

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To cite this article

Elbably, Y., & Nemt-allah, M. (2024). Grand challenges for ChatGPT usage in education: psychological theories, perspectives and opportunities. *Psychology Research on Education and Social Sciences*, 5(2), 31-36. DOI: <https://doi.org/10.5281/zenodo.12601568>

Introduction

The advent of artificial intelligence (AI) has brought about monumental changes across various facets of human life and activity. One domain that stands to be profoundly impacted is education (Rane, 2023). The introduction of chatbot technology such as ChatGPT has significant implications for learning and instruction. However, these changes also pose grand challenges that necessitate careful examination from psychological perspectives to harness AI's potential while safeguarding students' wellbeing.

ChatGPT refers to a chatbot launched in November 2022 by Anthropic, an AI safety startup. It uses a machine learning technique called transfer learning to generate human-like conversational text (Roose, 2022). The system is built on top of GPT-3, a language model developed by OpenAI for natural language processing tasks like translation and text

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completion. ChatGPT has been trained on massive datasets scraped from the internet to allow it to discuss nearly any topic and mimic human responses (Okey et al., 2023).

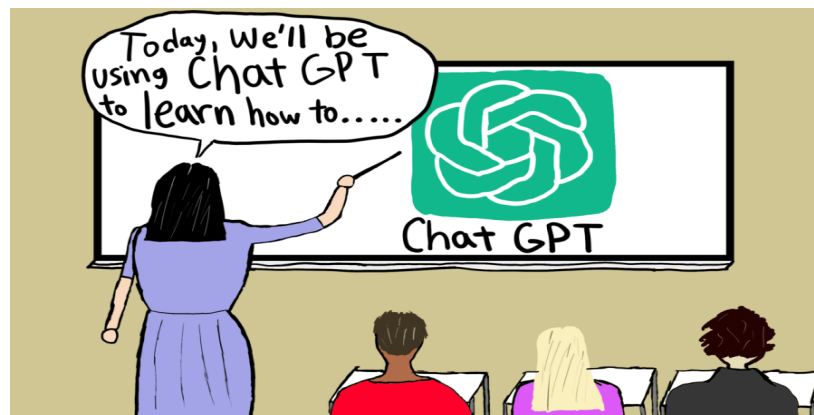


Figure 1. Students can use ChatGPT to create outlines and gather compelling topics and points (Chen, 2023)

ChatGPT's conversational abilities allow it to respond to text prompts with coherent and seemingly accurate paragraphs or essays on demand. It can summarize lengthy texts, answer follow-up questions, correct its own mistakes, decline inappropriate requests, and even admit the limitations of its knowledge (Roose, 2022). This combination of language proficiency and versatility make ChatGPT a potentially valuable educational aid. Students could use it for help on assignments, as a study aid, or as a source of feedback. However, its ability to generate original text also raises concerns about academic dishonesty.

Theoretical Grounding in Educational Psychology

Evaluating the risks and opportunities associated with integrating conversational AI like ChatGPT into academic contexts requires grounding the investigation in established learning theories and models of human-AI interaction. This section outlines key constructs and perspectives from educational psychology and human-computer collaboration that will inform this proposed study on the impacts of ChatGPT usage on students.

Constructivist Learning Theory

From a constructivist perspective, the value of ChatGPT depends on whether it engages students in actively creating knowledge by generating explanations or applying concepts themselves versus passively relying on its outputs. If overdependence on ChatGPT prompts students to absorb its responses passively without deeper cognitive processing, these risks impeding meaningful learning and critical thinking (Rasul et al., 2023). However, employing ChatGPT as a launchpad for students to explain concepts in their own words, relate them to personal experiences, and identify real-world applications could powerfully foster active knowledge construction.

Cognitive Load Theory

Cognitive load theory analyzes the cognitive demands placed on students' working memory during learning activities (Sweller, 1988). Optimal learning occurs when germane load is high and extraneous load is low. However, excessive total cognitive load can overwhelm working memory capacity and impede learning (Paas et al., 2003).

From this perspective, using ChatGPT has tradeoffs regarding cognitive load. Requests for explanations when stuck may reduce extraneous load by providing scaffolding tailored to the learner's needs (Daniel, 2023). However, overreliance on ChatGPT may limit germane cognitive processes like self-explaining concepts that facilitate encoding (Bai et al., 2023). Students may also experience underload if ChatGPT reduces intrinsic demands excessively, hindering learning. Evaluating these load effects is vital.

Sociocultural Learning Theory

Sociocultural learning theories emphasize that cognitive development stems from social interactions, communication, and assistance from others (Vygotsky, 1978). AI chatbots act as novel social partners during learning. Their quality as learning collaborators depends on how successfully they scaffold students' abilities and promote interactive dialogue

and knowledge co-construction versus one-way content delivery (Darling-Hammond et al., 2020). This aligns with constructivist emphases on conversation, authentic contexts, and active learner participation. Analyzing ChatGPT's capacity to fluidly provide knowledgeable, adaptive support through natural social dialogue is critical.

Human-AI Collaboration Theory

Models of effective human-AI teamwork also highlight key dynamics that should govern integration of AI like ChatGPT into education (Amershi et al., 2019). These frameworks emphasize that human-AI collaboration should allow them to complement each other's strengths and limitations. AI systems should enhance human capabilities while avoiding full automation that deprives users of agency and development (Bawden, 2008). Overreliance on ChatGPT risks reducing students' own skill growth, metacognition, and mental model calibration. Thus, ethical integration requires carefully defining tasks where ChatGPT supplements versus supplants human teaching and students' own thinking. The technology should empower human partners, not replace them (Hill et al., 2015). Furthermore, transparent communication of AI's capabilities and roles is essential so users can properly calibrate their trust in its outputs versus their own judgement (Schmidt et al., 2020; Zerilli et al., 2022).

Perspectives from constructivism, conceptual change theory, cognitive load, sociocultural learning theory, and human-AI interaction provide critical lenses for evaluating ChatGPT's impacts on student learning, motivation, relational dynamics with the chatbot, and appropriate integration strategies. This multifaceted theoretical grounding will enrich interpretation of quantitative usage and outcome data along with qualitative insights into students' lived academic experiences with this AI. Synthesizing established learning science and human-AI models will yield generalizable frameworks and evidence-based principles for successfully leveraging the benefits and overcoming the challenges of conversational AI in education

Opportunities for Educational Usage

ChatGPT offers several valuable capabilities as an educational tool despite potential risks associated with its usage. One key benefit is that it can provide personalized learning experiences by customizing its explanations and examples to match individual students' comprehension levels and background knowledge (Javaid et al., 2023). Moreover, ChatGPT facilitates writing skill development by assisting students with drafting, revising, and editing written assignments (Song & Song, 2023). It acts as an always-available teaching assistant that can answer academic questions on demand, providing extra help between classes (Joshi et al., 2023). Additionally, ChatGPT's conversational nature may increase student engagement compared to static informational sources. By responding conversationally, it can foster motivation and learning outcomes (Lin, 2023). ChatGPT further expands accessibility to educational content for students with disabilities through its spoken responses and multiple interaction modalities (Mosaiyebzadeh et al., 2023). From an instructor perspective, it can automate administrative and grading tasks to reduce teacher workloads and allow them to devote more time to students (Hashem et al., 2024). In summary, ChatGPT delivers personalized, interactive support that adapts to students' individual pace and learning style, demonstrating significant potential to enhance learning.

Challenges and ChatGPT in Academics

However, integrating ChatGPT into academics also introduces major challenges that could compromise learning and ethical AI usage unless proactively addressed. One fundamental concern is that students may misuse ChatGPT to automatically generate assignments to submit as their own work, cheating through AI (Lancaster, 2023). Detecting such AI-written submissions poses an immense challenge. Additionally, despite its language proficiency, ChatGPT sometimes produces factual errors, logically inconsistent responses, or biased and offensive text (Kocoń et al., 2023). Overreliance on its outputs risks propagating misinformation. Dependence on ChatGPT could also hamper critical thinking and knowledge retention as students passively absorb its explanations rather than construct their own (Bai et al., 2023). The system frequently plagiarizes sources without attribution due to its internet-based training, risking inadvertent student plagiarism (Hua et al., 2023). Unequal access to ChatGPT based on socioeconomic status may also widen achievement gaps (Mhlanga, 2023). From a privacy perspective, ChatGPT's collection of users' conversational data to improve itself raises ethical concerns about student consent (Hassani & Silva, 2023; Rane et al., 2023). Finally,

its exposure during training to unfiltered web content risks inappropriate, biased, or adult responses to students (Wach et al., 2023). In summary, proactively developing solutions to these multifaceted risks is essential to protect student wellbeing and learning integrity as ChatGPT is integrated into academics.

Table 1. A conceptual chart that outlines the major challenges

| Challenge | Description | Potential Impact |
|------------------------------|--|--|
| Cheating | Students might use AI to complete assignments. | Compromises academic integrity. |
| Detection | Difficulty in identifying AI-generated work. | Challenges for educators. |
| Inaccuracies | AI can produce errors or biased content | Spreads misinformation. |
| Critical Thinking | Overreliance on AI explanations. | Hinders learning and retention. |
| Plagiarism | AI may not cite sources properly. | Risks of student plagiarism. |
| Access Inequality | Socioeconomic factors affect AI access. | Widens educational disparities. |
| Privacy | AI collects user data for improvement. | Raises consent and privacy issues. |
| Inappropriate Content | Exposure to unfiltered web content. | Risk of harmful responses to students. |

Based on the table 1, Each of these challenges requires careful consideration and the development of robust strategies to mitigate their effects and ensure that AI tools serve as beneficial aids in education rather than detrimental ones.

Conclusion

The integration of ChatGPT into educational settings presents a paradigm shift in how learning and instruction are facilitated. While its potential benefits are significant, ranging from personalized learning experiences to enhanced writing skill development and increased accessibility, the challenges posed by its adoption are multifaceted and require careful consideration.

One of the primary concerns is the potential misuse of ChatGPT for academic dishonesty, with students potentially using it to generate assignments or essays without proper attribution. This not only undermines the integrity of academic assessments but also hinders the development of critical thinking and writing skills. Addressing this issue will necessitate the development of robust plagiarism detection techniques specifically tailored to identify AI-generated content.

Moreover, despite its impressive language proficiency, ChatGPT is not infallible and may produce factual errors, logical inconsistencies, or biased responses, which could inadvertently propagate misinformation or harmful stereotypes. This emphasizes the need for students and educators to maintain a critical lens when evaluating ChatGPT's outputs and to cross-reference information with reputable sources.

Another crucial aspect to consider is the potential impact of overreliance on ChatGPT on students' cognitive processes. While it can provide valuable scaffolding and reduce extraneous cognitive load, excessive dependence on the system's explanations may impede active knowledge construction and the development of self-explanation skills, which are crucial for deep learning and long-term retention. Additionally, the issue of equity and access to ChatGPT should be addressed, as socioeconomic disparities may widen the achievement gap between students who can access the technology and those who cannot. Efforts should be made to ensure equitable access to ChatGPT or equivalent resources to level the playing field.

Ultimately, the key to successful integration lies in maintaining a delicate balance between human agency and AI assistance. ChatGPT should be positioned as a supplementary tool that enhances and supports human teaching and learning, rather than replacing them entirely. Fostering students' metacognition, critical thinking, and appropriate trust calibration in the AI system's outputs is crucial to prevent overdependence and ensure the development of essential skills.

Furthermore, best practices and guidelines for integrating ChatGPT into educational settings should be developed. These guidelines should promote a balanced approach that fosters active knowledge construction, critical thinking, and writing skills development, while leveraging the benefits of ChatGPT as a supplementary tool. By establishing clear frameworks for effective integration, educators can maximize the advantages of ChatGPT while minimizing potential risks and ensuring a holistic learning experience for students.

Recommendations

Efforts should be made to explore strategies that ensure equitable access to ChatGPT or equivalent resources. Bridging the digital divide and providing equal opportunities for all students, regardless of socioeconomic status, is crucial to prevent widening the achievement gap. This could involve initiatives such as subsidized access programs or the development of open-source alternatives to ChatGPT.

Longitudinal studies should be conducted to assess the long-term impacts of ChatGPT usage on student learning outcomes, motivation, and cognitive processes. These studies will provide valuable insights and inform evidence-based decision-making regarding the optimal integration and utilization of conversational AI in educational contexts. By understanding the long-term effects, educators and policymakers can make informed decisions that prioritize student well-being and academic success.

Moreover, teacher training programs should be developed to equip educators with the necessary skills and knowledge to effectively integrate ChatGPT into their instructional practices. These programs should cover topics such as best practices for leveraging ChatGPT as a teaching aid, strategies for promoting critical thinking and active learning, and techniques for evaluating and curating AI-generated content. By empowering teachers with the right tools and knowledge, the benefits of ChatGPT can be maximized while mitigating potential risks.

Collaboration with AI developers and researchers is also essential to address privacy concerns, bias mitigation, and ethical considerations in the development and deployment of conversational AI systems like ChatGPT. By working closely with these stakeholders, the educational community can contribute to the responsible and ethical design of AI systems, ensuring that they prioritize user privacy, mitigate biases, and align with ethical principles.

Lastly, interdisciplinary collaborations between educators, psychologists, computer scientists, and policymakers should be fostered to establish comprehensive guidelines and frameworks for the responsible and ethical integration of AI in education. This collaborative approach will ensure that multiple perspectives and expertise are considered, leading to well-informed and holistic solutions that address the complexities of integrating AI into educational settings. By implementing these suggestions, the educational community can proactively address the challenges posed by ChatGPT and leverage its potential to revolutionize learning experiences, foster engagement, and empower students and educators in the pursuit of knowledge and academic excellence.

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