

The influence of ChatGPT and AI Tools on the Academic Performance

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Abstract:

The use of ChatGPT and other AI tools in education has become increasingly widespread these days, as educators seek to leverage the benefits of technology to improve student learning and academic performance. This review paper examines the existing research on the influence of ChatGPT and AI tools on academic performance, with an emphasis on both the potential benefits and challenges of these AI tools. The literature review indicates that while ChatGPT and other AI tools have the potential to enhance personalized learning, feedback and assessment, and interaction, they also encounter challenges such as moral concerns, lack of human interaction, and possible biases. In a summary, this paper emphasizes the need for additional empirical research to completely understand the impact of ChatGPT and AI tools on academic performance and provides recommendations for educators and policymakers on how to use these tools effectively and responsibly in educational environments.

Keywords: AI , ChatGPT, Education, Academic Performance.

I. Introduction

In the end of 2022, ChatGPT application released by OpenAI company to the public and millions of people started using in the first month because of its unprecedented level of intelligence and complexity in addition to part of the community claiming it will be the new Google search engine [1]. Educators were amazed by the exceptional abilities of ChatGPT to do in the education field [2]. ChatGPT is a generative AI model and generative AI is a type of machine learning algorithms that could learn from content such as audio, image, and text to generate new content [3]. So Generative AI models generate artifacts as an output, for example ChatGPT can generate output as a human-like language. There are other generative AI models which focused on specific domain like software engineering, such code auto-completion, convert natural language to code, and translate code from a specific programming language to another one [3]. Due to the ability of ChatGPT in generating human-like language and answering many questions in a logical manner even if these questions asking to prepare an assignment, quiz questions or any other academic task. Many academics started using ChatGPT and found it useful to save their time in teaching, assessment and research, so they can spend more time with students on other important activities [2]. Artificial intelligence (AI) has been

extensively incorporated into a number of educational technology systems, including 1- Virtual Mentor and 2- Voice Assistants, like Google Assistant, Siri (Apple), and Cortana (Microsoft). 3- Smart Content generator. 4- Presentation Translator. 5- International courses including MOOCs, Udemy, Google AI, Alison, Khan Academy, edX, Udacity, Coursera, etc. 6- Automatic assessment. 7- personalized learning, using Ruangguru as an example, etc. 7- Games for learning, 8- Intelligent Tutoring Systems (ITS), or Intelligent Computer-Aided Instruction (ICAI). The technique of simulating human thought processes and creating machines that behave like people is known as artificial intelligence (AI) [4]. Due to the crucial role that ChatGPT can play in education, one of the professors of University of Rhode located in South Africa, wrote an extensive guide (A Guide to Conversational AI) about using ChatGPT in higher education and what are the best practice for students and educators [5]. According to the mentioned guide, ChatGPT can be used in any domain, including research papers, presentations, and online material. Additionally, educators and students should be prepared for the social consequences of AI use, including ChatGPT, as well as any potential effects on job displacement and other social issues. Students and teachers must comprehend ChatGPT's and other AI tools capabilities and limitations, work together to share best practices, integrate those tools into pertinent courses, routinely evaluate the effectiveness of their use, and continue to investigate the technology's potential in projects, research, and industry. However, the objective of this paper is to explore the potentials of ChatGPT and other AI tools in education. Our paper will be organized into Introduction about AI tools in education, Literature review, benefits of ChatGPT and AI tools in education, challenges, and limitations of AI tools in education, future directions of these tools then finally the conclusion of this paper.

2. Literature Review

2.1. History Artificial Intelligence Applications

The application of artificial intelligence (AI) in education has a brief history but has acquired popularity rapidly in recent years. Early examples of artificial intelligence in education date back to the 1960s when Joseph Weizenbaum created ELIZA, a program that could simulate a conversation with a person, AI tools for language processing and conversational agents have existed. Since then, there have been numerous advancements in natural language processing and conversational AI, resulting in the development of a variety of AI tools and chatbots. This early work established the groundwork for the development of more sophisticated AI-powered educational tools and platforms that are now commonplace in today's classrooms. In the 1980s and 1990s, the proliferation of personal computers and the internet allowed for the development of more advanced educational software and online learning platforms [6]. Prior to providing personalized instruction or adapting to the requirements of individual learners, these early efforts were primarily focused on delivering content and assessment. Early in the twenty-first century, advancements in machine learning and natural language processing led to the creation of more sophisticated AI-driven educational tools. In recent years, artificial intelligence (AI) technologies have been increasingly utilized in education in a variety of ways including personalized learning, administrative task automation, and even tutoring and mentoring. These

tools can assist educators in analyzing pupil performance data, providing feedback, and providing individualized instruction. In addition, virtual assistants and chatbots powered by AI are used to provide personalized support, answer queries, and assist with administrative tasks for students.

A large quantity of data and computational techniques are used to make predictions regarding the meaningful combination of words. Similarly, in November 2022, the artificial intelligence company 'Open AI' published a new viral bot called 'ChatGPT'. This bot has attracted millions of users and investors, and scientists believe that it will eventually supersede humans. Open AI devised a user interface to enable direct public experimentation as a revolutionary step [7].

Overall, the development of AI tools has expanded educational opportunities and made it simpler for educators to provide students with personalized and effective learning experiences. As artificial intelligence (AI) technology continues to advance, we can anticipate even more innovations in education and other areas of society.

2.2. ChatGPT and Related Generative AI Advantages for Advancing Teaching and Learning

Chen and collaborators [8] demonstrated that a conversational agent (ChatGPT) based on a generative model could provide personalized math tutoring to students, resulting in enhanced learning outcomes. The study demonstrated that the conversational agent was able to tailor explanations to students' misconceptions and adapt to their level of comprehension.

Essay Grading Automation: ChatGPT can be taught to grade student essays, allowing instructors more time to focus on other aspects of instruction. Kim and colleagues [9] demonstrated that a generative model (ChatGPT) trained on a dataset of human-graded essays could accurately grade high school student essays with a correlation of 0.86 with human grades. The study demonstrated that the model could identify key characteristics of well-written essays and provide feedback comparable to that of human evaluators.

Translation: ChatGPT can be used to translate educational materials into multiple languages, making them accessible to a larger audience. Johnson and colleagues [10] demonstrated that a generative model (ChatGPT) trained on a dataset of bilingual sentence pairs could translate accurately between languages, attaining state-of-the-art results on several translation benchmarks. The research demonstrated that the model could comprehend the meaning of sentences in one language and produce accurate translations in another.

Interactive Learning: ChatGPT can be used to construct interactive learning environments in which students can converse with a virtual tutor who can answer students' queries and explain a variety of topics. This can be especially beneficial for students who are struggling with a particular topic or who require additional assistance outside of the classroom. In addition, research indicates that non-native speakers of national languages and students with learning

and language disabilities (i.e., writing difficulties) will benefit the most from these natural language models.

Adaptive Learning: ChatGPT can be used to construct adaptive learning systems that modify their teaching methods based on a student's performance and progress. A study [6] demonstrated that an adaptive learning system based on a generative model (ChatGPT) could provide more effective support for students learning programming, resulting in enhanced programming assessment performance. The study demonstrated that the model could comprehend students' knowledge and adjust the level of difficulty of the problems it generated accordingly.

ChatGPT has the potential to support and advance the work of educators, students, and researchers, according to some. Some educators have already begun evaluating the efficacy of ChatGPT by integrating it into their educational activities (e.g., research, teaching, assessment) and have discovered that by automating certain tasks and processes, ChatGPT can free up time for other important activities, such as spending more time with students [11].

Other AI-powered programs, such as Grammarly, Ecree, PaperRater, and TurnItIn, provide instructors with the ability to perform administrative tasks, such as checking for plagiarism, rating and grading student work, and providing students with feedback on improvement areas. AI has significantly reduced the paperwork and workload of instructors, especially in the performance of various administrative functions, allowing them to focus on their core mandate, instruction, dissemination of content and materials in accordance with the institution's or country's curriculum [12, 13].

According to Mikropoulos and Natsis, the development and use of AI, particularly its integration in online and web-based learning platforms, has led to improvements in instruction because AI has enabled the development and use of more effective pedagogical tools for these platforms [14].

Roll and Wylie summarize the impact of AI on education, particularly in improving instructional effectiveness and efficiency, by stating that AI, particularly tutoring or instructional systems, have been designed with the goal of resolving the challenges inherent in one-on-one teacher-student tutoring, thereby enhancing the overall quality of instructors' work [15].

Other significant themes or ways in which AI has affected the quality of instructors' work were also identified through the analysis. Some studies highlighted the role of technology and, more specifically, AI in promoting academic integrity through the use of plagiarism detectors, proctoring, and online supervision of students' activities on platforms like Grammarly, TurnItIn, and White Smoke, among others [16, 17].

2.3. Challenges of ChatGPT and AI tools

AI is a promising but technologically constrained field. The obstacles would be more complex and intricate, particularly if they were connected to an educational application. This review identifies three distinct categories of challenges: technique, instructors and students, and social ethics. While the use of ChatGPT and other generative AI models in education may have many

potential benefits, there are also some drawbacks to consider. These disadvantages are substantiated by research:

Lack of Understanding: The inability of generative models to comprehend context and circumstance can result in inappropriate or irrelevant responses. A study [18] confirmed that a generative model-based tutoring system was incapable of providing explanations that were tailored to students' misconceptions.

Absence of human contact: Students who interacted with a virtual tutor that exhibited human-like affective behavior had a superior learning outcome than those who interacted with a virtual tutor that lacked this behavior, according to a study by D'Mello and colleagues [19].

Data Dependent: A study demonstrated that a generative model-based question-answering system performed poorly when the training data was irrelevant to the task at hand [13]. On the other hand, failures in basic tasks have also been widely shared [20, 21]

Bias in Training Data: A generative model trained on a large corpus of internet-sourced text displayed gender bias in its language generation [22].

ChatGPT has a problem with hallucinations. It generates more extrinsic hallucinations - statements that cannot be independently verified from the source - from its parametric memory across all tasks, as it lacks access to external knowledge bases [23].

Insufficient capacity to personalize instruction: ChatGPT and other generative AI models can provide general information and assistance, but they may be unable to personalize instruction to meet the specific requirements of each student.

Privacy and Security: There are also privacy and data security concerns regarding the use of ChatGPT and other generative AI models in education.

Another great challenge is the reconceptualization of the role of educators. Teachers' attitudes towards AI have a significant influence on the effectiveness of using AI in education. Teachers may swing from total resistance to overreliance. The former could arise from inadequate, inappropriate, irrelevant, or outdated professional development. The latter may be due to teachers' unrealistic expectations. These teachers may focus too much on emerging AI technologies rather than learning itself.

Moreover, from the perspective of students, AI techniques may provide smart and efficient tools that allow them to avoid the knowledge-processing work that instructors require. For instance, AI translators may provide premade illustrations, pronunciation, fixed phrases, and even a list of examples. Therefore, students are unwilling to partake in inquiry-based learning processes.

ChatGPT's understanding and potential applications in various disciplines, such as law [16], the medical domain [24, 25], and finance [26], are the subject of numerous studies. Jeblick et al. [27] conduct a case study on the implementation of ChatGPT to radiology reports that have been simplified. Ethical concerns regarding the use of ChatGPT are another essential topic of discussion. Exam integrity and the use of academic writing generate the most debate [24, 25]. OpenAI also discusses the use of LM for disinformation and potential solutions. Zhuo et al.

[28] examine the AI ethics of ChatGPT based on criteria including bias, reliability, robustness, and toxicity. ChatGPT can be used as a supplement to constructive writing, evaluating content, and rephrasing the text, rather than as a replacement for a comprehensive original blueprint. In medical science, there is an ongoing process of updated research, and there is a growing concern that ChatGPT can be used to write papers that lack clinical reasoning and critical thinking [24].

It is essential to remember that ChatGPT and other generative AI models are effective instruments, but they cannot replace human teachers and tutors. It is essential to use these tools responsibly and in conjunction with human guidance and assistance [18].

Benefits of ChatGPT and AI tools in education

This section focuses on ChatGPT's usage in education, particularly how it can help both teachers and students. The possible advantages and limitations of ChatGPT in the educational context can be clarified by separating these roles.

1- Chat GPT for teachers and researchers:

Teachers can use large language models to create personalized learning experiences for their students. These models can analyze student's writing and responses, and provide tailored feedback and suggest materials that align with the student's specific learning needs[35].

In specific, teachers and researchers in the education sector may find ChatGPT to be a useful tool. this have some limitations in its usage, below are some pros and cons of using ChatGPT for lecturers:

- **Advantages:**
 - a- External resource of knowledge.
 - b- Creating and evaluating assessments.
 - c- Grammar and writing of course materials.
 - d- Curriculum Design.
 - e- Helping in writing research outlines

ChatGPT can help to introduce the lecture in an attractive way for students, for instance, we asked chatGPT to tell a story related to computer science that can help explain the concepts of research methodology, the answer was as follow:

“Once upon a time, there was a young computer scientist named Alice who wanted to solve a problem with slow computer performance. She was determined to find a solution and make computers faster and more efficient.

Alice started by conducting a literature review on the subject of computer performance. She read articles, books, and research papers to gather information about the current state of computer performance, including the latest research and advances in the field.

Next, she wrote down her research aim, which was to create a new algorithm that could improve computer performance. This aim was the overall goal of her project and provided a clear motivation for her work.

Finally, she wrote down her research objectives. She wanted to identify the causes of slow performance, evaluate the impact of various factors, and propose solutions to improve the speed and efficiency of computers.”

Limitations: There are also potential issues that need to be considered when deciding whether to use it in a teaching context. [35][36]

- a- Lack of interpretability and potential for bias.
- b- unexpected brittleness in relatively simple tasks.
- c- Issues in referencing.
- d- Limited ability to understand intent.

2- Chat GPT for Students:

For rapid responses to common inquiries and assistance with their academic work, students may find ChatGPT to be a useful tool. However, it might not always give the most correct or complete answers because to its limitations in recognizing context and domain-specific information. Below are some advantages and limitations or issues in ChatGPT[37]

Advantages:

1. **Help with homework:** ChatGPT can be used to help students in solving HomeWorks.
2. **Enhancing writing skills:** A student can type in a sentence and ask ChatGPT to correct it for them to see how it can be improved.
3. **Feedback:** Students can get feedback from ChatGPT so that they work in enhance their assignments before submitting.
4. **Conducting research:** Students can use ChatGPT to make research outline and guide them through research steps.
5. **Fast access to information:** ChatGPT provides a wide range of topics in real time.
6. **Personalized learning:** Students can tailor questions to their interests and even ask follow-up questions so ChatGPT will delve deeper into that interest.

Limitations:

- 1- **Decrease the Creativity:** relying on ChatGPT may reduce the time of critical thinking.
- 2- **Accuracy limitations:** ChatGPT is not 100% accurate because its data is pulled from the internet.
- 3- **Possible bias:** ChatGPT is trained in data, and if that data is biased, so is the machine.
- 4- **Lack of original thoughts:** All collected data are previously mentioned in an article, book, or any available materials, hence, new thoughts or experimental results will not be found in ChatGPT.
- 5- **Cancelling Homework Benefits:** Some publications have declared, perhaps a bit prematurely, that ChatGPT has killed homework altogether[38].

Threats:

The potential for ChatGPT to exacerbate pre-existing biases in language and perpetuate societal inequalities is a concern that can be mitigated through appropriate training and monitoring measures. Potential for Misinformation: ChatGPT has the potential to disseminate misinformation if its training datasets are biased or inaccurate, or if its programming prioritizes engagement at the expense of accuracy. The potential violation of privacy may occur if ChatGPT is utilized to gather and scrutinize sensitive personal data without obtaining the necessary consent. It is imperative to acknowledge the prospective advantages and drawbacks of ChatGPT and to persist in overseeing and controlling its progression and application to guarantee that it caters to the optimal welfare of society.

Conclusion

ChatGPT has the potential to serve diverse purposes, to be utilized across multiple domains, multifaceted applications, encompassing a diverse range of objectives. Capability to integrated into customer service systems, thereby enabling the provision of round-the-clock assistance and addressing commonly asked queries. Function as a personal assistant, providing support to users in various tasks such as organizing appointments, establishing prompts, and transmitting messages. In the education field to facilitate online learning by tailoring instructional approaches to individual learners, addressing student inquiries, and furnishing evaluations of academic tasks. Automated feedback on essays and assignments can also be facilitated through ChatGPT's usage. Support as a viable tool for mental health support, offering a secure platform for individuals to express their emotions and receive guidance and resources. Support healthcare practitioners in patient diagnosis and treatment. Additionally, it has the potential to furnish patients with pertinent details regarding their healthcare conditions and potential courses of treatment. To conduct data analysis and furnish valuable insights, thereby facilitating businesses in making well-informed decisions. Furthermore, it has the capability to

streamline monotonous activities, such as inputting information and communicating with clients. To generate interactive games and experiences, in addition to chatbots designed for virtual assistants or social media platforms, thereby serving as a source of entertainment. In research studies the Chat GPT can facilitate the analysis of voluminous textual data and the production of valuable insights. Additionally, it has the potential to serve as a tool for condensing research articles or suggesting avenues for future investigation, summarizing extensive texts, including scholarly papers and news articles. For employment in creative applications, specifically in the generation of ideas for art, music, and storytelling. To perform language translation services, enabling the conversion of written text from one language to another. To conduct sentiment analysis on textual data, enabling the identification of the polarity of the text as either positive, negative, or neutral. The ChatGPT possesses the capacity to provide advantageous outcomes as well as potential drawbacks in the forthcoming times.

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