

SWOT Analysis of ChatGPT: Implications for Educational Practice and Research

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Abstract: Technology plays a significant role in our lives today. OpenAI, a company at the forefront of artificial intelligence since 2015, has taken remarkable steps to make artificial intelligence more accessible and beneficial for everyone. One significant achievement in its journey is the development of Chat Generative Pre-trained Transformers (ChatGPT). We used the SWOT analysis framework to outline ChatGPT's strengths and weaknesses and to discuss its opportunities for and threats to education. The strengths include using a sophisticated natural language model to generate plausible answers, self-improving capability, and providing personalised and real-time responses. As such, ChatGPT can increase access to information, facilitate personalised and complex learning, and decrease teaching workload, thereby making key processes and tasks more efficient. The weaknesses are a lack of deep understanding, difficulty in evaluating the quality of responses, a risk of bias and discrimination, and a lack of higher-order thinking skills. Threats to education include a lack of understanding of the context, threatening academic integrity, perpetuating discrimination in education, democratising plagiarism, and declining high-order cognitive skills.

Keywords: Analysis, ChatGPT, Education Technology

A. Introduction

Artificial Intelligence (AI) refers to the science and engineering of creating systems capable of performing tasks commonly associated with learning, judgment, and decision-making (Cotton et al., 2023; Sugiarto, 2023; Bakti et al., 2023; Ghahramani, 2015). AI has proven successful in solving complex problems in various domains, including education (Benzaghta et al., 2021) The application of AI in the field of language processing has led to the creation of chatbots and intelligent virtual assistants capable of understanding and generating human language (Ahsan et al.,

2022). One such powerful AI-based chatbot is the 'Chat Generative Pre-trained Transformer' known as ChatGPT (Lu et al., 2018). This new AI tool was first introduced to the public on November 30, 2022, and quickly gained over a million subscribers within its first week.

ChatGPT was developed based on the Open AI language model and trained with a large dataset of human conversations, allowing it to perform complex tasks and generate human-like responses (Ahsan et al., 2022). ChatGPT uses deep learning techniques to understand, process, and generate natural human language with a high degree of complexity yet considerable accuracy and usability (Dehouche, 2021). In conclusion AI can interact with and help humans perform at a higher level. AI is now seen by many as an integral driver of revolution fourth industry, and could trigger a fourth revolution in education. Nevertheless, educators are required to review current AI capabilities and identify possible pathways to optimize learning. Given the increasing attention, it is time to reviewing AI research, such as usage Chat GPT recently used by academics to provide educators with the latest understanding. Technologies like ChatGPT, have changed the way humans interact with machines and unlock new potential in teaching and learning.

B. Methods

This research uses a qualitative approach with a SWOT design. Refers to a research approach that uses SWOT analysis to explore and understand in depth the qualitative factors that influence a phenomenon or research topic. In this context, the research focuses on the strengths, weaknesses, opportunities, and threats encountered through observations, interviews, or text analysis. Qualitative SWOT design involves data collection that is descriptive and interpretive, rather than relying solely on numbers or statistics. The results of a SWOT analysis can provide a deeper understanding of the context and dynamics of a situation, helping researchers identify relevant strategies or recommendations based on contextual understanding.

C. Results and Discussion

SWOT Analysis Framework

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats, which was first introduced in the early 1950s as a framework for investigating organizational strategy (Floridi & Chiriatti, 2020). This framework has been widely used in education to provide information for strategic planning and decision-making in situations that require consideration of the perceptions and capabilities of various parties (Gao, 2021).

Based on SWOT analysis, a successful strategy in adopting new technologies in education is to take advantage of technological opportunities by building on its

strengths and overcome threats by improving or compensating for its weaknesses. SWOT analysis provides a clear structure for gathering information from various sources and provides a picture of internal factors (i.e. strengths and weaknesses) and external factors (i.e. threats and opportunities) that may affect the integration of new technologies in education (Hastiana et al., 2023; Komalasari, Abdullah, Yiharodiyah, & Amanda, 2023; Komalasari, Abdullah, Yiharodiyah, Sutiyo, et al., 2023; Purba et al., 2021). Strengths are considered to be resources or capacities that enable new technologies to achieve predetermined goals (Rizky, 2022; Rohibni et al., 2022; Roisatin et al., 2022; Triayomi & Pamugkas, 2023). Opportunities relate to internal or external characteristics associated with the technology that increase the demand for what the technology can provide to its users (Imaduddin & Astuti, 2022; Niza & Suyanto, 2023). Weaknesses are limitations or defects associated with the technology that impede progress towards the set goals. Finally, threats can be unfavourable characteristics of the technology that hinder its strategy by posing obstacles or constraints, thus limiting the achievement of goals (Elkins & Chun, 2020).

Guided by the SWOT framework and supported by available literature, this review provides a comprehensive overview of ChatGPT's strengths, which can help identify its various opportunities for education (Lucy & Bamman, 2021). It also provides a clear understanding of the ChatGPT's weaknesses to highlight potential threats that may be faced by relevant parties in the future. This will enable the development of specific strategies to effectively manage and eliminate such threats.

Strengths of ChatGPT

A review of the scientific literature revealed some key strengths of ChatGPT:

Generating Sensible Responses

ChatGPT is a highly advanced language model that uses a 'transformer architecture' for a variety of language processing tasks, including language generation and understanding (Yeadon et al., 2023). This architecture allows AI-based chatbots to model the relationships between words in a sentence, maintain context, and generate cohesive and relevant responses. (Li & Xing, 2021) ChatGPT's superior performance is largely due to the large amount of training data (Kasneci et al., 2023), allowing it to capture a wide range of linguistic patterns and relationships, thus providing a good understanding of language and context (Jafar, 2021; Ritual et al., 2020) (Stokel-Walker, 2022). These features allow ChatGPT to provide responses that make sense and seem more credible compared to other similar AI tools

ChatGPT has also become a very useful tool in many applications, such as in the automated translation industry, natural language processing, and business-based chatbots. The advantages in context understanding and wide usage make ChatGPT a

reliable solution for solving various challenges in the world of information technology (Rawas, 2023).

In addition, thanks to the continuous development of technology, models like ChatGPT are getting smarter and are able to learn from new experiences and data. This means that in the future, we can expect ChatGPT and similar language models to become smarter, more sophisticated and more efficient in various applications, helping us to communicate and interact with technology more smoothly and effectively. With these continuous improvements, ChatGPT and similar models will continue to play an important role in changing the way we interact with the digital world (Stokel-Walker, 2022).

Advances in ChatGPT and similar language models have also had a positive impact in educational and research contexts. These models can be used to analyze and better understand complex texts, support research in various disciplines, and assist teachers and students in the teaching-learning process. They also open up opportunities for applications in other fields such as sentiment analysis, named entity recognition, and massive text analysis. ChatGPT also triggers important discussions about ethics and responsibility in the development and use of artificial intelligence. We need to consider issues such as bias in training data, privacy, and the social impact of using these models. Governments and industry are working to develop appropriate guidelines and regulations to address these issues and ensure that the development of artificial intelligence continues to benefit society at large (Qin et al., 2023).

In other words, ChatGPT is an important representation of technological advances in the field of natural language processing and artificial intelligence. Its potential in a wide range of applications, whether in the business, education or research sectors, makes it an invaluable tool in the changing ways we interact with an increasingly complex digital and human-machine world (Motlagh et al., 2023). However, it is important to continue to consider the ethical and social implications of these developments, while continuing to encourage innovations that bring benefits to us all. As we continue to explore the role of ChatGPT and similar language models in various contexts, we must also recognize the challenges that may arise in the future. One of the main challenges is maintaining safety and security in the use of this technology. With ChatGPT's ability to generate authentic-looking text, there is potential for abuse such as fraud and dissemination of false information. Therefore, developers and users of this technology need to work together to develop tools and methods to detect and prevent this kind of abuse (Floridi & Chiriatti, 2020).

In addition, it is important to continue to improve the interpretability of language models such as ChatGPT. While they can generate cohesive and relevant responses, it is often difficult to understand the reasoning behind certain responses. This is especially important in decision-making involving these models, such as in natural

language processing in law or healthcare. Openness and a better understanding of how these models make decisions can help us maintain transparency and accountability (Lucy & Bamman, 2021). Thus, while ChatGPT and similar technologies have brought many benefits, we also need to maintain a balance between innovation and ethics. Continuing to develop our understanding of its potential and limits and working together to address the challenges that arise will be key in ensuring that it remains a positive asset in our society.

Self-Improvement Capability

A unique feature of ChatGPT is its self-improvement or self-learning capabilities. ChatGPT uses a more complex language processing model compared to other AI chatbots, called generative pre-training (GPT). GPT is an AI text generator that uses reinforcement learning from human feedback to update its language model. (Perez et al., 2017) This capability allows ChatGPT to adjust and improve responses based on input from human raters (Stokel-Walker, 2022) In addition, continuous improvement to its training data helps ChatGPT to be constantly updated with new data, so it can become more accurate over

Providing Personalized Responses

Chat GPT's ability to learn from its interactions with humans makes it an adaptable conversational agent. (Zawacki-Richter et al., 2019) ChatGPT can remember and incorporate previous conversations into its responses. This allows it to maintain context and continue a more natural and cohesive conversation with the user over time. Thanks to training on large amounts of data, ChatGPT has the potential to provide personalized responses based on the context of a particular prompt (Haque et al., 2022). In addition, ChatGPT can generate responses using different tones and structures depending on the user's preferences and needs. (H. Lee, 2023) This feature allows users to create unique texts in what looks and feels like an authentic dialogue with a chatbot that becomes more personalized with each interaction.

Provides Real-Time Responses

The processing speed of ChatGPT may vary depending on various factors such as the complexity and number of questions. However, by using advanced natural language processing models, ChatGPT is able to understand complex questions and provide relevant answers in real-time. (Masters, 2019) In a study to explore the potential of ChatGPT for academic writing, the response rate by ChatGPT was revealed to be extremely fast, taking less than 2 minutes to generate 300-500 words of text (H. Lee, 2023). This capability can significantly simplify the process of obtaining information, as users no longer need to manually search through multiple sources and search engines. In a fast-paced world, where finding sensible answers is sometimes under

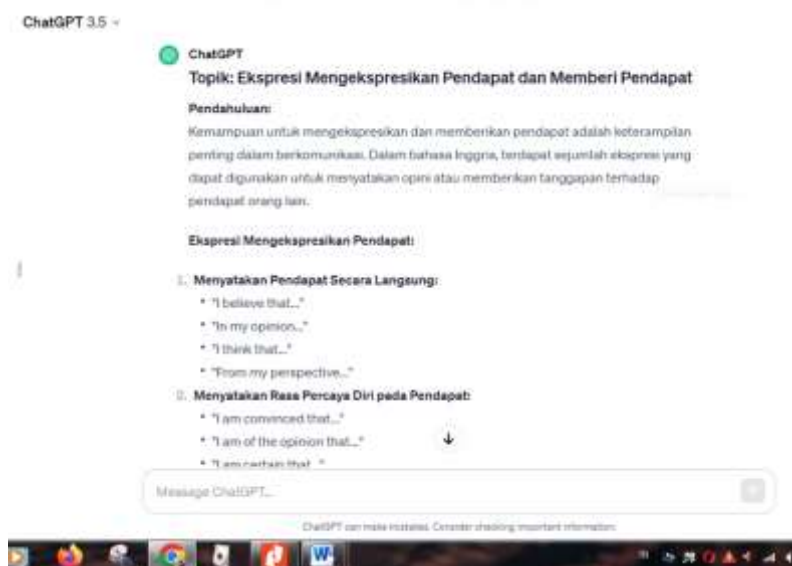
the pressure of a deadline or the need for quick decision-making, this feature can be of great benefit.

Opportunities for Education

ChatGPT has the potential to offer a number of opportunities for higher education students and teachers. The key opportunities of ChatGPT for education are described below.

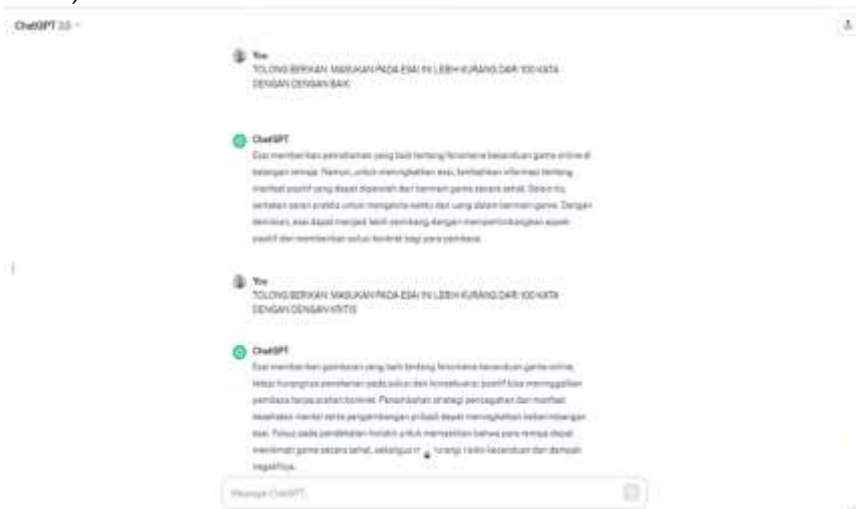
Improving Information Accessibility

ChatGPT can provide students and teachers with easy access to information through various platforms (e.g., websites or smart phone apps) and in various fields. In addition, ChatGPT is a more efficient tool compared to traditional search engines because it provides written answers rather than just a list of sources. ChatGPT can find and summarize relevant information (H. Lee, 2023), making it easier for students to access detailed information quickly. From a pedagogical perspective, this means that ChatGPT can save access time for students, and instead students can spend more time reading and critically reflecting on a given document. For teachers, ChatGPT can assist them in identifying and creating relevant teaching materials. It can also assist them in generating lesson plans for teaching with a set of parameters and constraints (Halaweh, 2023). For example, ChatGPT can generate a lesson plan for a 60-minute session on argumentation skills for university students as shown in Figure 1. This generation can serve as a starting point for novice teachers who have more teaching experience and pedagogical knowledge.



Facilitating Learning

ChatGPT has the potential to provide personalized support and feedback to students at different levels of complexity. For example, in the context of writing argumentative essays as one of the important learning tasks for college students, we had ChatGPT provide feedback on an anonymous essay on 'Video Games for Children' in three different scenarios by considering three main features of feedback, including constructive, affective, and critical features. While ChatGPT provided more positive and affective feedback with praising question types, it generated more critical feedback with critical question types (Figure 2). For teachers, this implies that they should carefully consider the type of questions to provide personalized feedback to students, because when feedback is solely critical but not positive, students generally do not accept such feedback for psychological and emotional reasons (Elbanna & Armstrong, 2023).



As the example shows, ChatGPT can remember the context of the first question and can provide relevant responses to follow-up questions from students. This feature is very useful for providing an interactive and meaningful dialog between the student and ChatGPT. As a conversation partner, it allows the student to ask for further explanations of ChatGPT's responses and even correct them if there are any mistakes (Motlagh et al., 2023).

Facilitating complex learning

Previous findings show the potential of artificial intelligence (AI) tools in facilitating the development of complex learning such as language learning and critical thinking (Chen et al., 2020). The same applies to ChatGPT as a smart tutor system that can provide customized instructions and feedback to students regarding complex tasks, such as academic writing skill and programming skills (J. Lee et al., 2021). ChatGPT has also demonstrated the ability to stimulate critical thinking among students by

challenging them to respond to a series of questions tailored to each student's skill level (Chen et al., 2020). With its potential as a smart conversation companion, ChatGPT can also provide students with valuable opportunities to improve their argumentation skills as a result of complex learning through low-stakes practices (Masters, 2019). Students can take one side of a debate and ask ChatGPT to take the other side, presenting their arguments and asking the chatbot to refute them. In addition, similar to the pre-trained language representation model (Zhao et al., 2020), ChatGPT can help students evaluate the judgment of their peers so that students can learn to improve their feedback.

Reducing teaching workload

ChatGPT has great potential to significantly reduce teacher workload. For example, it can be used as a feedback tool to provide responses to student assignments, essays, and tasks (Zhao et al., 2020). Teachers can ask ChatGPT to create different forms of exams such as open-ended questions, multiple choice, or even rubrics to evaluate student assignments (Topol, 2019). ChatGPT can be used for automated grading of assignments, especially for text-based courses (Katznelson & Gerke, 2021). In addition, teachers can easily provide feedback on student essays in a short time (Caliskan et al., 2017).

Disadvantages Of ChatGPT

Despite its advantages, ChatGPT also has a number of limitations and drawbacks as listed below.

Lack of in-depth understanding

ChatGPT lacks deep understanding of the meaning of the words it processes (Klimova et al., 2023). While it can recognize patterns and generate plausible responses, ChatGPT does not fully understand the concepts behind the words (Carr et al., 2022). This can result in responses that sometimes lack depth and insight (Chan & Zary, 2019), as well as the potential to go off topic (Küçük et al., 2016), especially for performing tasks that require nuanced understanding of specific domain knowledge (Paranjape et al., 2019). In empirical studies, ChatGPT demonstrated the ability to generate acceptable responses to complex problems in the field of Pathology; however, the responses lacked a deep understanding of the theoretical concepts (Reiss, 2021). This weakness is not necessarily a problem, as long as there is a process that helps to gain a deeper and more nuanced understanding necessary for a more meaningful understanding.

Difficulties in Assessing Response Quality

ChatGPT lacks the humanized ability to assess the credibility of the data used for its training (Paranjape et al., 2019). This weakness limits its ability to evaluate the accuracy of the information generated (Katznelson & Gerke, 2021), except for information that has sufficient consensus, such as the 'flat earth theory' (Caliskan et al., 2017). ChatGPT does not have access to the Internet and currently has limited knowledge of world events after 2021 (Klimova et al., 2023). As knowledge continues to evolve, these limitations can sometimes result in outdated and inaccurate responses. For example, when asked to include recent references, ChatGPT may create ones that seem reasonable but do not point to real-world sources (Carr et al., 2022).

Lack of Higher Order Thinking Skills

Although ChatGPT can facilitate the development of complex learning outcomes, these chatbots themselves lack competence in content that requires higher-order thinking skills, such as critical and analytical thinking (Whalley et al., 2021). This is mainly due to artificial intelligence tools' high reliance on trained data without a deep understanding of context (Küçük et al., 2016) common sense (Chan & Zary, 2019) and emotions (Zhao et al., 2020) which are essential for higher-order thinking. For example, their ability to generate higher-order critical thinking questions is limited, as such questions require a deeper understanding of the material (Miller et al., 2002).

Threats to education

While the ChatGPT's advantages provide various opportunities for education, its weaknesses pose certain threats listed below.

Lack of Understanding of Context

Lack of understanding of context and the true meaning behind words can pose various risks, especially in the educational domain. For example, the use of ChatGPT for personalized learning may lack an in-depth understanding of the curriculum, the learning styles of individual students, and the cultural context in which students live, which may result in content recommendations that are too difficult or too easy for students. Another example is the use of ChatGPT for essay grading, which may lack the necessary context and background knowledge to accurately grade essays (Topol, 2019).

Threats to Academic Integrity

With the advent of ChatGPT, many concerns have been raised regarding the security of online assessments and cheating in online exams via ChatGPT (J. Lee et al., 2021;

Aryanto, et al., 2023). ChatGPT has been shown to be capable of producing human-like text, which can carry potential risks to the integrity of online exams, especially in higher education settings where such exams are becoming more common (Masters, 2019; Shodikin, et al., 2023). It has also been shown that ChatGPT has the potential to provide adequate responses to exam questions in the fields of medicine (Chen et al., 2020) and law (H. Lee, 2023). In an empirical study, showed that the answers provided by ChatGPT on a university life support exam were on average relevant, accurate, and had better concordance with resuscitation guidelines compared to previous studies using other artificial intelligence tools. With such performance, ChatGPT poses a serious threat to academic integrity, especially in higher education (Elbanna & Armstrong, 2023).

In the face of the challenges posed by the capabilities of ChatGPT and similar artificial intelligence tools, educational institutions should also consider a proactive approach in integrating these technologies into learning and assessment processes (Rawas, 2023). Some additional steps that can be taken include:

- a. Integration of ChatGPT as a Learning Tool: Shift attention away from using ChatGPT as a cheating tool by integrating it as a legitimate learning tool. ChatGPT can be used to assist students in understanding material, designing projects, or developing critical thinking skills.
- b. Building Adaptive Exams: Colleges can design adaptive online exams, where the difficulty of questions changes according to the performance of the participant. This can make it difficult to use ChatGPT to answer questions accurately, as participants will be tested based on their own understanding.
- c. Development of Cheating Detection Technology: Continue to develop and improve cheating detection technologies that can detect the use of ChatGPT or other artificial intelligence tools. This could involve using artificial intelligence to identify suspicious patterns of behavior during the exam.
- d. Make Examinees aware: Educate examinees about the potential risks and consequences of cheating that can undermine their academic integrity. With this knowledge, participants will be more cautious and more likely to abide by the rules during the exam.
- e. Collaboration with Technology Developers: Educational institutions can work with technology developers and researchers to develop more advanced security solutions that can deal with technological developments such as ChatGPT.

In an era where technology is increasingly profound in education, addressing the risks posed by ChatGPT is an urgent task. However, with a balanced approach between surveillance and technology integration, educational institutions can maintain the integrity of online exams while utilizing the learning potential offered by artificial intelligence tools (Evawati & Susilowati, 2023). With these measures, educational institutions can face the potential risks presented by the ChatGPT and ensure that

online exams remain fair and adequate in measuring participants' knowledge and skills. As technology evolves, collaboration with technology is also necessary to identify and prevent the unauthorized use of ChatGPT or other artificial intelligence tools in online exams.

Democratizing Plagiarism in Education/Research

ChatGPT has raised various ethical issues such as encouraging plagiarism and cheating (Motlagh et al., 2023) and is prone to errors such as the provision of false information (Elbanna & Armstrong, 2023). According to OpenAI, no ChatGPT response is an exact copy of a specific text, but rather is generated by synthesizing training data. Nonetheless, the model has the potential to generate responses similar to existing sources. This was evidenced by a recent test where ChatGPT wrote a 500-word essay with 45% similarity to an existing source (Halaweh, 2023). Therefore, it is not surprising that Mike Sharples warns that 'GPT democratizes plagiarism' (Dogan et al., 2023). Students may use ChatGPT for its promising capabilities without realizing that it may lead to plagiarism. Moreover, there is a high risk of plagiarism becoming more common in academia. Empirical studies show that ChatGPT can produce research studies at acceptable publishing levels (Qin et al., 2023) and can write scientific abstracts with fake data that reviewers may not be able to detect (Rawas, 2023). This ability may encourage college students to rely solely on ChatGPT when writing academic essays. This ethical issue becomes more serious when considering the fact that ChatGPT is prone to generating.

Therefore, the use of ChatGPT and similar AI models needs to be closely monitored and accompanied by strict ethical guidelines. Educational institutions, technology companies, and governments need to work together to develop rules and regulations that can reduce the potential for plagiarism, cheating, and other negative impacts that may arise from the use of ChatGPT. In addition, education on ethics and academic integrity also needs to be improved to ensure that ChatGPT users understand the consequences of their actions and practice the right principles in the learning and research process (H. Lee, 2023).

In addition, there needs to be efforts to increase transparency in the use of ChatGPT and similar AI technologies. Users should be provided with clear information about the resources they are using, including their potential limitations and risks. This will help users make wiser decisions about how they utilize these technologies (Halaweh, 2023).

Another action that can be taken is the development of more sophisticated and adaptive plagiarism detection tools and systems. This will help in identifying cases of plagiarism that involve the use of ChatGPT or other AI models. Additionally,

companies developing this technology should also be active in developing features and algorithms to minimize the chances of generating ethically dubious content.

It is important to remember that technologies like ChatGPT can also be used for good, such as assisting in the writing process, research, or education. However, thoughtful and responsible use is essential so that ethical concerns and potential misuse can be minimized.

As such, it is important that all parties involved continue to monitor developments in the field of AI and respond quickly to any regulatory or ethical changes that may be required. By doing so, we can ensure that the use of ChatGPT and other AI technologies can provide maximum benefits while minimizing their negative impact on society and education.

D. Conclusion

One of the impressive features of ChatGPT is its ability to think critically and express thoughts and ideas with eloquent language, which seems comparable to human abilities. Humans become critical thinkers if they regularly learn and assess their thinking to improve it. ChatGPT has great possibilities to benefit students, educators, and researchers. However, it is important to note that technological advancements such as these are not without drawbacks, which include risks to academic integrity, biased evaluations among students, factual inaccuracies, and over-reliance on artificial intelligence that may lead to limited skill development. Finally, it should be noted that while SWOT analysis can provide an in-depth analysis of ChatGPT in education, it has limitations in prioritizing the issues identified in each category, as also noted by Therefore, empirical studies with quantitative approaches such as the best-worst method are needed to extend the findings of the current review. This can be done through in-depth interviews with relevant experts to determine the weight and importance of the identified opportunities and weaknesses.

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