

A research of the impact of ChatGPT on education

Yu Fu

The School of Arts and Sciences, Rutgers–New Brunswick, New Brunswick, NJ
08901-8554, America

yf290@scarletmail.rutgers.edu

Abstract. The integration of AI language models, particularly ChatGPT, into higher education has sparked concerns about academic integrity and its impact on student learning experiences. This research aims to explore the applications, benefits, challenges, and future implications of ChatGPT in education, striving to achieve a balanced and beneficial integration of AI in higher education. The study reviews related works on ChatGPT, investigating its development, capabilities, and potential applications in education. Firstly, the paper emphasizes that ChatGPT changes teaching methods, enabling teachers to adopt more flexible and interactive approaches to education. Secondly, the paper highlights that ChatGPT can provide personalized learning experiences for students by generating customized teaching content based on their needs and offering real-time assistance and guidance, thereby enhancing learning effectiveness. However, the paper also acknowledges some potential challenges and issues, including concerns regarding plagiarism and privacy, as well as the possibility of biases and the generation of erroneous information. Addressing these issues requires technological improvements and the development of sound usage policies. The paper concludes by summarizing the findings and prospects of the research.

Keywords: ChatGPT, education, faculty application, students, risks.

1. Introduction

The landscape of higher education is continuously evolving, driven by technological advancements. This research focuses on the integration of ChatGPT, a state-of-the-art AI language model, in higher education institutions. The study aims to explore the various applications of ChatGPT, assess its impact on students and faculty, and investigate the future of AI in higher education, with a focus on adapting universities to this emerging technology.

ChatGPT, a cutting-edge AI language model developed by OpenAI, has garnered significant attention for its capabilities and potential applications in higher education. ChatGPT utilizes the Transformer deep learning architecture and is trained on extensive text data to generate human-like text responses [1]. OpenAI has been actively involved in researching the risks of AI misuse, focusing on AI systems' potential to facilitate influence operations since their early work on malicious AI use in 2018 and GPT-2 in 2019 [2]. They have collaborated with external experts to develop proofs of concept and encouraged third-party analysis of these risks. Despite OpenAI's efforts, ChatGPT's integration into higher education has raised important discussions and concerns. Some educators and experts have expressed apprehension regarding the authenticity of academic submissions and work, as ChatGPT's text-generation abilities may lead to potential plagiarism or the presentation of AI-generated work as

the original creation of students. Grace et al. list instances of cheating in professional and licensing examinations to demonstrate concerns over the misuse of ChatGPT in education [3]. The evaluation of such submissions becomes challenging for teachers and professors, necessitating a closer examination of the implications and ethical considerations of ChatGPT's use in education. Meanwhile, researchers like Fesenmaier argue that the pivotal inquiry for university professors should prioritize nurturing creativity and critical thinking, exploring how AI integration advances essential ideas, and adapting assessment methods to align with the evolving educational landscape [4]. Similarly, Tate et al. advise against outright banning the use of AI but instead propose incorporating education on AI features and ethical utilization, including the proper citation of AI usage. They argue for teaching students to exercise caution and critically assess AI responses [5].

By examining its applications, benefits, challenges, and future implications, this study aims to facilitate a balanced and beneficial integration of ChatGPT in education. The insights gathered will aid in the development of strategies to harness the opportunities and mitigate the challenges associated with ChatGPT and similar AI tools in higher education. By exploring the impact of ChatGPT in education in various fields, this research contributes to the ongoing discourse on the transformative potential of machine learning in higher education.

2. Findings

As a new and rapidly evolving technology, academic journals lack comprehensive reviews of ChatGPT. Instead, the general public's opinions about ChatGPT are better captured on social media platforms. Mogavi et al. conducted research on user perspectives on ChatGPT, using an extensive qualitative content analysis of four prominent social media platforms (Twitter, Reddit, YouTube, and LinkedIn) [6].

The research centered on the experiences and viewpoints of early adopters in various education sectors concerning ChatGPT, an AI Chatbot technology. The primary focus of the study was on how ChatGPT is being used in education and the diverse perceptions surrounding its application. The results indicated that ChatGPT finds its primary usage in higher education (24.18%), K-12 education (22.09%), and practical-skills learning (15.28%). Social media conversations concerning ChatGPT primarily revolve around its effectiveness, efficiency, and ethical considerations. Among early adopters, opinions on ChatGPT differ. Some view it as a revolutionary technology capable of enhancing students' belief in their own abilities and motivation to learn. Conversely, some individuals have reservations, suggesting that an overreliance on the AI system could lead to surface-level learning methods and erode students' abilities for critical thinking and social interaction.

In summary, the views on ChatGPT can be categorized into two main perspectives: the educator's view and the learner/student's view. We'll delve deeper into these perspectives in the following discussion.

2.1. Faculty application

According to Gill et al.'s research, AI, especially tools like ChatGPT, is transforming online education by revolutionizing assessment design and language learning [7]. E-learning platforms are utilizing AI systems, including ChatGPT, to detect errors in student assignments. Instructors find ChatGPT versatile, allowing them to create unique assessments and disrupt paid homework assistance models. AI chatbots powered by ChatGPT assist students with personalized queries, feedback, and improving critical thinking skills. Language learning benefits from ChatGPT, too, as it helps students with sentence modification, pronunciation practice, and real-time interpretations. Notably, ChatGPT can generate written content in response to exam or essay questions, allowing educators and students to compose articles and receive suggestions for improvement. However, ethical considerations and business dynamics are relevant, as ChatGPT provides a cost-effective alternative to existing AI creative solutions. OpenAI's collaboration with Microsoft aims to enhance ChatGPT's effectiveness and commercialize new advancements. The release of GPT-4, with improved precision and reliability, has generated debates, and its integration with productivity applications is expected to drive adoption. Embracing and

understanding AI-powered educational tools, as emphasized by ChatGPT, is crucial for more precise and responsive education technology.

ChatGPT shows promise as an invaluable tool for educators in developing course materials and assessments. However, concerns have arisen regarding the authenticity of generated content. A potential solution is to create training materials specifically designed for course-specific chatbots using ChatGPT. For example, educators can utilize ChatGPT to simulate conversations with a "native speaker" role, aiding students in acquiring English language skills. Once the accuracy of the materials is verified, teachers can convert them into a format compatible with AI-based chatbots, providing students with personalized and engaging learning experiences.

Additionally, ChatGPT has the potential to enhance active learning approaches. The flipped classroom model, where students review course materials before class, allows for interactive learning activities such as group discussions. However, traditional flipped classrooms face challenges related to pre-class learning, which were accentuated during the COVID-19 pandemic, resulting in decreased classroom participation and reduced interest in peer collaboration. As a virtual instructor, ChatGPT can support learners in conducting web-based independent research by responding to inquiries and offering suggestions for debate frameworks, fostering collaboration, and providing immediate feedback.

ChatGPT functions to support instructors in their teaching routines from Chung's research showcases the main applications of ChatGPT in educators' teaching and working routines based on prior research [8]. For instance, Megahed et al. utilized ChatGPT to create a syllabus for an undergraduate statistics course and observed that its teaching recommendations could be implemented with minimal alterations [9].

2.2. Student application

According to Malinka et al.'s research, the usage of ChatGPT by students has been found to have significant impacts [10]. The experiments revealed variability in the correctness of ChatGPT's answers, with different outcomes observed for identical questions. ChatGPT also tends to generate fictional events, links, and references, potentially introducing errors in the generated text. Negative impacts include the facilitation of cheating in university environments, as ChatGPT provides easy access to correct answers, term papers, and code, undermining the learning experience and promoting plagiarism. Freshmen may be particularly affected, as ChatGPT's ability to solve easy assignments without the need for understanding can hinder the development of essential concepts, leading to difficulties in more challenging tasks later on. Furthermore, ChatGPT's occasional provision of incorrect or misleading answers can propagate misinformation. Experiments in the Czech language raise concerns that ChatGPT, regardless of the native language, could enable students to pass courses without genuine comprehension. This issue is more critical during circumstances like a pandemic lockdown, where AI tools make cheating easier.

Malinka et al.'s evaluation (Figure 1) compares AI performance to genuine student results in various tasks [10].

1. Fulltext exam: ChatGPT provides correct but broad and less specific answers. It struggles with questions requiring knowledge application and lacks contextual understanding.

2. Tests: AI solutions in Copy&Paste mode are not always correct, but interpretation mode improves response quality.

3. Term essays: AI performs worse than students in essay writing, but it can save time in generating certain descriptions.

4. Completing Predefined Code: ChatGPT enables easy code generation with predefined structures, saving time in homework completion.

5. Small Projects: ChatGPT can implement algorithms like Miller-Rabin, Solovay-Strassen, and Pollard-Rho, but copying output reduces the educational effect as no algorithm study is required. In summary, the experiments highlight the potential for AI-based tools like ChatGPT to impact academic integrity and learning experiences in various educational tasks.

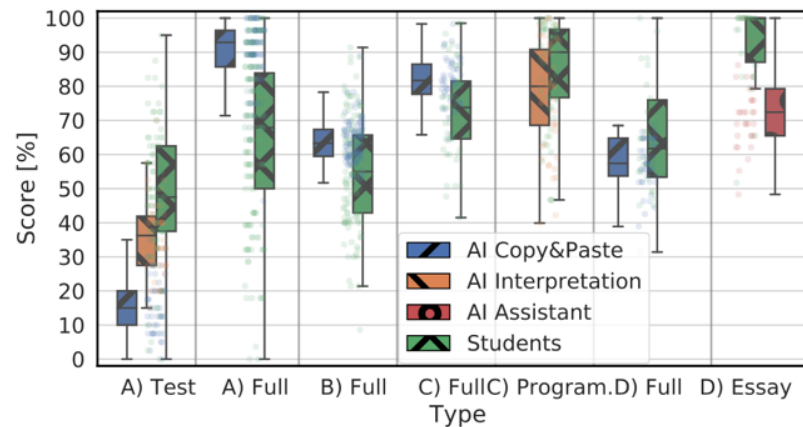


Figure 1. The comparison of AI performance *with* genuine student results in various tasks.

The variability in the correctness of ChatGPT's answers is evident, with diametrically different responses for similar questions. The tool tends to make up events, links, and references, potentially leading to errors in submitted texts, which can be a starting point for detecting AI-written papers. Negative impacts include ChatGPT enabling easy cheating in the university environment, hampering genuine learning experiences, and promoting plagiarism in term papers and programming assignments. Freshmen may be affected as they might not grasp essential concepts if ChatGPT solves easy assignments without intervention, while potentially providing incorrect answers may spread misinformation. On the positive side, ChatGPT can act as a teaching assistant, aiding students in discussing problems and ideas, which is particularly helpful for those facing social barriers. It can also accelerate learning for IT-experienced individuals by providing explanations, sample codes, and knowledge on unfamiliar topics. The experiments conducted in the Czech language support these findings, demonstrating that the impact of ChatGPT on academic integrity is not limited by the native language, and the implications could be further amplified during scenarios like pandemic lockdowns, where increased computer usage facilitates AI tool cheating.

Chung's research outlines ChatGPT's functions that contribute to supporting student learning [8]. These functions are categorized into two primary aspects: learning (answering inquiries, summarizing data, and fostering collaboration) and assessment (validating concepts and preparing for exams, assisting in drafting, and delivering feedback). Operating as a virtual tutor, ChatGPT offers diverse forms of assistance to students. Within the learning aspect, it can generate various scenarios for collaborative group tasks, furnish discussion frameworks, provide real-time feedback, and offer personalized guidance, thereby enhancing small-group conversations and problem-solving interactions. In terms of assessment, students can employ ChatGPT as a scaffolding tool for initial drafts, refining them by rectifying errors and incorporating references into the final versions of written assignments. While ChatGPT's initial responses can trigger further exploration and promote the application of knowledge and reasoning, it should not replace critical thinking and original content creation. Instead, it should function as a support in enhancing writing and research skills.

2.3. Risks

Concerning the accuracy and reliability of ChatGPT, researchers have raised significant concerns. Malinka et al. noted that ChatGPT's responses showed great variability, with some answers being accurate and others completely wrong, even for similar questions [10]. It was observed that the tool tends to generate fictional events, links, and references, which could lead to errors in the generated text. This could be particularly concerning when considering the authenticity and credibility of the information provided by ChatGPT.

Another critical issue is related to plagiarism prevention. ChatGPT-generated texts have been found to bypass conventional plagiarism detectors. When tested using plagiarism detection applications like Turnitin and iThenticate, the similarity index between ChatGPT's output and existing work was often found to be quite low, suggesting a high level of originality. This poses challenges for educators and institutions in ensuring academic integrity and preventing students from submitting AI-generated content as their own.

2.4. Potential solutions

In response to these challenges, researchers have put forth a variety of approaches aimed at tackling the potential drawbacks linked to the use of ChatGPT in education. These approaches can be grouped into three primary categories: task design, detection of AI-generated writing, and institutional policy.

Within the realm of task design, the focus lies on devising inventive formats that foster creativity and critical thinking among students. This could encompass the integration of multimedia resources, the adoption of novel question styles, and the utilization of assessment formats that do not rely on digital tools. Researchers also underscore the significance of prioritizing higher-order cognitive skills, including application, analysis, and creation, when designing assessments.

To discern AI-generated writing, the implementation of AI-powered writing detection tools and cross-referencing of sources has been proposed as effective strategies. Given that ChatGPT might not consistently produce accurate reference lists, identifying discrepancies in references could serve as a potential indicator of AI-authored content. In addition to detection techniques, the establishment of anti-plagiarism guidelines and the education of students about academic integrity are viewed as crucial steps to uphold the integrity of educational processes. Chung's study outlines the strategies and policies intended to address concerns about plagiarism stemming from the use of ChatGPT, illustrating the comprehensive response to this emerging issue [8].

3. Conclusion

In conclusion, the findings from various research studies highlight the diverse perspectives and potential applications of ChatGPT in education. Social media platforms serve as valuable sources for understanding public opinions, with educators and learners expressing contrasting views on ChatGPT's impact. Faculty application reveals the versatility of ChatGPT in the course material generation, personalized feedback, and language learning support, yet ethical considerations arise concerning its cost-effectiveness as an AI creative solution. For students, ChatGPT demonstrates variability in correctness, potentially enabling cheating and misinformation, but it can also act as a helpful teaching assistant, fostering problem-solving discussions and assisting IT-experienced learners. However, concerns about academic integrity and plagiarism prevention remain crucial.

To address the challenges, several strategies are proposed, including innovative task design to encourage critical thinking, AI writing detection tools, and anti-plagiarism guidelines to maintain academic integrity. Educating students about AI limitations and academic misconduct is vital in preventing misuse. Although ChatGPT shows promise as an educational tool, its integration into higher education requires careful consideration and measures to ensure responsible and effective usage. By embracing AI technology responsibly and enhancing educational practices, educators can harness ChatGPT's potential while preserving the authenticity and quality of student learning experiences. To navigate the rapidly evolving landscape of AI-powered educational tools, continuous research, policy development, and collaboration between educators and AI developers are crucial for a transformative and responsive education technology environment.

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