



# Exploring the Potential of ChatGPT as an Educational Technology: An Emerging Technology Report

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Accepted: 1 August 2023 / Published online: 8 August 2023  
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## Abstract

This emerging technology report explores the potential of ChatGPT, an AI-powered chatbot developed by OpenAI, as an educational technology. Drawing on previous research on AI and education, the relevance of ChatGPT for learning, instruction, and assessment is discussed, as well as how the tool is being used in practice. Potential ethical concerns and limitations associated with its use in education are also considered. While there is significant interest in the potential of ChatGPT to transform education and create more personalized, efficient, and effective learning experiences, there are also concerns about the impact it could have on human interactions and the learning process.

**Keywords** ChatGPT · OpenAI · Ai chat bot · Artificial intelligence

## 1 Introduction

For more than three decades, researchers have been conducting studies on the utilization of artificial intelligence (AI) technologies in education (O'shea & Self, 1986). Throughout this period, research has investigated how AI can enhance inferences, judgments, and predictions in educational contexts to facilitate the teaching and learning process (Holmes et al., 2016). Due to recent advancements in computational systems and processing power, there has been a renewed interest in utilizing AI in education, resulting in a growing body of research that examines the potential of this technology (Hwang et al., 2020). In particular, AI has been widely implemented in educational technologies and learning environments, such as intelligent tutoring systems, teaching robots, learning analytics dashboards, adaptive learning systems, and more (Kabudiert al., 2021; Hwang et al., 2020).

In the last few months, ChatGPT, an AI tool has captured the attention of educational institutions around the world. Given its seemingly remarkable capabilities, this tool has generated a significant amount of buzz in the media due as society grapples with its potential to transform the way we communicate and work (Kasneci et al., 2023). For example, ChatGPT has been featured in numerous news articles and publications, which have

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highlighted its ability to understand human language and generate human-like text. There has been some controversy surrounding the use of ChatGPT in education with some school districts going as far as blocking the tool from their network (Rosenblatt, 2023). While the technology has the potential to revolutionize the way we teach and learn, there are concerns about the impact it could have on human interactions and the learning process (Zhai, 2022).

Therefore it is the goal of this emerging technology report to highlight the potential of ChatGPT as an educational technology, to discuss its relevance for learning, instruction, and assessment, to showcase how the tool is being used in practice, and to discuss potential ethical concerns and limitations.

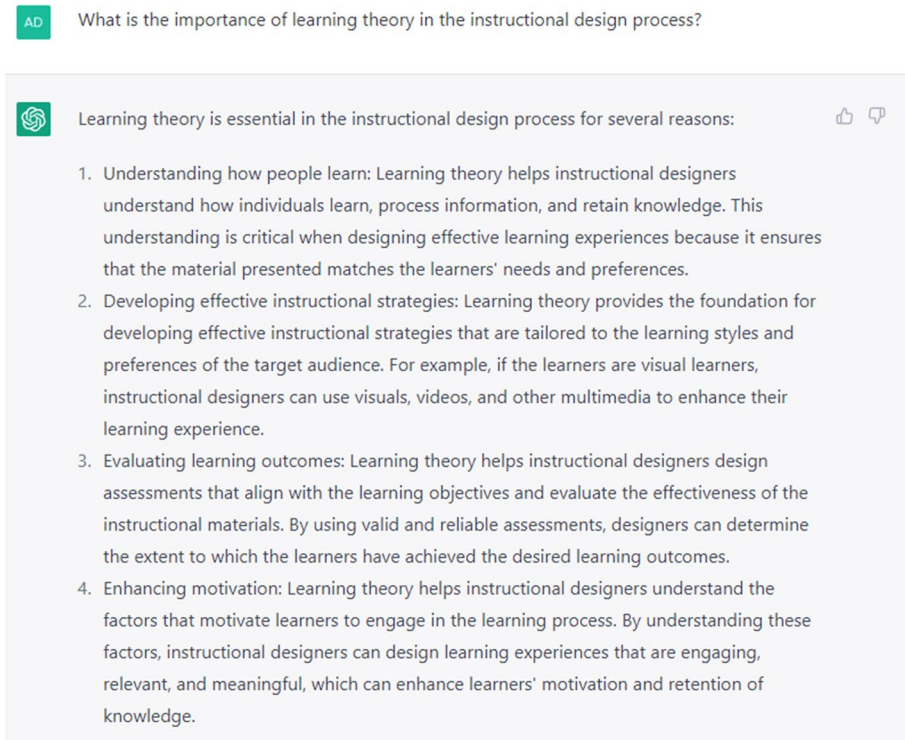
## 2 Introduction and Description of ChatGPT

ChatGPT is an AI-powered chatbot developed by OpenAI (<https://openai.com/>), a research group that has developed a range of bespoke AI technologies (e.g., DALL-E which creates original realistic art from text descriptions and Whisper which can transcribe speech into text). ChatGPT uses natural language processing (NLP) and machine learning techniques to generate human-like responses to user queries (Lund & Wang, 2023). It is based on the Generative Pre-trained Transformer 3 (GPT-3) language model, which has been trained on a massive amount of text data, including books, articles, and web pages. Since ChatGPT has been trained on a large amount of publicly available digital text-based data, it is able to understand and respond to questions (see Fig. 1), generate text, write custom programming code (see Fig. 2), summarize papers, evaluate responses, and carry out a variety of other language-related tasks (Aydın & Karaarslan, 2023). Further, ChatGPT is able to be trained, which means that it is responsive to the unique inputs from one user to another and can be individually reactive to the needs of each individual (van Dis et al., 2023).

## 3 Relevance for Learning, Instruction, and Assessment

While ChatGPT is still relatively new, its relevance for learning, instruction, and assessment can in many ways be derived from broader AI technologies such as the use of generative models. In particular, perhaps the most compelling benefits lies in its ability to provide a personalized and interactive learning experience for students (Kokku et al., 2018). Computer science researchers have long maintained the benefits of AI for education and in recent years, the emergence of AI and machine learning ML, coupled with progress in big data analysis, has brought about new perspectives that provide insight and direction for personalized education (Maghsudi et al., 2021).

In particular, ChatGPT can be used to adapt to the individual needs and preferences of each learner by providing customized content and feedback (Chan & Zary, 2019; Zhai, 2022). This can help learners to engage with the material more effectively and improve their learning outcomes. For example, instructors can input student essays, discussion board responses, and other assignments into ChatGPT to seek out alignment to assignment requirements and to seek out evidence for the need of further instruction/intervention. This approach is one that has been widely considered in the past (e.g., Uto & Okano, 2020;



**Fig. 1** An example of ChatGPT responding to a query

Warschauer & Grimes, 2008), but has faced prominent challenges due to limitations in the technology that ChatGPT has improved upon (Vijaya Shetty et al., 2022).

Related, is that ChatGPT can also be used to support instructional design efforts by providing feedback on the effectiveness of different teaching strategies and materials (Atlas, 2023). Educators can use this feedback to optimize their teaching methods and improve learning outcomes. As an AI language model, ChatGPT can also assist in writing curriculum by providing subject-specific knowledge, generating content ideas, offering feedback, and creating assessments (Gupta et al., 2023). ChatGPT can also provide relevant information on different topics and concepts related to the curriculum, which can aid in the development of the curriculum content. For example, by inputting the learning objectives, ChatGPT can generate a range of relevant topics and ideas that can be included in the curriculum. With proper prompting, ChatGPT can then provide a range of synchronous and asynchronous learning activities that can be added to a course shell. Moreover, users can ask ChatGPT to review their existing curriculum and can request feedback to ensure that it is coherent, relevant, and aligned with the learning objectives (Lee, 2023). It can also assist in developing assessments that align with the curriculum content and learning outcomes.

Perhaps the most compelling use case of ChatGPT is the integration of its application programming interface (API) into external learning technologies and into the development of custom AI-enhanced systems (Cox & Tzoc, 2023; Taecharungroj, 2023). For example, virtual reality (VR) environments and video games have long been cited for their tremendous educational benefits (Dalgarno & Lee, 2010; Squire, 2003). Despite these benefits,



Can you write me R studio code to conduct a linear regression on data from a csv file called participant-data-2021



Sure, here's an example R code that reads in a CSV file called "participant-data-2021" and performs a linear regression on the data using the `lm()` function:



```
R Copy code

# Load necessary library for data manipulation
library(tidyverse)

# Read in the data from the CSV file
data <- read_csv("participant-data-2021.csv")

# Perform a linear regression on the data
model <- lm(dependent_variable ~ independent_variable, data = data)

# Print the model summary
summary(model)
```

Make sure to replace "dependent\_variable" and "independent\_variable" with the appropriate column names in your dataset. Additionally, make sure the CSV file is saved in the same directory as your R script or provide the appropriate file path if it's located elsewhere.

**Fig. 2** An example of ChatGPT writing custom programming code

difficulties in design and development efforts have typically stymied their adoption (e.g., Glaser et al., 2021; Schmidt et al., 2023). However, with the advent of ChatGPT, there is a renewed interest in developing methods to integrate generative models into 3D environments (Baidoo-Anu & Owusu Ansah, 2023) with a particular interest in using the technology to provide adaptive and customized interactions from non-playable or fictional characters (Aydin & Karaarslan, 2022; Jovanović, 2023).

## 4 Emerging Technology in Practice

The emergence of ChatGPT in educational research is a relatively new phenomenon. As such, there are only a handful of scholarly articles that have been published on the topic to date. As of the time this manuscript was written, only a limited number of findings from educational research involving ChatGPT have been made available in major academic databases and through Google Scholar. Furthermore, among these, only a few examples have been sourced from non-peer-reviewed platforms, underlining the emerging nature of this field of study.

In this example, a pair of educators describe the creation of a customizable AI conversation partner using Unity, 3D characters, and C# coding, allowing students to practice their English conversation skills with an AI partner that responds naturally to any interaction.

The developers give the AI a unique personality and background to match each student's interests. The authors conducted a three-day class activity with mixed-level English proficiency students where each pair of students had ten minutes to speak with their AI conversation partner. The article reported that this activity was well-received, and students enjoyed the novelty of interacting with an AI that they helped to create. However, some students also faced issues with pronunciation and vocabulary recognition, especially as they attempted to probe the edges of ChatGPT's capabilities (Quinn & Bonner, 2023).

A second study explored the use of ChatGPT through a three-stage qualitative case study of using chatbots in education (Tilili et al., 2023). Analysis showed widespread enthusiasm about its educational use, balanced by some caution. This study delved into ChatGPT's impact on education, response quality, utility, emotional interaction, and ethical concerns. Issues surfaced around cheating, honesty, privacy, and manipulation, underscoring the need for research and guidelines for safe AI chatbot integration in education. The study highlighted the necessity for 'upskilling competencies' and new educational philosophies that embrace this paradigm shift (Tililil et al., 2023).

Given the potential of ChatGPT to be utilized to create customized learning experiences, to automate repetitive tasks, to create educational resources, and to enhance the accessibility of learning materials, it is expected that research will begin to be published on the matter soon. Perhaps this paper in itself can act as a call and to highlight the need for more research in this area.

## 5 Significant Challenges and Conclusions

As outlined in this emerging technology report, AI-powered tools like ChatGPT hold immense transformative potential. However, while ChatGPT has tremendous potential as an educational technology (Zhai, 2022), there are also several challenges that need to be addressed. It offers a vision of personalized, efficient, and inclusive learning experiences that cross traditional boundaries.

A primary concern lies in ChatGPT's occasional production of inaccurate outputs (Kasneji et al., 2023). As ChatGPT is trained on extensive, unrefined data, it may lack objectivity and can potentially produce critical inaccuracies. The performance of generative models depends significantly on the diversity and quality of their training data. If this data contains biases, these biases can infiltrate the model. For instance, if a model is predominantly trained using essays from a particular demographic, its ability to evaluate essays from other demographics may be compromised. Such biases can arise from a heavy reliance on research data from wealthy nations or textbooks with a narrow perspective (Mbakwe et al., 2023; Yang, 2023). However, this limitation also presents an avenue for progress. By incorporating real-time feedback and error correction mechanisms, ChatGPT's accuracy can be improved over time. This transforms learners from passive receivers of information to active participants in their education, fostering a culture of critical thinking and active learning (Rudolph et al., 2023). Moreover, potential biases in AI responses can be mitigated by diversifying the data used for training and by designing AI systems to recognize and correct their biases (Marinucci et al., 2023).

Accessibility and inclusivity, although challenging, also present opportunities for ChatGPT to revolutionize the learning process (Robinson, 2020). By expanding its multi-language support and ensuring compatibility with assistive technologies, ChatGPT can break down barriers, offering an inclusive educational tool for learners worldwide, irrespective of their physical abilities or linguistic backgrounds (Sanderson, 2023). Nonetheless, despite

the potential promises, the technology's accessibility is currently somewhat restricted, as it necessitates a paid subscription and compliance with usage limitations (Grassini, 2023). Despite the advancements of this technology, there is dissatisfaction within the scientific community over OpenAI's opacity concerning the model's training processes, data sources, and the internal mechanics of GPT-4 beyond its user interface.

ChatGPT's potential to handle grading and evaluation tasks brings up significant ethical concerns (Zawacki-Richter et al., 2019). While AI grading systems could potentially enhance grading impartiality (Schlippe et al., 2022), there is a vital need to investigate the significance of grading explanations and transparency of the process that these systems convey to students. This aspect is crucial when considering both the ethical implications of the technology and its acceptability (Grassini, 2023). Important to this is the need for implementing robust privacy protection policies and establishing clear ethical guidelines that can ensure responsible usage of AI in these sensitive areas.

While technology's rapid evolution and significant impact on education bring tools like ChatGPT to the forefront of classroom learning, concerns about reduced personal interaction in an AI-driven environment are equally present (Rudolph et al., 2023). However, these fears can be alleviated when we view ChatGPT not as a replacement for human teachers, but as a tool that complements and enhances their efforts. By taking over routine tasks, ChatGPT enables teachers to focus more on cultivating students' critical thinking, creativity, and interpersonal skills — areas where AI still cannot compete. Furthering this notion, a recent study examined ChatGPT's potential role in the classroom learning process, employing qualitative research methods such as attentive listening and careful documentation (Ausat et al., 2023). This study concludes that although ChatGPT is a powerful tool in education, it cannot completely supplant a teacher's role. Hence, the appropriate and effective integration of such technology into learning is paramount, along with the enhancement of teachers' skills in managing education with the aid of technology. The study's findings echo the emerging research in this area and shed light on how we should approach the coexistence of AI and human facilitation in education (Ausat et al., 2023).

In conclusion, the process of integrating ChatGPT into education comes with its fair share of challenges. Yet, it is these very challenges that provide us with opportunities to innovate and refine not just the AI, but the entire educational landscape. By addressing these issues, we not only enhance ChatGPT's functionality but also foster an educational environment that encourages critical thinking, inclusivity, and ethical responsibility. Therefore, ChatGPT's game-changing potential lies not just in its capabilities as a tool, but in the transformative educational process it encourages (Zhai, 2022).

## 6 Conclusion

In conclusion, ChatGPT is a cutting-edge AI tool that has captured the attention of educators worldwide due to its remarkable capabilities in generating human-like text and its potential to revolutionize the way we teach and learn. Its ability to provide personalized and interactive learning experiences, automate repetitive tasks, and enhance the accessibility of learning materials has enormous potential to transform education. However, there are also significant challenges that need to be addressed, such as ensuring the accuracy and reliability of the ChatGPT's responses, making sure it is inclusive for all learners, and addressing concerns about its impact on human interactions and critical thinking skills. As with any new technology, it will be important to carefully consider the potential benefits and risks of using

ChatGPT in education and to develop appropriate guidelines and policies to ensure that it is used in a responsible and ethical manner. Further research is needed to evaluate the efficacy of ChatGPT in education and to address its potential limitations and ethical concerns.

**Funding** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Availability of Data and Materials** Given the nature of this work there is no dataset used and/or analyzed.

## Declarations

**Conflict of interest** The author declare that they have no conflict of interest.

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