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A Review of ChatGPT in Promoting Teaching and Learning

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Abstract - Recent advancements in artificial intelligence technologies have had a big effects on a lot of different areas, including education. Education is constantly altering to keep up with the industry's changing requirements and with the current technical developments. Implementing generative AI technologies, such as the ChatGPT introduced by Open AI in November 2022 specifically for conversational purposes, is one promising breakthrough in this area. With the use of numerous prompts, ChatGPT, which was trained on a substantial volume of conversational text, may produce responses that are human-like. New concepts are developed using ChatGPT and shared in real-time dialogues. With its capacity to deliver personalized and adaptable learning experiences it brings tremendous improvements to the education industry. It has the ability to influence the direction of teaching and learning while serving as a beneficial educational tool for both students and teachers. The review study offers perceptions on the possibilities and difficulties of incorporating ChatGPT into teaching and suggests that Because ChatGPT employs generative AI, which is not always accurate and may produce information that is false or illogical. Therefore, it's imperative to use these technologies with caution and to think about creating rules for their proper application. The review survey also aims to encourage more discussions on ChatGPT use in education.

Key Words: ChatGPT, AI, Teaching, Learning, Education, Applications, Policy.

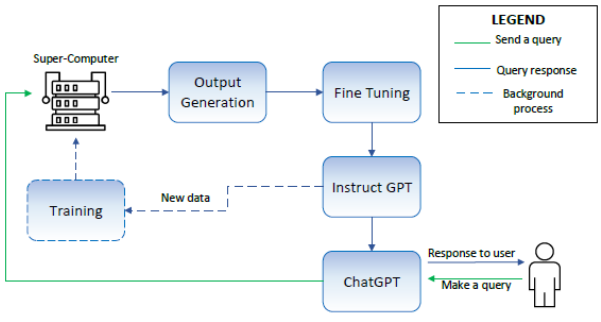
1. INTRODUCTION

ChatGPT is an advanced natural language processing model that is trained on a vast amount of data, including billions of web pages and documents, making it capable of generating human-like text responses to prompts [2]. It is based on the GPT architecture, which was originally developed for language generation tasks such as machine translation and summarization. ChatGPT is a text-to- text generative AI compared to other generative AI models that are text-to-image [1]. Since its launch, it has quickly become one of the fastest-growing consumer applications in history, with an estimated 100 million active users monthly. Its vast knowledge base and language processing capabilities have the potential to revolutionize the way people interact with technology, making it easier and more natural to communicate with machines [2]. A key feature of ChatGPT is its ability to maintain a conversational style with a consistent persona or identity throughout a conversation, which allows it to engage in more realistic natural dialogues, rather than simply responding with unrelated or unrelated responses [1]. However, while ChatGPT has impressive language processing capabilities and is an exciting technology with a wide range of potential applications in various fields, it still has limitations and challenges, including bias and the occasional generation of nonsensical output, known as "hallucination" [2].

Some experts are even calling the change wrought upon by the rise of AI as so significant that it will completely overhaul current programming Practices. It's important to take stock of the situation in a balanced manner and prognosticate the future of education in the presence of tools such as ChatGPT, which will continue to improve and become more impressive. Technology often disrupts traditional practices, requiring people to adapt and consider the potential benefits and drawbacks of new technologies. There have been a number of studies that have explored the use of artificial intelligence in education, including the use of chatbots and other NLP tools. It's important to note that ChatGPT is a tool, and like any tool, it's important to use it responsibly [1].

This study sheds light on how ChatGPT can be used in different domains for the greater good while minimizing potential harm and how society can prepare for the opportunities and challenges presented by this emerging technology. These advancements offer significant potential in research and industrial contexts, and future developments are expected to lead to even more improved capabilities. There are many publications that study different aspects of ChatGPT, and we will review some of them in the next section summarizing the main applications, opportunities, and threats of ChatGPT [2]. Towards this end, ChatGPT was trained on a large data set of conversational text, including chat logs, forums, and social media posts, and is able to generate human-like responses to the prompts and questions [1].

2. WORKING PROCESS OF CHATGPT



The working process of ChatGPT [12]

The working procedure of ChatGPT can be described briefly through above diagram. The working process can be divided into two types: Query and Response. The device behind the

ChatGPT is an artificially intelligent super-computer. This computer is trained on a massive dataset with numerous parameters. This supercomputer is unsupervised learned to identify the patterns of input data by determining the statistical structure within the data.

Generally, a user can make a Query to the ChatGPT. This query is directly sent to the super-compter. Now, the query is processed by the super-computer. The output generation circuitry generates the probable outputs and then the output data are fine-tuned. After that, ChatGPT is instructed to respond. Finally, ChatGPT, the conversational interface, interacts with a human by providing a human-like response. ChatGPT can perform a wide range of functions in the academic sector, for example, automated essay writing based on the context and mode (formal, informal, etc.), providing instant feedback to any text leading to enhancing the quality and accessibility of education. On the other hand, ChatGPT can create some challenges in the academic sector also including generating biased output, difficulties to ensure academic integrity, diminishing individual writing skills, etc. So, to understand the implications of ChatGPT in the academic domain as well as to improve the quality of education with effective and efficient use of this AI model, it is necessary to explore the opportunities and challenges of this AI model in academia. Therefore, the objective of this research is to explore the challenges and opportunities of ChatGPT in academia. Some challenges of using ChatGPT in the academic sector include the potential for biased output, limitations in its abilities, and issues with ensuring academic integrity. Additionally, there may be concerns about reducing personalization and the potential for job loss among human teachers and tutors [12].

3. POTENTIAL OF AI FOR EDUCATION

The use of artificial intelligence (AI) in education has a relatively short history, but it has rapidly gained popularity in recent years. Early examples of AI in education can be traced back to the 1960s and 1970s, when researchers began using computers to deliver personalized instruction and adapt to the needs of individual learners. This early work laid the foundation for the development of more advanced AI-powered educational tools and platforms that have become common in classrooms today. These early efforts were largely focused on delivering content and assessment, rather than providing personalized instruction or adapting to the needs of individual learners. In the early 2000s, advances in machine learning and natural language processing led to the development of more advanced AI-powered educational tools. These tools were able to adapt to the needs of individual learners, provide personalized instruction, and even grade assignments. Today, AI is being used in a variety of ways in education, including for personalized learning, automating administrative tasks, and even for tutoring and mentorship. As the field of AI continues to advance, it is likely that we will see even more innovative uses of AI in education in the future [9].

A. AI for Personalized Learning

Artificial intelligence (AI) has the potential to revolutionize the way we teach and learn by providing personalized learning experiences for students. Personalized learning refers to the use of technology to tailor educational content and experiences to the unique needs, abilities, and interests of individual learners. AI-powered educational software can analyze a student's progress and adjust the difficulty of content in real-time to ensure that it is appropriately challenging. Adaptive learning is a teaching and learning approach that uses technology to automatically adjust the content and difficulty of a learning experience based on a student's performance. This approach is designed to help students learn more efficiently and effectively by providing them with personalized learning experiences that are tailored to their individual needs and abilities. AI can analyze a student's interests and learning style and provide personalized recommendations for content and resources. Personalized recommendations can be used in education to help students discover new learning materials or activities that are tailored to their individual needs and interests. These recommendations can be based on a student's past performance, their learning style, or other factors such as their goals or interests. AI can be used to provide individualized instruction to students, using techniques like one-on-one tutoring or personalized lesson plans. Artificial intelligence (AI) can be used to support individualized instruction, which is a teaching and learning approach that aims to tailor the learning experience to the unique needs and abilities of each student. Individualized instruction can take many forms, including one-on-one tutoring, small group instruction, or self-paced learning. Artificial intelligence (AI) can be used to support the early identification of learning needs, which refers to the process of identifying and addressing students' academic, social, or emotional needs as early as possible. Early identification of learning needs is important because it can help to prevent learning difficulties from becoming more serious, and can help to ensure that students receive the support they need to succeed in school [9].

B. Automating Administrative Tasks in Education

Automating administrative tasks in education refers to the use of technology, such as artificial intelligence (AI) and automation software, to streamline and automate various administrative tasks in the education system. These tasks can include tasks such as data entry, scheduling, and financial aid processing, as well as tasks related to student and faculty management, such as enrollment and course management. The goal of automating administrative tasks in education is to improve the efficiency and accuracy of these tasks, as well as to free up time and resources for more important tasks, such as teaching and learning. By automating administrative tasks, educators and administrators can focus on the core mission of education, which is to provide high-quality learning experiences for students. There are many potential benefits to automating administrative tasks in education. Automation can also help to improve the efficiency of the education system, by reducing the time and resources required to complete administrative tasks. However, it is important to note that automation is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators and administrators. Artificial intelligence (AI) can be used to support the enrollment and registration process in education, which refers to the process of enrolling students in courses or programs and registering them for classes. AI can be used to automatically process enrollment and registration forms, which can save time and reduce the workload for administrators. AI can be used to automate various tasks related to enrollment and registration, including processing forms, verifying information, and updating student records. Artificial intelligence (AI) can be

used to support student record management, which refers to the process of organizing, storing, and accessing student records. AI can be used to automatically classify, sort, and index student records, which can make it easier to find and retrieve specific records. AI can be used to automate various tasks related to student record management, including classifying, sorting, and indexing records, as well as verifying and updating information. Artificial intelligence (AI) has been applied to various aspects of education, including grading and assessment, for many years. AI can be used to automatically grade assignments and assessments, which can save time and reduce the workload for teachers. Artificial intelligence (AI) has been applied to various aspects of education, including course scheduling, for many years. AI can be used to automatically schedule courses and assign teachers and classrooms, which can save time and reduce the need for manual scheduling. Artificial intelligence (AI) has been applied to various aspects of education, including financial aid, for many years.AI can be used to automatically process financial aid applications and determine eligibility, which can save time and reduce the workload for administrators. One of the earliest examples of using AI for financial aid was the development of automated systems for processing financial aid applications and awarding aid to students. These systems were designed to improve the efficiency and accuracy of the financial aid process, by automating tasks such as data entry, verification, and calculations [9].

C. AI for Tutoring and Mentorship

Artificial intelligence (AI) has been applied to various aspects of education, including tutoring and mentorship, for many years. Over the years, AI has been increasingly used to automate various aspects of tutoring and mentorship, including the delivery of personalized instruction and feedback, the identification of student learning needs and challenges, and the design of personalized learning plans. One of the earliest examples of using AI for tutoring was the development of intelligent tutoring systems (ITS), which were designed to provide personalized instruction and feedback to students based on their individual needs and abilities. These systems were typically implemented as computer-based programs that were used to supplement traditional classroom instruction. The use of AI for tutoring and mentorship has the potential to improve the efficiency and effectiveness of the learning process, as well as to provide more personalized learning experiences for students. There are also many potential applications for AI in educational tutoring and mentorship beyond traditional one-on-one tutoring. For example, AI can be used to provide group tutoring or mentorship, or to design personalized learning experiences for students based on their individual needs and preferences. However, it is important to note that AI is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators and mentors [9].

4. EDUCATING WITH CHATGPT

As an initial foundation for developing course syllabi, instructional resources, and evaluation activities, ChatGPT might be a useful tool for educators. In the evolving landscape of online education, artificial intelligence (AI) is proving to be a game-changer, with tools such as ChatGPT leading a radical transformation that ranges from assessment design to language learning.

AI chatbots can assist students in honing their understanding of text by posing personalised queries and offering comments on their responses. By way of illustration, flipped education can be employed, in which learners are expected to read material before classes. This kind of education can allow for more participatory learning activities, including group discussions during class time. Many e-learning platforms, including Coursera, use AI to detect common errors in their assignments. Using ChatGPT to produce material, instructors can develop unique assessments and learning content, while businesses (e.g., Course Hero) could see their paid homework assistance models disrupted by the AI's cost-effective versatility. The tool can also be used to enhance a person's critical and analytical abilities. However, there are issues that need to be resolved about the produced content's authenticity. A potential fix might be to build training materials for course-specific bots using ChatGPT. Additionally ChatGPT can offer suggestions for how to enhance grammatical structures, brevity, or clearness of multiple drafts of the same essay – enabling users to get through barriers to writing and provide fresh viewpoints on their selected subject.

The release of ChatGPT4 in March 2023 has already generated debate since the tool looks more precise, dependable, and responsive. As the AI-powered educational tools continue to advance, embracing and understanding their use becomes crucial; the advent of ChatGPT4 highlights this, setting the stage for more precise, reliable, and responsive education technology. ChatGPT, as a virtual instructor, may help learners with their web-based independent research by responding to their inquiries and can improve collaboration by offering suggestions for a debate framework and giving immediate response [11].

A. Teaching

The study's results show that individualized instruction is another possible benefit of ChatGPT. This is especially helpful for students who have trouble learning. Participants pointed out that to successfully integrate AI tools such as ChatGPT into the overall learning experience, a number of factors need to be considered. For example, a participant stated that:

"it is necessary to provide teachers with training on how to use them. This necessitates not only having access to the appropriate tools but also having the knowledge and expertise necessary to make successful use of those tools."

The study results further show that when artificial intelligence (AI) tools are used in educational settings, the traditional way of teaching needs to be changed. A participant noted that:

“This requires the implementation of active learning practices that create new information for the future, requiring a complete overhaul of the educational system, and an emphasis on educating teachers to use AI tools effectively."

This is especially helpful for teachers and students who have disabilities such as blindness or other conditions that make it difficult for them to learn new things. An interviewee stated the following:

“I would see ChatGPT as being a win-win for a lot of students who may struggle due to language impairments. Having something that could help them, would be very beneficial.” [3].

B. Learning

This research aimed to investigate how using ChatGPT influences the learning process. The individuals who participated in the study presented various points of view regarding the impact that ChatGPT has had on the educational system, identifying both positive and negative aspects. Generally, participants held a positive view of ChatGPT in facilitating learning. For example, a participant indicated that: "ChatGPT could be used as a thought starter or a springboard to begin their task, which would improve the overall learning experience."

Students could also use ChatGPT to check their work for mistakes, saving them time for proofreading and editing. It was also said that using ChatGPT could help students be more productive in their schoolwork by making it take less time and effort to complete assignments. A participant mentioned that ChatGPT "can be used for sentence construction far better than Grammarly."

They stated that relying too much on ChatGPT could reduce the requirement for critical thinking and analysis, both of which are necessary abilities for ongoing education. This is due to the fact that ChatGPT may offer simple solutions to difficult situations, hence reducing the need for creative thinking. It is crucial to remember that ChatGPT's effect on creative thinking may vary depending on how the tool is employed and the educational objectives that are aimed to be accomplished [3].

C. Assessment

The participants came up with several different suggestions for how the evaluation procedure may be reorganized in order to incorporate the use of ChatGPT. This includes more testing done in the classroom, orally, based on problems or case studies, and testing done in the subject matter context.

The introduction of ChatGPT into the learning process necessitates reorganizing the evaluation process to align with the changing educational landscape. These strategies may aim to improve alignment between the learning process and the evaluation process, as well as to encourage authentic learning as a means of education. A participant stated the following:

"We'll have to be less lazy in our assessment procedures. We would likely push assignments and tasks to become more concrete and ongoing in terms of how they're assessed."

The people who participated in the research emphasized how important it is to educate educators on how to reorganize grading systems, use AI to create more efficient and pertinent assignments and understand the distinctions between work generated by humans and work generated by AI. The potential of ChatGPT to improve the learning experience while mitigating the hazards connected with academic dishonesty and plagiarism is something teachers need to be aware of to do their jobs effectively [3].

5. CHATGPT APPLICATIONS

ChatGPT, it can be used to answer questions in various fields, create articles/texts, create recommendations in different sectors and fields, do language translation in natural languages and machine languages. In addition, there are classical methods such as correcting code errors in programming languages, debugging program code, solving mathematical equation, creating keywords for a text or article, writing an academic article, accepting an article by editors, explaining the issue asked [10].

A. Technical Educational Applications of ChatGPT

Technical Educational Applications of ChatGPT

ChatGPT has been used in a variety of applications, including generating chatbot responses, generating ideas for stories and content, and even creating music. ChatGPT has caused significant excitement in the field, as well as some consternation. There exist a number of beneficial educational applications of ChatGPT both for learners and educators. For instance, some technical educational applications such as the ability to solve mathematical questions; theoretical/conceptual questions; and even generate code [1].

B. Creative Writing Oriented Educational

Creative Writing Oriented Educational Applications of ChatGPT

In the context of education, ChatGPT can use both learners and teachers. Students can use it for help in solving questions, writing essays, and getting formative feedback on their work. Such tools will also find wide in assisting writers in creative writing through outlining or providing leads to be further pursued and refined [1].

C. Computer Software Education

Computer software education is an area where education is given at all grade and at all levels, from basic education to higher education. This learning process requires students to learn a number of programming languages and programming tools. Using artificial intelligence models such as ChatGPT can help students learn computer software topics more interestingly and interactively. It can also provide insight into the strengths and weaknesses of the scripting language, best practices for solving coding problems, and best practices for software development. Thus, ChatGPT can be used to reach the information needed in different programming languages within seconds. This software offers developers the

opportunity to speed up the development process and learn new coding techniques. By giving ChatGPT a specified code template and a set of instructions, it can generate new code(s) tailored to specific needs. ChatGPT can be used to suggest next lines of code based on the current situation. This interactive discussion can provide more effective code generation and more information about the written code. Code written in one programming language can be translated into another programming language using the ChatGPT. This process requires the user to decipher the standards, features and program flow of both programming languages. In this way, time and cost savings can be achieved. Software documentation is critical in the software lifecycle. It can be used to create clear and concise documents for a program developed with language models. This process, which can be carried out autonomously, can save labor and time. ChatGPT can be an alternative to debugging the code for the relevant programming language found in many modern software development environments. ChatGPT can also be used to create automated tests in computer software. It can be used to automatically generate tests or test cases that developers can use to verify the expected functionality of the software. Language models such as ChatGPT in education provide benefits in the learning process [10].

D. Applications For Teachers and For Students

- **For Teachers**

ChatGPT is particularly suitable as a working tool for teachers. The focus here is less on automated text generation. It can also help streamline instructions, overviews, and the like, and create standardized text types such as event descriptions. Teachers should use the chatbot as part of their teaching approach, which limits the privacy issue to the teacher's data. Didactic scenarios could include identifying fake news, managing discussions, comparing summaries, comparing text formats and writing styles, and developing criteria for a successful scientific text [8]. ChatGPT can produce instructional content and create presentations by providing templates, generate diverse perspectives and facilitate discussions on diversity and inclusion, suggesting images and graphics, and recommend ways to make the presentations more engaging. It can also answer common questions, help understand complex concepts, and provide sample examples for programming languages such as C, Python, Java, and many more [2].

i. Facilitating personalized and adaptive learning experiences:

ChatGPT can be used by teachers to create personalized and adaptive learning experiences for their students. For example, ChatGPT could be used to provide students with tailored feedback and recommendations based on their individual learning needs and progress [1].

ii. Enhancing student engagement and retention:

ChatGPT has the potential to increase student engagement and retention by providing students with engaging and interactive learning experiences. For example, ChatGPT could be used to create interactive quizzes or games that help students learn and practice important concepts [1].

iii. Supporting student learning outside of traditional classroom hours:

ChatGPT can be used to support student learning outside of traditional classroom hours, for example by providing students with on-demand access to educational resources and support [1].

iv. Enhancing teacher efficiency:

ChatGPT has the potential to enhance teacher efficiency by automating certain tasks, such as grading assignments or providing feedback to students [1].

- **For Students**

ChatGPT can also help create individualized materials, such as assignments for students. If ChatGPT is to be used as a tool to assist students in the future, there will inevitably be new rules requiring students to indicate which tools they have used. ChatGPT could also be a reason to change the culture of examinations at universities to one where students refrain from cheating and recognize the value of academic integrity [8]. ChatGPT can assist with suggesting research ideas and methodologies (whether qualitative or quantitative) and providing examples of how these methodologies have been used in previous studies. These can be obtained by giving the article's information or copying and pasting the study into the chatbot [2].

i. Enhancing learning and retention:

ChatGPT can be used by students to enhance their learning and retention by providing them with personalized and adaptive learning experiences. For example, ChatGPT could be used to create interactive quizzes or games that help students learn and practice important concepts [1]

ii. Providing on-demand access to educational resources and support:

ChatGPT can be used by students to access educational resources and support on-demand, for example by answering questions or providing explanations on difficult concepts [1].

iii. Enhancing communication with teachers:

ChatGPT can be used by students to communicate with teachers and other students in real-time, for example by asking questions or seeking feedback on assignments [1].

Overall, ChatGPT has the potential to be a useful tool for both teachers and students in the education context, providing a range of benefits including personalized and adaptive learning experiences, increased student engagement and retention, and enhanced teacher efficiency [1].

6. EDUCATION INTERVENTION: METACOGNITION AND SELF-REGULATION

An education intervention refers to a targeted, well-designed, and systematically implemented instructional approach aimed at addressing specific learning challenges and enhancing learning outcomes amongst diverse student populations. In utilising ChatGPT as a distance and innovative education solution, metacognition and self-regulation emerge as essential education interventions [4].

Metacognition, a critical aspect of self-regulation, entails learners awareness of their cognitive processes, which enables them to plan, monitor, and evaluate their learning strategies.

Through metacognitive intervention, students can develop an in-depth understanding of their thinking patterns, hone their problem-solving skills, and adapt their learning techniques to match the demands of specific tasks or learning environments. In the case of ChatGPT, fostering metacognition is crucial as it empowers students to take full advantage of the technology's AI-driven personalized and adaptive learning opportunities [4].

Self-regulation, on the other hand, encompasses many strategies that enable learners to set goals, manage their time and efforts efficiently, and regulate their emotions and motivation to optimise learning outcomes. By integrating self-regulation strategies into the ChatGPT learning experience, students can become ChatGPT as a Leadership Issue in Distance Education more proactive in utilizing AI-mediated instructional materials, generate meaningful and goal-oriented interactions with the AI tutor, and manage their learning processes more effectively [4].

A concrete example of an educational intervention that combines metacognition and self-regulation in the context of ChatGPT could involve embedding prompts or guiding questions within the AI-driven instructional materials. These prompts would encourage students to reflect on their learning approaches and strategies, assess their progress, identify any obstacles or misconceptions, and seek adequate feedback and clarification from ChatGPT. For instance, when engaging with a complex topic, students could be prompted to create a concept map using the information provided by ChatGPT, which will help them visualise the relationships between concepts and monitor their comprehension. To support self-regulation, students could set specific learning objectives, identify any gaps in their understanding, and adjust their learning strategies accordingly. Through these structured interactions, students can benefit from the personalised feedback and guidance provided by ChatGPT while cultivating metacognitive and self-regulation skills that promote lifelong learning and academic success [4].

7. POLICY OF CHATGPT

Faculty should explicitly state in the course syllabus or assessment (e.g., project or assignment) that ChatGPT can be used and even encouraged to be utilized. The policy should explain the purpose of using the tool, as well as provide clear instructions and guidelines for its use. The following basic policy has been developed based on author's experience of using the tool, and experience of crafting academic policies [7].

i. ChatGPT is an AI-based tool that helps you generate texts in a very short amount of time, making it easier and more efficient to search for and find summarized information and ideas related to the subject of interest, and to improve your writing.
ii. You need to examine and evaluate the information generated by ChatGPT, as it may produce irrelevant or inaccurate information. You need to check the source of the information and cite it properly. Texts generated by ChatGPT copied and submitted as your final writing is considered plagiarism.
iii. You should explicitly acknowledge the assistance of ChatGPT in the creation of you work (sections or parts included ideas/issues initially identified via ChatGPT, or tasks achieved such as editing and paraphrasing, or calculations)
iv. When submitting your final report, you should provide two files: an audit trail of queries and a reflection report/note.
v. All reports and assignments created with the help of ChatGPT will be evaluated through viva and presentation to ensure comprehension and understanding of the topics and issues, defending ideas or proof of understanding of program codes, and you should be ready for any questions or adjustments requested by the instructors in real-time during presentation.
vi. As students might be asked to write a report on a single topic or program code for an application, it is expected that there may be some degree of similarity between student reports. However, in all cases, students must ensure that their work has a low percentage of similarity (as per the university policy) and is free of plagiarism. Furthermore, the contents of the report must be largely generated by human (taking into account the tool used for editing and paraphrasing), not AI-generated; this can be verified by using AI content detection software tools.
vii. The instructor will carefully inspect any texts that are suspected of plagiarism or have been generated largely by AI, as indicated by detection software, and make a judgment on such cases to take the most appropriate action, taking into consideration the context of the course and the specific assignment.

8. WEAKNESS OF CHATGPT

Though ChatGPT is a powerful tool with numerous potential benefits, there are some challenges that may arise with its use [12].

These includes:

i. Spread misinformation:

ChatGPT is trained on a huge but limited data set up to 2021. In 2023, there is a chance to provide incorrect information as well as results through this model [12]. It's important for students to verify the accuracy of the information they receive from these tools and to use multiple sources when researching a topic [1].

ii. Misinterpret student understanding:

Incorrect assessment of student understanding may happen if ChatGPT is not able to properly account for different learning styles or prior knowledge and experiences [12].

iii. Difficulty in evaluating the quality of responses

ChatGPT lacks the human ability to assess the credibility of the data it was trained on. This weakness limits its capability to evaluate the accuracy of the generated information, except for those that there is a fair amount of consensus, such as 'flat-earth theory'. ChatGPT doesn't have access to the Internet and currently has limited knowledge of world events after 2021. As knowledge continues to evolve, this limitation may sometimes result in the provision of outdated and inaccurate responses [6].

iv. Lack of higher-order thinking skills

Although ChatGPT can facilitate the development of complex learning outcomes, the chatbot itself is less competent when it comes to content that requires higher-order thinking skills, such as critical and analytical thinking. This is mainly because of the high dependency of AI tools on the data that are trained without a deep understanding of the context, common sense, and emotions, which are crucial for higher-order thinking [6].

v. Threatening academic integrity

With the emergence of ChatGPT, many concerns have been raised about online assessment security and cheating in online exams through ChatGPT. ChatGPT has been shown to generate human-like text, which could pose a potential risk to the integrity of online exams, especially in higher education settings where such exams are becoming more prevalent [6].

vi. Declining in high-order cognitive skills

Over-dependence on ChatGPT can have negative consequences both for students and teachers. For students it can lead to a decline in their higher-order cognitive skills such as creativity, critical thinking, reasoning, and problem-solving. This is because the use of ChatGPT can result in simplification of the process of obtaining answers or information, which can have a negative impact on the students' motivation to perform independent research and arrive at their own conclusions or solutions. For teachers, over-dependence on ChatGPT can reduce the quality of their interactions with students and exacerbate existing inequalities [6].

vii. Internet connectivity:

Many AI systems rely on internet connectivity to function properly. This can be a challenge in areas where internet access is limited or unreliable [9].

viii. Privacy concerns:

Finally, there are privacy concerns surrounding the use of ChatGPT and other AI tools in schools. It's important for schools to have clear policies in place regarding the use of these tools and to ensure that student data is properly protected [1].

It is worth noting that our experiments were conducted on ChatGPT, which is currently in an active development phase. During the experiments, we obtained significant results in code generation, error checking and debugging, and optimization of the solution code.

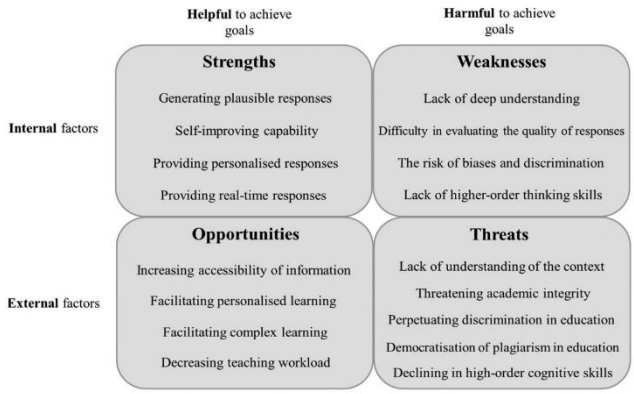
However, the results may vary for the following reasons: (i) the release of a new version of ChatGPT may lead to different results; (ii) asking different questions than those presented in this study; (iii) results may vary for different problem descriptions; (iv) code optimization results may vary for different solution codes [5].

Overall, it is important to carefully consider the technological limitations of using ChatGPT in education and to implement appropriate measures to address these limitations.

9. SWOT ANALYSIS

One way to approach the review of any new idea, practice, or resource is to conduct a SWOT analysis. SWOT stands for strengths, weaknesses, opportunities, and threats, and this framework is one way to guide the decision-making process in an open-minded and measured way [13].

The SWOT analysis of ChatGPT revealed that this new AI technology has various potential applications for education, but also comes with certain challenges, as shown below. The outcome of the SWOT analysis could help address this question: 'what should we do with ChatGPT?' [6].



SWOT analysis of using ChatGPT in education [6]

10. A GLIMPSE INTO THE FUTURE OF EDUCATION

The rise of generative and conversational artificial intelligence (AI) tools such as GPT (Generative Pretraining Transformer) is likely to have a significant impact on university education, particularly in terms of teaching and assessment. The future of ChatGPT in education is likely to involve a continued expansion of its use and integration into various aspects of the education system [1].

With the increasing prevalence of tools like ChatGPT, it is important for schools and colleges to provide education on responsible and productive use of technology to young learners. This can involve teaching students about the ethical considerations involved in using technology, such as avoiding plagiarism and properly citing sources. It can also involve teaching students how to use technology effectively and productively, such as learning how to use chatbots and language models to generate ideas and inspiration for their own original work. In addition to providing education on responsible and effective use of technology, it is also important for schools and colleges to provide a well-rounded education that includes critical thinking skills, problem-solving skills, and the ability to communicate effectively. These skills will be important for students to use technology responsibly and effectively, as well as to succeed in their careers and personal lives. Ultimately, the right education for young learners in schools and colleges will depend on the specific needs and goals of the students and the institution. It is important for educators to consider the role that technology can play in education, and to provide the necessary guidance and resources to ensure that students are able to use it responsibly and effectively [1].

Overall, the future of AI in education is likely to involve the continued expansion of its use and integration into various aspects of the education system, with the goal of improving the efficiency and effectiveness of teaching and learning. It is important to carefully consider the ethical, technological, and other challenges associated with the use of AI in education, and to implement appropriate measures to address these challenges and ensure that AI is used ethically and effectively in the education system [9].

11. CONCLUSION

AI has the potential to transform the way we think about education and how it is delivered [9]. ChatGPT and other AI language models have the potential to be helpful and convenient tools for engineering education, both for students and teachers [1]. Teachers should receive training on how to utilise ChatGPT efficiently and spot plagiarism in homework. Learners must also be made aware of ChatGPT's capabilities, restrictions, and possible impact on their educational credibility [11]. However, it is important to remember that ChatGPT and other AI language models are not perfect and may make mistakes or provide incorrect information. It is therefore important to use these tools with caution and to consider establishing community guidelines and standards for their fair use [1]. It is clear that engineering education and the profession will eventually adopt such tools, and assessment strategies will have to evolve to prevent unethical conduct while still allowing for the productivity that can be achieved with these tools [1].

Education interventions focusing on metacognition and self-regulation will maximize the benefits of ChatGPT's personalized, adaptive learning capabilities [4]. The model can be used to answer questions, write essays, solve problems, explain complex topics, provide virtual tutoring, practice languages, learn programming, teach, and support research. Furthermore, the ChatGPT model can be used to solve technical (e.g., engineering and computer programming) and non-technical (e.g., language and literature) problems [5]. The education field is undergoing rapid transformations due to the emergence of new technologies and the resultant demand for a different set of skills than those of previous generations. Students will be expected to demonstrate more critical thinking in their evaluation of information, as well as to develop and present new ideas. Moreover, presentation skills will be essential for successful learning and for defending one's work, both of which are necessary competencies for the real world of work. Presentation/viva and defending one's work will become standard assessments in the educational environment, in order to verify the learning specially when assessment are done in collaboration with ChatGPT [7].

However, it is important to carefully consider the ethical, technological, and other challenges associated with the use of AI in education, and to implement appropriate measures to address these challenges and ensure that AI is used ethically and effectively in the education system [9].

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