Implications of ChatGPT on Teaching and Education

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Abstract

ChatGPT, developed by Open AI, was introduced on 30th November 2022. Since then, there had been numerous papers discussing its merits and demerits related to its use in teaching and education. This paper undertook a review of the implications of ChatGPT on teaching and education. A search of Google Scholar yielded 17 papers for this review. Most papers followed the general pattern of describing ChatGPT, its advantages and disadvantages, some examples of its use or misuse and suggestions on how it can be used in teaching and education. Generally, the advantages overweigh the disadvantages. Hence, most papers recommended its adoption by students, teachers, and academic institutions. To reduce its harmful effects, ChatGPT should be used as a human-AI collaboration rather than a competition. Both students and teachers should use this as initial input to generate ideas and develop further using manual methods. Journals should accept ChatGPT as a method of research. Governments should enact laws to prevent its harmful use to the public. International collaborations for the development of guidelines are necessary.

Keywords: ChatGPT, Education, Teaching, Review

Introduction

ChatGPT is an artificial intelligence chatbot developed by OpenAI. It was launched on November 30, 2022. It enables users to refine and steer a conversation towards a desired length, format, style, level of detail, and language. It gives prompts and replies at different stages of a conversation. Its content covers a wide range of knowledge domains (Lock, 2022). However, sometimes, it provides erroneous information confidently.

By January 2023, ChatGPT became the fastest-growing consumer software application in history. It registered over 100 million users. This resulted in the increase of OpenAI's valuation to US$29 billion.

ChatGPT can generate academic articles. Bushard (2023) noted that fake scientific abstracts and research papers were generated by using OpenAI's highly advanced chatbot ChatGPT. These articles fooled scientists into thinking they were real reports in about 68% of instances. Plagiarism detection programmes marked such reports as 100% unique. The use of AI like ChatGPT to write assignments and theses has been prevented by many universities. The implications of ChatGPT on teaching and education arise from this issue.

Methodology and Results

This paper aims to undertake a qualitative review of the implications of ChatGPT in teaching and education. A search for papers in Google Scholar was done with the title of the paper as the keywords to select papers for this review. This process yielded 17 papers relevant papers which are discussed in the following sections.

General aspects of ChatGPT

According to Aiswarya (2023), ChatGPT has both benefits and challenges when it is used to replace traditional teaching methods. It can generate content, answer students' questions, and grade assignments, especially in e-learning platforms. Thus, it can provide personalised and adaptive learning experiences to students. Its natural language processing (NLP) ability can help students by engaging them conversationally and providing instant feedback and support. Its benefits are personalized learning, language learning, assistance to educators, instant feedback etc Its challenges are privacy and security, accuracy, possible bias, highly technology-dependent, and high implementation costs.

As was noted by Trust, Whalen, and Mouza (2023) in its "Educator Considerations for ChatGPT" document, OpenAI (n.d.) warns about the potential risks of using ChatGPT, including plagiarism, harmful and biased content, equity and access, the trustworthiness of the AI-generated content, and overreliance on the tool for assessment purposes. The authors consider that the best solution to the problem of its improper use is one of inclusion instead of exclusion. Educators can prepare a best practices model for students by integrating AI tools into classwork and curriculum. Students can try to use it to increase productivity, comprehension, and creativity by better understanding how to use it properly. The Turing Test devised in 1950 (Turing, 1950) assesses how close computers can mimic humans. A report was published in the New York Times by Miller et al (2023), titled, "Did a Fourth Grader Write This? Or the New Chatbot?" features a series of texts written by students along with text written by ChatGPT. A fourth-grade teacher, a professional writing tutor, a college education professor, and a children's author were not always able to distinguish between text from a child or the chatbot. Thus, Chat GPT passes the Turing test to a considerable extent. ChatGPT helps students to pass difficult school and college examinations and medical licensing tests. Many AI tools are being designed and are being used to assist teaching. Students have also started using AI tools as grammar and sentence correctors (e.g., Grammarly), translation tools (e.g., Google Translate), language learning tools (e.g., Duolingo), and answer engines (e.g., Wolfram|Alpha) to help them to communicate, think, and learn. Some teacher education programs have embedded AI-based digital clinical simulations and virtual reality training systems (e.g., Mursion), helping to prepare future teachers for successful teaching. On the other hand, AI-based automated assessment systems save teachers time to grade student work; but perpetuate systemic bias and discrimination by favouring dominant ways of thinking, knowing, and using language. There is a long list of how ChatGPT can help teaching and education. Sometimes, Inaccurate, biased, and imperfect information are provided by ChatGPT, which may affect both teaching and learning. Breach of privacy and security is against the law. ChatGPT encourages students to cheat in examinations and assignments. ChatGPT can also produce misinformation, hateful, harmful, and biased information very quickly. Even when some steps were taken by OpenAI to prevent such content, many users discovered alternate means of using it wrongly. It can impersonate individuals or organisations and spread false information, automatically perform scamming and phishing to send fraudulent messages or steal personal information and online harassment. The above facts show that ChatGPT can be used for teaching and education if sufficient safeguards are incorporated against wrong and unethical use by students, teachers, or educational institutions.

In a discussion paper, Hong (2023) pointed out that ChatGPT is lauded by tech-savvy people for its incredible range of capabilities. In the education field, on the other hand, there had been both amazement and apprehension. Reports of the use of ChatGPT leading to cheating and

misconduct (Jonathan, 2023) have prompted education institutes to ban its use (Reuters, 2023) (Reuters, 2023). Teachers and school administrators perceive ChatGPT as opening Pandora's box threatening students' development of critical thinking and writing abilities. However, the educational field has always initially resisted the use of new technologies in the past also. Their apprehensions are legitimate. It may be due to the misalignment of anticipation and reality to human beings' natural tendency to envision the unknown as the enemy or that individuals and organizations are simply reluctant to accept major changes, widely known as the "innovator's dilemma". In language teaching, ChatGPT can cause unoriginal writing. The disadvantages of ChatGPT lead to seeking ways for ethical and responsible use of this facility. ChatGPT can be used as an efficient personal language tutor. Further research is required for objective assessment and any possible improvements in Chat GPT for its wide acceptance.

The scope of using ChatGPT for language learning was explored by Baskara and Mukarto (2023). The limitations and potential challenges of using ChatGPT include it cannot handle more complex and abstract concepts, ethical aspects like biased or offensive content, plagiarism, and breach of privacy and security. There is also the remote possibility of a potential threat of substituting human language teachers. On the other hand, in the case of higher education, the implications are the personalised language learning, lesson plans and materials catering to the specific needs of each student, and its capability to generate authentic language materials. These considerations lead to the identification of the potential benefits of ChatGPT for language education. It can create practice exercises based on the capabilities of individual learners. Thus, if the limitations are addressed, ChatGPT is an effective and efficient tool for language learning.

Based on the merits and demerits of ChatGPT, Lo (2023) suggested immediate action to update the assessment methods and institutional policies in educational institutions. Both instructors and students should be trained to respond to the impact of ChatGPT on the educational environment. The rapid review by the authors showed its performance as unsatisfactory for mathematics, software testing, sports science and technology, and MCQ-based exams on all subjects. Strategies to prevent plagiarism have been tabulated. The lack of citations and references in ChatGPT outputs was pointed out by Opara, Theresa, and Aduke (2023). The authors suggested ensuring that the tool cites and gives references to its replies.

Specific educational contexts

It was observed by Lee (2023) that in medical education, ChatGPT has the potential to serve as a virtual teaching assistant. It can provide students with detailed and relevant information and interactive simulations. It can also increase student engagement and improve student learning. The challenges and limitations of ChatGPT, like ethical issues and harmful effects, need to be considered. More or less similar observations were made by Qadir (2023) in the case of engineering education suggesting that engineering educators should understand the implications of this technology and adapt the engineering education ecosystem to use ChatGPT maximising its benefits and minimising its limitations for the advantage to the next generation of engineers.

SWOT Analysis of ChatGPT

A SWOT analysis of Chat GPT was done by Farrokhnia, Banihashem, Noroozi, and Wals (2023), as given in Fig 1, to identify its strengths and weaknesses and opportunities for and threats to education.

Helpful to achieve goals

Harmful to achieve goals

Internal factors

Strengths

Generating plausible responses

Self-improving capability

Providing personalised responses

Providing real-time responses

Weaknesses

Lack of deep understanding

Difficulty in evaluating the quality of responses

The risk of biases and discrimination

Lack of higher-order thinking skills

External factors

Opportunities

Increasing accessibility of information

Facilitating personalised learning

Facilitating complex learning

Decreasing teaching workload

Threats

Lack of understanding of the context

Threatening academic integrity

Perpetuating discrimination in education

Democratisation of plagiarism in education

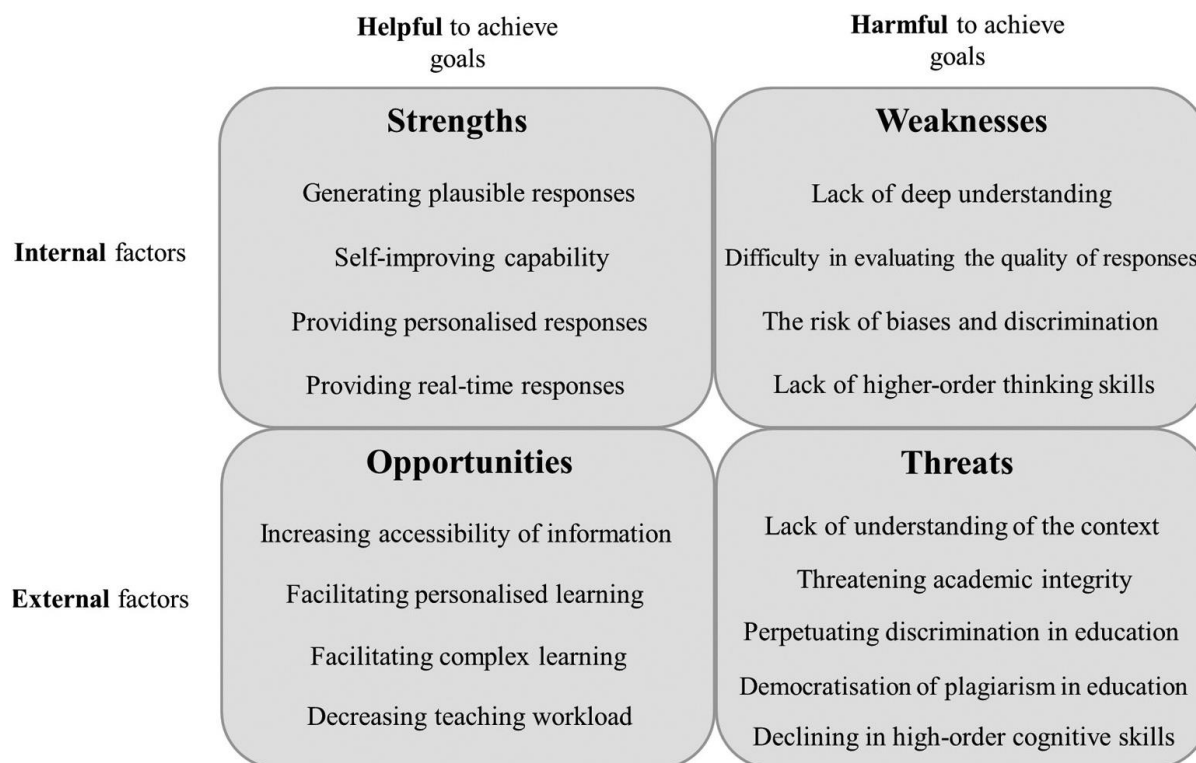Declining in high-order cognitive skills

Figure 1 SWOT analysis of ChatGPT (Farrokhnia, Banihashem, Noroozi, & Wals, 2023).

Some points from the SWOT analysis related to teaching and education are as follows. It can capture a wide range of linguistic patterns and relationships, thereby providing a fair understanding of language and context. Chat GPT can increasingly become accurate over time due to its self-learning ability from human feedback. Its capability for personalised responses is useful for personalised learning. Rapid real-time responses can speed up text outputs. It has accessibility to a large range of information, which can be accessed by teachers and learners using different methods like websites, smartphones etc. It is a more efficient search tool than the conventional search engines. It offers a written answer to the search query instead of a list of resources. As it can summarise information collected from relevant sources, students can save time, which they can use for reading and critically evaluating what was offered to them. For teachers, it can prepare lesson plans, and help them to locate appropriate teaching materials. Since it adjusts its feedback based on the tone of the document, some care is required in accepting the comments. It facilitates complex learning and decreases teaching workloads. The weaknesses due to a lack of deep understanding, affect the adequacy of depth required in some responses. Its lack of capability to check the quality or credibility of information can lead to errors in feedback on queries. The risk of bias and discrimination (already discussed above) and lack of ability for higher-order thinking are also weaknesses to apply in education. Therefore, it cannot answer questions requiring critical thinking. The applicability of ChatGPT in education is threatened by many factors. When used for personalised learning, its lack of deep understanding of the curriculum, the learning style of each student, and the cultural context of the student leads to recommendations either too difficult or too easy for students. Grading is another example of this. Its use often threatens academic integrity. It can also perpetuate discrimination in education. Training on a particular group of students may lead to the evaluation of other groups lower. Other harmful effects like plagiarism etc. have been discussed above. Overdependence on

ChatGPT can reduce the higher-order cognitive skills of students including creativity, critical thinking, reasoning, and problem-solving. In the case of teachers, overdependence on ChatGPT can reduce the quality of interactions with students and increase the current inequalities. The authors have given recommendations to use its strengths and opportunities to address the weaknesses and threats. Some directions for future research have also been indicated.

Empirical results

Zhai (2022) noted that ChatGPT can create a high impact on education due to its capacity of ChatGPT to drive changes in educational learning goals, learning activities, and assessment and evaluation practices. The author used it to create an academic paper on "Artificial Intelligence for Education." The product was partially coherent, accurate, informative, systematic and time-saving (only 2-3 hours). The author suggested adjusting learning goals. It should enable students to conduct subject-domain tasks and improve students' creativity and critical thinking rather than being limited to their general skills. To achieve the learning goals, the AI should be designed to learn tasks and engage students in solving real-world problems. There is also a concern that ChatGPT may induce students to outsource their assessment tasks. The academic paper produced by ChatGPT in this work did not use any references or in-text citations. It only alluded to some papers published in certain journals.

Results obtained by Ali, Shamsan, Hezam, and Mohammed (2023) from a survey of 80 students and teachers, who had experience using ChatGPT from the beginning, showed that ChatGPT motivated students to develop reading and writing skills. They did not find any effect on listening and speaking skills. Thus, if Chat GPT is used as a learning tool (without considering its negative aspects), it promotes motivation to develop certain language skills.

In qualitative research, Wardat, Tashtoush, AlAli, and Jarrah (2023) used a two-stage instrumental case study consisting of content analysis of 30 interviews with students, teachers etc. and user experience on ChatGPT to teach mathematics. The interview responses were mostly positive. The responses recognised its improved math capabilities. It has also the ability to improve success in basic knowledge of mathematics and various topics. ChatGPT offers comprehensive instruction and assistance in the study of geometry. Public opinion about ChatGPT on social media is generally positive. There is a general enthusiasm for the use of ChatGPT in teaching mathematics in educational settings. However, user experience with simple algebraic and geometric problems was not so encouraging. ChatGPT made simple mistakes in the tested problems and failed to give correct answers. The need for more research and development to make ChatGPT error-free is obvious from these results.

After an extensive review of the literature, Karthikeyan (2023) hoped that another version that makes the life of the learning community better to outwit or outclass ChatGPT may come. Till then, ChatGPT will provide a supportive role rather than a competitor to educational professionals.

The holistic picture

In an opinion paper Dwivedi, et al. (2023), multi-disciplinary insights were presented by 43 contributions from experts in fields such as computer science, marketing, information systems, education, policy, hospitality and tourism, management, publishing, and nursing. In the case of education, ChatGPT has created more anxiety than enthusiasm because it may threaten academic integrity it may lead to high levels of plagiarism and avoid learning by students. Although this is

true, it may be wrong shutting off all possibilities of using such technologies by pointing to academic integrity. ChatGPT can radically change classroom experience and outcomes of knowledge and skills of learners. The authors suggest the use of mindfulness by instructors and students to motivate students to explore new tools like ChatGPT. Mindfulness will help to identify fake news and to create a more secure online behaviour. Both teachers and students should explore ChatGPT applications together and use the most desirable ones in the curriculum. Students can be asked to use Chat GPT to write an essay on a topic and then critically review it. This will help to work through the limitations of ChatGPT. Along with it, students need to be guided on the ethical implications of using ChatGPT and its capabilities and boundaries of it. Thus, trust in technology helps to use the technology and the teacher helps to develop critical thinking by asking them to review the texts critically. Methods of assessment of student work also need to be revised. The authors note that huge investments by leading companies in AI applications will lead to more developments in this respect. Academic institutions and journals need to revise their ethical guidelines to keep pace with the development of technologies. Journals can ask to include the use of ChatGPT in the methods section. All journals and conferences will ultimately guide authors on the correct (and incorrect) use of generative AI tools, as this will become inevitable soon. Using these tools will save time spent on preparing articles for publications and use that time for other productive purposes. A human-ChatGPT collaboration may be a good solution to the problems. Digital transformation of academia through ChatGPT enables a shift in the significance of the text as a medium in research and education towards the ability to ask meaningful questions and find answers using suitable algorithms. Now the question arises: If ChatGPT does almost everything for students and teachers, will it destroy creativity and critical thinking? Assignments can be made more complex and based on recent developments for ChatGPT to handle. Instead of using ChatGPT for an assumed good result, the tool can be guided to correct mistakes using new methods of collaboration. Instead of presenting a text generated by ChatGPT as an assignment given by the teacher, it can be intensified by manual modifications to raise its standard. This will avoid branding the work as plagiarism. Thus, ChatGPT can be used as a supplement for generating academic works. ChatGPT can be easily integrated into educational platforms and systems like virtual learning environments, learning management systems, and resource repositories to provide instant feedback and guidance to students. These platforms have 24/7 access to relevant course and programme information to engage students in context-specific conversational interactions. There is a need to provide legal guidelines on how to use and how not to use ChatGPT. A time will soon come necessitating educational policies of academic institutions and the government to revise their policies to accommodate the use of ChatGPT and similar tools. The need for the journal community to join and develop guidelines on the use of ChatGPT is highlighted. International coordination is also necessary to regulate the proper use of ChatGPT.

Conclusions

The papers in the general aspects section followed the pattern of describing ChatGPT, its potential benefits and disadvantages, some examples, and suggestions for its use in education. The points about benefits and disadvantages were repetitive in all the papers in all sections. One SWOT analysis and three empirical results confirmed these observations.

The overall conclusion emerging from the foregoing review is that ChatGPT can be constructively adopted recognising its limitations. Its benefits can be fully utilised by students and teachers if proper guidance and guidelines are provided. Supportive policies by academic

institutions and journal publishers are required to prevent its unethical and harmful use. ChatGPT should be used as a human-AI collaborator rather than in competition. Governments should enact laws against its unscrupulous use by anyone for harmful purposes against the public. International collaborations to develop guidelines on the use of AI like ChatGPT need to be developed to tackle the problematic issues globally.

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