

# The potential of ChatGPT technology in education: advantages, obstacles and future growth

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## Article Info

### Article history:

Received May 11, 2023

Revised Aug 7, 2023

Accepted Sep 13, 2023

### Keywords:

Artificial intelligence

ChatGPT

Information systems

Natural language processing

Decision support systems

## ABSTRACT

Information and communication technology is becoming increasingly prevalent in our daily lives, with interactive communication modes such as social networks and instant messaging reaching unprecedented popularity. These tools are now widely utilised in various academic and research institutions by both faculty and students for communication and distance learning purposes. Chat generative pre-trained transformer (ChatGPT) and artificial intelligence tools hold the potential to revolutionise the way that students obtain knowledge and support. ChatGPT is a cutting-edge language technology capable of constructing intelligent, coherent texts, making it a valuable tool for writing and communication across different fields, including education. However, universities that incorporate ChatGPT as a teaching tool must address concerns regarding plagiarism and academic integrity. This investigation focuses on the advantages and obstacles of applying ChatGPT technology in the education field and its potential for future development. Findings reveal that through careful consideration of the ethical dilemmas and issues, academic institutions can leverage the maximum potential of ChatGPT to provide a more accessible, successful, and personalised learning experience for learners. The development prospects for ChatGPT appear promising, given its potential to grow and enhance its capabilities through on-going research and innovation.

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## 1. INTRODUCTION

The rise of artificial intelligence (AI) has led to a surge in the number of intelligence applications being employed in educational settings. This phenomenon has considerable implications for the field of education, where AI has the potential to completely transform how teachers impart knowledge and students acquire knowledge. AI development and integration in educational programs and systems presents a significant leap forward by equipping educators and academic institutions with innovative AI-driven tools and applications [1]–[3]. In the education field, information and communication technology (ICT) has been leveraged to enhance the teaching and learning experience through incorporating AI technologies. Decision support systems, expert systems and machine learning (ML) can transform the education field by assessing student records and proposing a personalised learning experience that caters to the specific learning needs and knowledge level of each student. One example of an intelligent technology that can aid in evaluating educational data, improving the academic learning environment, increasing learner engagement and meeting expected outcomes for teaching and learning methods is chat generative pre-trained transformer (ChatGPT).

By assessing teachers' performance and offering timely feedback and recommendations, ChatGPT elevates both the overall standard of instruction and the performance of learning institutions [3]–[8].

Open AI used the generative pre-trained transformer (GPT) architecture to create ChatGPT, a natural language processing (NLP) model that employs AI to construct text that simulates human writing. The unveiling of ChatGPT on November 30, 2022, marked a major step forward in the technology of language models [5], [9]–[11]. ChatGPT has numerous applications, including technical assistance, automatic translation, voice discussions, manufacture of educational content, and automated generation of articles, news and stories. It is important to note, however, that ChatGPT is primarily tailored for conversational purposes, and so its effectiveness in the aforementioned tasks could be constrained by the specific context and the quality of input data [5], [6].

ChatGPT can be employed to support the individual learning of students in various ways by, for instance, clarifying confusing concepts encountered in class, providing appropriate and quick answers to their queries, and providing personalised feedback and improvement suggestions for improved learning. By raising incisive questions and encouraging students to think in more depth, the development of critical and analytical thinking abilities in students can be promoted. Moreover, providing each student easy access to diverse and relevant educational materials will improve their understanding of course materials. However, educational goals should be clearly delineated if the full benefits of ChatGPT are to be realised in the realm of education [5], [6], [12]–[14]. A compilation of studies carried out in diverse fields to examine the potential of ChatGPT is presented in Table 1, where the objectives and results of each study are shown.

Table 1. Summaries of selected studies

Study	Study domain	Citations count on Google Scholar	Objectives	Results
[15]	General education	31	Provide an in-depth review of AI technologies to showcase how ChatGPT holds the potential to transform education.	AI can improve learning outcomes, student engagement, and productivity by offering individualised education support.
[16]	Medical	38	Examine the role of ChatGPT in medical education.	Medical education can benefit significantly from the application of ChatGPT.
[17]	Mathematics	8	Explore the viewpoints of teachers and learners regarding the use of AI in mathematics education.	ChatGPT is a valuable educational tool that requires usage guidelines for safety.
[18]	Law	133	Evaluate the capability of ChatGPT to generate law school exams without human intervention.	ChatGPT is at an average level (C+) when generating written content for law school exams.
[19]	Pharmaceutical	6	Leverage the conversational approach of ChatGPT to produce a brief review of "lipid-based drug delivery systems."	ChatGPT offers general information regarding the topic but does not have the capability to engage in detailed discussions.
[20]	Climate	48	Examine the potential application of ChatGPT in understanding global warming.	ChatGPT can improve knowledge of climate change and the accuracy of climate forecasts.
[21]	Computer science	41	Investigate the constraints of ChatGPT in addressing programming bugs and the value of utilising other debugging tools and techniques to verify its predictions and explanations.	ChatGPT aids programmers in debugging, providing explanations, and predicting the presence of bugs.
[22]	Academia and libraries	211	Present an overview of the key definitions related to ChatGPT and its underlying technology, namely, GPT.	ChatGPT has immense potential to modernise academia and librarianship, but also brings with it worrisome implications.
[23]	Higher education	10	Investigates the impacts of ChatGPT for educational institutions and students by analysing the perspectives of scholars and students.	The importance of obtaining a solid grasp of AI-related opportunities and challenges in higher education is highlighted.
[24]	Business	80	Surveys the potential of ChatGPT in developing e-commerce and other sectors, including finance, education, health, productivity, and news.	ChatGPT can improve efficiency, customer interactions, and support across various sectors.

Although interest in leveraging ChatGPT in education is growing, extensive research that examines evaluates the advantages, obstacles, and development prospects of integrating it into educational contexts remains scarce. Accordingly, this investigation intends to narrow this research gap by examining both positive and negative implications of integrating AI technologies and ChatGPT in higher education as well as

discussing their potentials for further development. The remainder of this paper is structured as follows: section 2 examines the advantages of ChatGPT technology being integrated into an educational context, section 3 delves into the obstacles associated with ChatGPT usage in education, section 4 discusses the future prospects of ChatGPT development, and last but not least, section 5 concludes this paper.

## **2. ADVANTAGES OF USING CHATGPT TECHNOLOGY IN THE EDUCATION SECTOR**

### **2.1. Personalised learning**

ChatGPT can undergo training with diverse educational resources, like articles, academic papers, instructional videos, and textbooks. By analysing individual student responses to questions and their interaction with the learning materials, ChatGPT can adapt and personalise the educational content to fit each student's learning requirements, preferences, and style. These personalised learning environments both promote the quality of education and enrich the learning of disadvantaged, vulnerable learners, especially students who require special education. For instance, AI-based educational tools such as ChatGPT can increase the reading comprehension of students with dyslexia or autism spectrum disorder. AI tools such as ChatGPT may play a vital role in helping students with learning disabilities reach their optimal potential [15], [25], [26].

### **2.2. Real-time support**

ChatGPT offers round-the-clock support, assistance, and advice to students anytime and anywhere. This accessibility can be appealing to online students who do not have access to in-person assistance or who have questions that require them to seek assistance beyond regular university hours or during weekends and holidays. It can help them enhance their knowledge, skills, and equip them with the essential resources realise their academic goals. ChatGPT allows students to access support and information on demand. By having the resources to learn more effectively, the students upgrade their ability to retain the course content longer and ultimately improve their academic performance [27].

### **2.3. Improved learning experience**

Through personalised and interactive support, ChatGPT enhances the student's learning experience by providing customised recommendations for instructional materials and tools. In addition, it offers specially designed exercises and games to cater to the specific needs of the student, thereby optimising their overall learning experience [28]. For instance, students can employ ChatGPT to engage in an on-going conversation so as to enrich their ability to communicate while learning a foreign language. The NLP capabilities of ChatGPT can motivate students to improve their conversational skills, encourage their collaborative learning, and improve their communication skills with their peers [15], [26].

### **2.4. Improved critical thinking skills**

ChatGPT can significantly enhance students' critical thinking skills by facilitating their participation in discussions that encourage the analysis and evaluation of ideas, exploration of different viewpoints, and comparison of concepts. As a result, ChatGPT supports the development of students' critical reasoning, problem-solving, and decision-making competencies, ultimately fostering a more well-rounded, and intellectually capable student body [25], [29].

### **2.5. Time savings**

The responsibilities of instructors in universities are increasing steadily, demanding immense effort and time from them to create lesson plans, prepare lectures and activities, design exams, monitor grades, analyse data, and offer individualised support to students especially those who are struggling. Allocating sufficient time to accomplish all these tasks is difficult. Thus, professors can benefit from AI technologies such as ChatGPT, as these help reduce their workload and streamline time-consuming tasks. ChatGPT can take charge of repetitive, time-consuming tasks or prepare replies to frequently asked questions, allowing professors to commit their time towards tasks like lesson planning and curriculum creation. It can likewise aid in generating educational resources (e.g. quizzes, tests, and assignments), leading to more time savings [30], [31].

### **2.6. Improved integrity of exams and assessments**

With cheating a serious concern for all educators, the use of AI-powered anti-cheating systems in the education sector is on the rise to stop and/or discourage cheating during exams and assessments. These systems (i.e. ChatGPT and proctoring) utilise advanced technologies such as NLP, ML, and computer vision to detect cheating activities and guarantee the integrity of the examinee. With ChatGPT, exams can be designed to be more interactive and individualised to lessen the likelihood of cheating. Students will find it difficult to cheat by copying the answers from their peers because ChatGPT will generate unique questions

and answers based on the students' learning history and level of knowledge. The advantages of ChatGPT in the education sector are illustrated in Figure 1 [26].

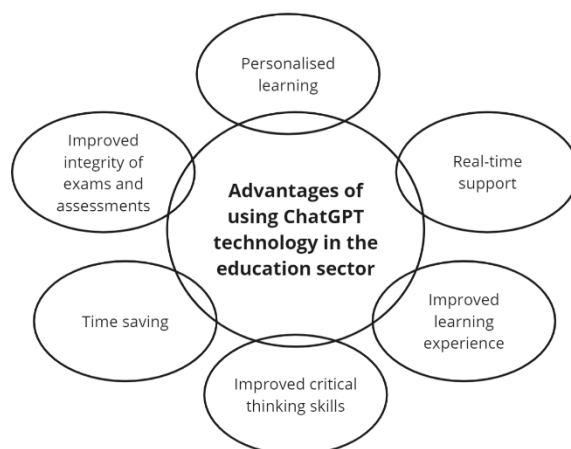


Figure 1. Advantages of using ChatGPT technology in the education sector

### 3. CHALLENGES OF USING CHATGPT TECHNOLOGY IN THE EDUCATION SECTOR

Remarkable advancements have been accomplishments in AI and ML technologies over the past few years, all of which have significantly influenced scientific research [32]. The education sector has also achieved various improvements, with AI technologies such as ChatGPT helping enhance the learning experience by delivering customised support to students and enriching the learning process. Nonetheless, the integration of AI technologies like ChatGPT into education has led to numerous obstacles and uncertainties. Some of more pressing concerns are presented in following sub section.

#### 3.1. Cybersecurity concerns

Using ChatGPT to produce malicious content or when it is accessed by unauthorised users can potentially result in a security risk. When ChatGPT is utilised in the classroom, ensuring security becomes a crucial concern. Learning institutions must give priority to ensuring the security and confidentiality of the information entrusted to them, including personal information, grades, and student records. The installation and implementation of proper safeguards, secure communication protocols, access controls and user authentication, and regular monitoring and auditing of data access can help mitigate such security risks [13], [33], [34].

#### 3.2. Accuracy issue

The accuracy of the system depends on several elements, including data quality, variety, and complexity. Training data that are low in quality or not diverse enough can lead the system to learn incomplete or incorrect patterns. Furthermore, the accuracy of AI models is affected by the complexity of the input data and the quality of the information provides by the students provide. If the latter do not provide clear, concise, and relevant data, then the system may have generate inaccurate responses. This deficiency is especially obstructive when students are not certain about what type of information they require or are unable to express their queries clearly for the system to understand [25].

#### 3.3. Limited knowledge and inaccurate citations

The stock knowledge of ChatGPT is limited, and without access to current and reliable sources, it may generate inaccurate information or citations [33]. The design and training of AI language models like ChatGPT result in limited knowledge, because these models operate only using the training data gathered from the internet and other sources, which have a cut-off date. The model has no access to data or events beyond this date. With regard to GPT-3.5, its knowledge cut-off is September 2021, hence it cannot provide information about events or developments after this [33], [35].

#### 3.4. Cheating issues

The academe is plagued by students' prevalent use of illegal or dishonest methods to answer or solve homework, without them even exerting effort to comprehend and solve the tasks given. This predicament has a negative impact on academic integrity and the trust between faculty and students.

Addressing this cheating problem when students are completing homework is crucial to the ability of universities to uphold academic integrity and promote effective learning. Instances of cheating can be lessened and students encouraged to practice integrity through several strategies: i) teaching students the value of academic integrity and honest work ethics by describing the negative impact of cheating in the long term and how integrity can help develop their skills and knowledge further, ii) employing innovative assignment designs to inspire students' creativity and use of reference sources instead of direct copying (i.e. plagiarism), iii) leveraging available software tools, such as citation and plagiarism detection programs, to recognise fraud, iv) implementing auditing and monitoring measures both in the classroom and online to deter cheating and safeguard the integrity of students' output, and v) mandating in-person exams at the university as part of the overall student evaluation to lessen opportunities for cheating, such as sharing one's answers with other students or using ChatGPT to compose answers [36]–[38].

### 3.5. Over-reliance on technology

Students must avoid over-reliance on technology as it may limit the development of their higher-order reasoning skills. Even though ChatGPT makes it easy to obtain targeted educational assistance and experiences, students still need to cultivate their analytical and critical thinking abilities in order to ensure proper learning. Over-reliance on ChatGPT, or on technology in general, may turn them into passive learners. When system-generated responses are accepted without question (i.e. passively), students lose the capacity to critically question or evaluate the accuracy or applicability of the information generated. They become incapable of assessing the credibility and quality of their sources, reaching logical conclusions and furthering concepts through creativity and innovation. Additionally, over-reliance on technology may reinforce pre-existing biases and bring about an imbalance in education opportunities. Universities should, therefore, focus on providing students with clear, detailed instructions on the acceptable use of ChatGPT as a learning tool, rather than as a replacement for their own critical reasoning and independent learning. These learning institutions should offer various opportunities for active learning that promote independent inquiry, critical reasoning, and problem-solving [25]. Figure 2 highlights the multifaceted challenges that accompany the integration of ChatGPT technology in the education sector [13], [33]–[38].

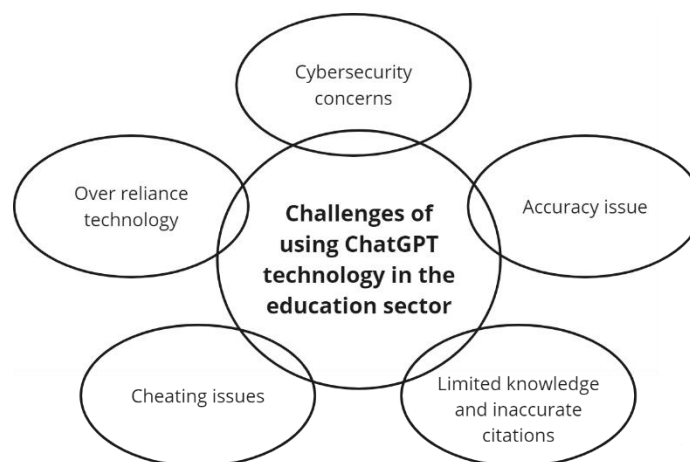


Figure 2. Challenges of using ChatGPT technology in the education sector

## 4. DEVELOPMENT PROSPECTS OF CHAT GENERATIVE PRE-TRAINED TRANSFORMER

Exciting prospects are in store for AI models and ChatGPT. These technologies may be utilised in a wide range of applications that may completely transform how such technologies are leveraged as they continue to advance [39]. To increase the proficiency of ChatGPT at understanding and reacting to human language, modifications and innovation can be applied to its NLP functions for further improvement. The functions of ChatGPT and other AI-driven NLP models can be enhanced by using larger and more diverse datasets for training. The use of AI in NLP holds tremendous potential in various areas. Some development highlights in this field are presented below:

- Enhancing human comprehension and interaction: artificial language models may develop the capability to comprehend human language and engage with individuals in manner that is more similar to human processes. They will be more sophisticated and capable of providing subtle suggestions.

- Leveraging context and general knowledge: an artificial language model such as ChatGPT can employ its wide-ranging general knowledge to decode complex texts and generate information about a broader range of topics with greater precision.
- Comprehending mindsets and sentiments: in the future, ChatGPT may develop the capability to identify feelings in texts and generate a suitable and perceptive way of responding to human emotions.
- Strengthening deep learning and active engagement: to achieve improved knowledge dissemination and more accurate contextual understanding, ChatGPT is poised to develop more sophisticated text analytics and engagement.
- Maximising visual and audio knowledge: ChatGPT may be able to provide high-engagement experiences by merging linguistic information with visual and audio knowledge [32], [40], [41].

As time passes, natural language models like ChatGPT will have improved interactivity and comprehension for written text and discussions. Such developments will have a profound impact on the academic experience of students and the extent and quality of assistance provided to teachers [42]. For instance, consider an educational application from ChatGPT named TeacherBot. By utilising AI innovations and NLP technology, TeacherBot can serve as an interactive learning platform installed on smartphones and tablets to assist students in their daily studies. How does TeacherBot work?

- Comprehension and vocabulary evaluation: TeacherBot can comprehend and analyse educational content, such as lessons, essays, and reference materials by mining key vocabulary and relevant terms.
- Aiding students with comprehension: TeacherBot can aid students who have difficulties with comprehension by explaining complicated concepts through illustrations, examples, and simplified language.
- Identifying the level of difficulty: by evaluating a student's existing knowledge and skills to identify their corresponding educational level, TeacherBot can recommend educational content that is proportional to the student's capabilities.
- Language learning: TeacherBot can help students learn a new language by providing immediate translation and customised resource materials for their specific requirements. Such assistance will enable students to gain language proficiency and comprehension faster.
- Research support: TeacherBot can be an invaluable learning tool by providing students access to big data and helping with their research and review of reference materials. With this function, students will be able to conduct their research more efficiently, thus resulting in better-quality research output.
- Enrich the learning experience via feedback: TeacherBot can easily assess the performance of students in activities and exams, and provide timely feedback for their improvement. If used as a personal learning assistant, TeacherBot can enrich students' learning experience, support teachers in classroom management, and opening up opportunities for customising instructions according to the students' level of knowledge and understanding. This feature can help improve students' scholastic performance and intensify their engagement in the learning process.
- Building inclusive learning environments: integrating educational platforms such as Zoom and Microsoft Teams with TeacherBot can help build inclusive learning environments for students, teachers, and universities. TeacherBot can be rolled out with a user-friendly interface that allows users to input text, then retrieve relevant and appropriate responses. Furthermore, the application can promote successful exchange between students, faculty, staff, and parents in a safe and trustworthy virtual environment, where everyone can pose questions and ask for clarifications and receive immediate feedback. It allows its users to set up virtual classrooms and simplify the organisation of activities and assignments. Students can also employ personalised resources to improve their understanding of concepts and learning materials according to their needs and knowledge level [43].

## 5. CONCLUSION

Along the continuing evolution of the education sector, technology plays an ever-increasing supporting role in students' learning and development. The integration of AI technologies such as ChatGPT, which has gained rapid popularity and usage, in universities holds the promise of completely transforming how students access information and obtain support. Such integration of AI with related courses, such as data science and computer science, is a game-changer in the education field, as it will grant students the opportunity to engage with technology and learn about it in a profound manner. By providing prompt and precise responses to students' questions, ChatGPT arms them with the resources they need to learn at their own pace. Integrating ChatGPT with the education sector can yield numerous advantages, such as easier access to information, enhanced efficiency and targeted learning outcomes. Keep in mind, however, that such integration involves dealing with serious ethical dilemmas and issues that requires thorough reflection. Before organisations even consider adopting ChatGPT or other AI technologies, they need to first resolve obstacles such as ethical risks and cybersecurity issues as well as ensure fair access to the technology for all

interested users. Systematic training should also be given to faculty and students for them to achieve competent and effective utilisation of ChatGPT. The performance of ChatGPT in the classroom should be assessed regularly to determine its overall impact on improving student learning and comprehension. The findings from such assessments can help stakeholders in developing policies for incorporating these AI technologies into educational methodologies and settings.





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