

A Systematic Review of the Impact of ChatGPT on Higher Education

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ABSTRACT

ChatGPT is shaking up the higher education world by generating informative content that mimics human writing. However, its integration into university settings raises concerns about academic integrity and potential information security risks. The aim of this study is to systematically review the impact of using ChatGPT in university settings and its implications for higher education. This study employed a systematic review method to assess the evidence in the literature. Thirty-nine articles were analyzed according to PRISMA principles. The findings suggest that ChatGPT has the potential to personalize learning and improve writing performance. However, there are still potential issues, such as undermining academic integrity and breaching personal information. Therefore, urgent action is needed to address these issues and optimize the use of ChatGPT in higher education. Future research could further discuss how to fully utilize ChatGPT in academia while carefully considering ethical issues.

KEYWORDS

Academic Integrity, ChatGPT, Higher Education, Information Security, Personalized Learning, Writing

INTRODUCTION

ChatGPT is a human–artificial intelligence (AI) interaction application that is able to perform human-like functions like learning, adapting, and processing data. Integrating artificial intelligence (AI) and chatbots into education has become more common recently. However, the increasing use of AI and chatbots in education also raises ethical challenges that need to be addressed (Hung & Chen, 2023; Kooli, 2023; Lo, 2023; Meyer et al., 2023). As Lim et al. put it, ChatGPT could destroy some education practices while at the same time supporting them (Lim et al., 2023). Thus, this study aims to investigate both the opportunity and challenge of using ChatGPT in education.

The study opens by discussing ChatGPT and how it relates to higher education. It then thoroughly analyses the previous research on the use of ChatGPT in higher education. Preferred reporting item for systematic reviews and meta-analyses (PRISMA) methodology, which offers a structured procedure for conducting systematic reviews, is used in the study's methods section. After a discussion and summary of the findings, the study concludes by offering insights about how these advanced AI models can be used in education and especially in university settings. Our hope is that this study will intrigue interest and further discussion related to leveraging ChatGPT in academia appropriately.

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Possibilities and Benefits Brought About by ChatGPT in Education

ChatGPT can serve as an effective tool for providing immediate feedback and personalized learning experience. In this regard, ChatGPT functions as a personal language tutor for students (Xiao & Zhi, 2023). Researchers have long maintained the benefits of AI for education and in recent years, it has brought about new perspectives for personalized education (Lambert & Stevens, 2023; Maghsudi et al., 2021). In particular, ChatGPT can be used to adapt to the individual needs and preferences of each learner by providing customized content and feedback. This can ensure that each student's unique learning style and pace are taken into account, leading to more efficient and effective learning and improve their learning outcomes (Abd-alrazaq et al., 2023; Cotton et al., 2023). For example, instructors can input student essays, discussion board responses, and other assignments into ChatGPT to search for alignment to assignment requirements and to search for evidence for the need of further instruction (Glaser, 2023).

ChatGPT also serves as a valuable writing tool, generating creative content (D. Yan, 2023). ChatGPT can provide writing assistance to students, especially non-native English-speaking students, by enabling them to brainstorm ideas and get feedback on their writing. ChatGPT is also believed to be useful research aids for generating ideas, synthesizing information, and summarizing a vast amount of text data to help researchers analyze data and compose their writing, contributing to efficiency in publication, generating ideas or finding inspiration (C. K. Y. Chan & Hu, 2023; Wu & Yu, 2023). According to Michalon & Camacho-Zuñiga, ChatGPT's requirement of concise prompts can be a driving force in improving the ability to effectively express ideas and communicate intentions. (Michalon & Camacho-Zuñiga, 2023). Additionally, other researchers demonstrated that ChatGPT is a highly effective tool for analyzing and detecting errors in EFL writing. However, it does have some limitations compared to human analysis (Algaraady & Mahyoob, 2023).

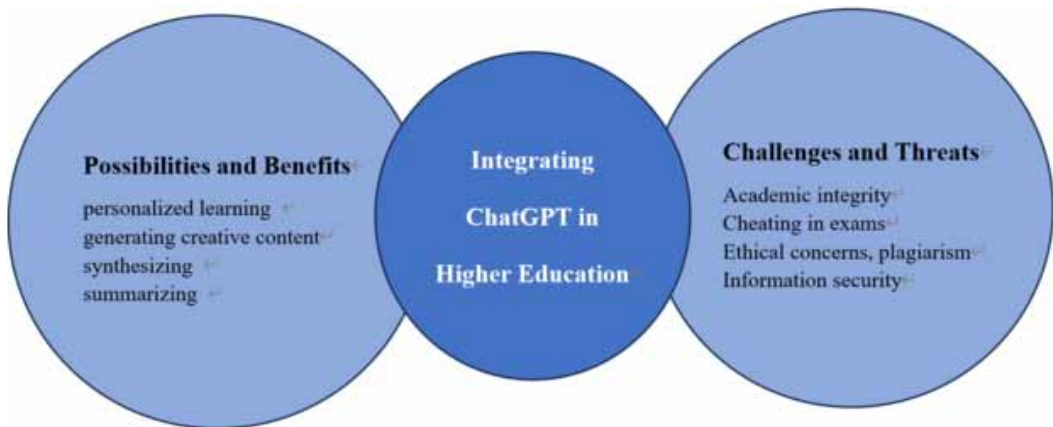
Challenges and Threats Posed by ChatGPT in Education

Chatbots have emerged as a promising educational tool, with the potential to enhance the learning experience by providing personalized and immediate feedback to students. However, the use of chatbots in the educational field also raises ethical challenges that need to be addressed (Kooli, 2023). With its ability to provide specific answers to user questions, it can be used to complete written assignments and examinations on behalf of students, leading to concerns about AI-assisted cheating. BBC News (2023, as cited in (Ajevski et al., 2023)) also noted that students could use ChatGPT in several different ways, from submitting assessment questions to it and copying and pasting the results into their assignments, to drafting the assignment themselves and asking ChatGPT to improve its written style, spelling and grammar.

ChatGPT has been shown to generate human-like text (Lim et al., 2023), which could pose a potential risk to the integrity of online exams, especially in higher education settings where such exams are becoming more prevalent. With such performance, ChatGPT is a serious threat to academic integrity (Cotton et al., 2023). This was echoed by Michel-Villarreal's interview with ChatGPT, and it responded that "With the ability to generate human-like responses, ChatGPT raises concerns about academic integrity. Students could potentially misuse the model to generate plagiarized content or cheat on assignments and assessments. This poses a challenge for educators and institutions in ensuring fair evaluation and maintaining academic standards." (Vilalta-Perdomo et al., 2023). Additionally, some researchers contended that AI-assisted plagiarism is hard to spot using traditional plagiarism detection approaches adopted by higher education institutions (Perkins, 2023)

There are also risks of breaches in privacy and security when using ChatGPT. The training data for models like ChatGPT comes from various sources that may contain personal information. This information may then be used to track and profile individuals (Lambert & Stevens, 2023). Chan et al, also noted that the use of GenAI raised privacy and ethical concerns, which was mostly mentioned by students majored in arts and social science. They worried that AI would collect personal information from the conversation, which can pose privacy and security risks (C. K. Y. Chan & Hu, 2023). In

Figure 1. Possibilities and challenges of integrating ChatGPT in higher education



an empirical study conducted by Tlili et al., some participants were concerned about exposing their private and demographic information to ChatGPT through repetitive interactions (Tlili et al., 2023).

Although research on ChatGPT has grown considerably in recent years, there are relatively few studies that have conducted a systematic review that focus on the impact of ChatGPT on specific aspects, especially in university settings. This study, therefore, will examine ChatGPT's impact on personalized learning, writing performance, academic integrity and information security, as well as implications to mitigate challenges and leverage potential opportunities. In doing so, we will aim to answer the following research questions:

RQ1: How can ChatGPT promote personalized learning?

RQ2: How can ChatGPT promote writing performance for university students?

RQ3: What are the impacts of ChatGPT on academic integrity?

RQ4: What are the impacts of ChatGPT on information security?

RQ5: What are the implications for the use of ChatGPT in education?

RESEARCH METHODS

Research Design

This study employed a systematic review method to assess the evidence in the literature, guided by the Preferred Items for Systematic Review and Meta-Analysis Program (PRISMA-P). It followed four steps to identify and synthesize previous research, enabling a comprehensive understanding of the advantages and risks associated with the utilization of ChatGPT. Initially, the researchers executed a literature search on Web of Science, based on the proposed research questions. Subsequently, they employed clustering and mapping techniques in VOSviewer to discern prevalent research themes and develop several focused queries. Next, the researchers appraised the articles against the established inclusion and exclusion criteria. Finally, they reviewed and summarized the literature to gain an overall perspective on the benefits and risks connected with ChatGPT utilization.

Research Corpus

On October 22, 2023, the researchers developed their search strategies and obtained literature by searching the Web of Science databases. The Web of Science databases include various resources such as Science Citation Index Expanded (SCI-EXPANDED, 2013-2023), Social Sciences Citation

Index (SSCI, 2008-2023), Social Sciences Citation Index (SSCI)--2008-present, Arts & Humanities Citation Index (AHCI, 2008-2023), Emerging Sources Citation Index (ESCI, 2018-2023), Current Chemical Reactions (CCR-EXPANDED, 1985-2023), and Index Chemicus (IC, 1993-2023). By searching these online databases, the researchers aimed to minimize selection bias and increase the representativeness of their sample.

On October 22, 2023, the researchers searched the Web of Science databases using the search terms “ChatGPT*” (Topic) and “educat*” (Topic) and found 488 results. On October 23, 2023, they added more topics related to ChatGPT and found 777 results using the search terms “ChatGPT*” (Topic) and “educat*” OR “impact*” OR “implication*” OR “academic*” (Topic). The search period covered January 2022 to October 2023.

To select search directions from the collected literature, the researcher obtained the results (N = 777) in plain text and read them with VOSviewer. The data were then interpreted with VOSviewer by selecting “co-occurrence” as the type of analysis, “all keywords” as the unit of analysis, and “full counting” as the counting method. The minimum number of keyword occurrences was set at 1. Two hundred and fourteen keywords reached this threshold. Figure 1 presents an overview of the bibliographic network.

A total of 214 keywords were divided into 22 clusters. Aside from artificial intelligence, which is the context of the ChatGPT, it is evident that higher education was a largely studied concept. Cluster 1 contained 13 terms, such as blended learning, technology, course design, and satisfaction. Cluster 2 contained 12 items, such as courses, environment, performance, engagement, teachers, and students. Cluster 3 contained 10 items, such as online learning environment, education technology, tool, and collaborative learning. Cluster 4 contained 9 terms, e.g., e-learning, satisfaction, students, learning environment, technology acceptance, and user acceptance. The researchers chose popular research topics based on a keyword list with the highest number of co-occurrence links. The link strengths of plagiarism (N = 16), academic integrity (N = 25), ethics (N = 43), challenges (N = 19), impact (N = 23), academic writing (N = 9), higher education (N = 44), and ChatGPT (N = 229) were at the top. This study will thus center on these top items, coupled with information security.

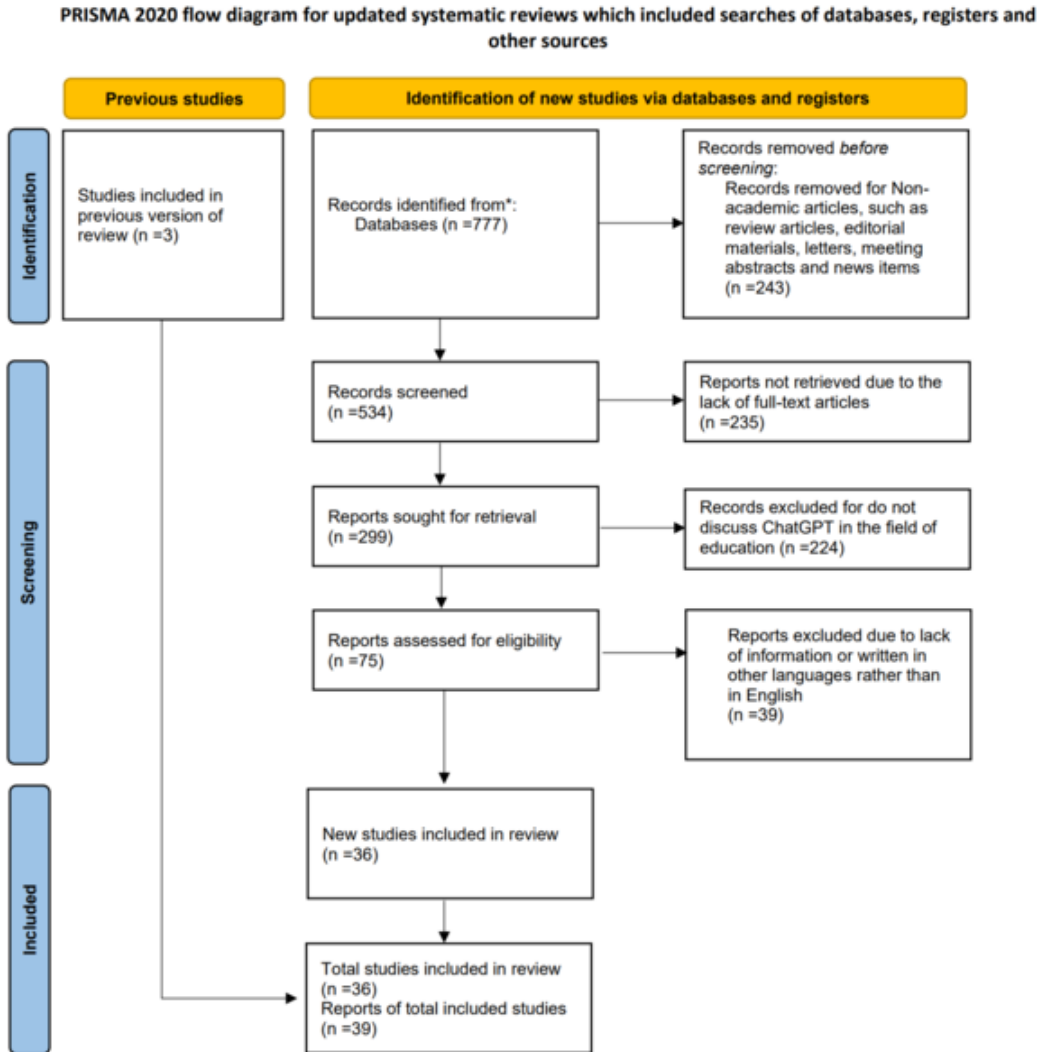
Inclusion and Exclusion Criteria

Using a systematic review process and following the PRISMA-P guidelines, researchers screened the collected literature to determine which studies should be included and excluded from the analysis. To be eligible for inclusion, studies had to meet the following criteria: (1) they focused on the topic of ChatGPT in the field of education; (2) they provided sufficient information for the study; (3) they were available in full text format; and (4) they were academic articles. Studies were excluded if they: (1) did not fall within the field of education; (2) failed to provide enough information; (3) were not available in full text format; or (4) were non-academic articles such as review articles, editorial materials, letters, meeting abstracts, or news items.

Study Selection

Two researchers independently followed a four-step process to analyze the collected literature, using formal inclusion and exclusion criteria (see Figure 2). First, they retrieved 777 publications from Web of Science. After excluding non-academic articles based on the type of publication, they selected 299 fully available publications. Next, they conducted an exclusion based on the research area, excluding 224 publications that were not related to the field of education. Finally, they included 39 articles in this systematic review. The Cohen’s Kappa value provided a measure of inter-rater reliability between the two researchers, indicating a high level of agreement (See the result of Kappa test in the Supplementary Material for comprehensive analysis). This ensured a reliable and consistent approach to the literature selection process.

Figure 3. A flow diagram of the study selection based on PRISM



“I believe that the use of ChatGPT will reduce teachers’ workload for answering questions. I may also use it to generate some lesson plans.”(C. K. Y. Chan & Hu, 2023; Nganji, 2018). Moreover, Vilalta-Perdomo et al. proposed that ChatGPT can promote self-directed learning for it regards itself as a tool capable of providing “personalized feedback, explanations, and recommendations based on individual student queries”.(Vilalta-Perdomo et al., 2023). Additionally, ChatGPT generates different feedback with different types of prompt, thus it can contend the needs of different students and give varied feedback. (Farrokhnia et al., 2023; Tapalova & Zhiyenbayeva, 2022)

RQ2: How can ChatGPT Promote Writing Performance for University Students?

The findings of this review suggested that ChatGPT can potentially promote writing performance by serving as a readily available and dependable writing assistant tool.

Generating Ideas and Inspiration

Students can use ChatGPT to solicit ideas and inspiration as a starting place for writing. The answer generated by ChatGPT provides an array of factors for the inquiring students to consider (Akiba & Fraboni, 2023; Yu & Yu, 2019). ChatGPT could be required to summarize concepts, historical events, or pieces of text such as chapters, scenes, or primary documents in history. Students can consult with ChatGPT as they collaborate on writing a short story (Lambert & Stevens, 2023). Furthermore, students can also use ChatGPT to generate research questions. By typing a topic or research area into ChatGPT, students can obtain a list of potential research questions. This feature can be particularly useful for students who are seeking inspiration for a research project. However, it is important to use ChatGPT with caution and in conjunction with other research methods (Dergaa et al., 2023). In addition, in a questionnaire designed by Yan, ChatGPT was believed to be “good at giving examples” from “many disciplines and fields” (Yan, 2023).

Editing and Revising

ChatGPT can provide preliminary feedback on a first draft, e.g. on grammatical errors and transitional phrases or higher-level vocabulary or definitions (Lambert & Stevens, 2023). According to the investigation of Shaikh et al., learners admitted that ChatGPT can expand their vocabulary, enhance their grammatical and syntactical structures, and thus improve their writing and conversational skills (Shaikh et al., 2023). Algaraady & Mahyoob demonstrated that ChatGPT is a highly effective tool for analyzing and detecting errors in EFL writing, especially those surface-level errors (Yu, 2022). However, it does have some limitations compared to human analysis (Algaraady & Mahyoob, 2023). Furthermore, users could leverage the flexibility feature of ChatGPT to request for a change in linguistics tones or flavors. As a student reported: I was shocked to play with the different styles of language ChatGPT generated. For example, when you ask it to produce a text with “academic tone” or “casual style”, it would generate very different writings (D. Yan, 2023).

Saving Time

ChatGPT allows students to complete a writing task without much effort. Specifically, it could reduce the editing load for students. In this way, less time will be spent on removing commas and breaking up paragraphs, and more time handling what is important—the science (Borger et al., 2023). For instance, ChatGPT can be utilized to analyze academic papers by scanning them and extracting important details such as the author(s), publication date, and significant findings (Lin & Yu, 2023). This feature not only saves time but also enables researchers to avoid the tedious manual searching of papers. ChatGPT can also be used to create summaries in academic research, which can be a time-consuming process (Dergaa et al., 2023). Additionally, ChatGPT helps users collect reference materials for their research papers or essays (Hung & Chen, 2023), significantly increasing the efficiency of students’ work and allowing them to devote more energy and time to creative tasks.

However, this raises concerns about learning loss, especially in developing critical and creative thinking. This will most likely to arise when students become too reliant on the tool for convenience. Moreover, students’ reliance on ChatGPT may undermine some important goals of writing pedagogy, which are to foster creativity, develop critical thinking, and enhance the ability to articulate ideas with clarity and precision (Barrot, 2023).

RQ3: What are the Impacts of ChatGPT on Academic Integrity?

ChatGPT is a serious threat to academic integrity, especially in higher education (Farrokhnia et al., 2023). Michel-Villarreal et al. argued that plagiarism is one of the most cited concerns in existing academic literature, exerting a heated debate on whether the technology should be completely banned. In his interview with ChatGPT, it suggested that “*Students could potentially misuse the model to*

generate plagiarized content or cheat on assignments and assessments” (Vilalta-Perdomo et al., 2023). In fact, a recent survey of university students found that nearly one in three students had used a form of AI, such as essay-generating software, to complete their coursework (C. Chan, 2023). As a result, for students with low motivation to learn, it is unavoidable that they would take a shortcut by using ChatGPT as a ghostwriter (Xiao & Zhi, 2023).

Language learners could use ChatGPT for assistance in completing language assignments or assessments, which raises concerns about plagiarism, cheating, and the authenticity of learners’ work (Currie, 2023). AI technology has the potential to be used by students to cheat on assessments and exams, which undermines the integrity of the education system and devalues the efforts of other students who have earned their grades honestly. Additionally, they can use it in real time to cheat on exams, thereby compromising the fairness of these exams and potentially resulting in “inaccurate assessments of students’ knowledge and skills” (Vaccino-Salvadore, 2023). These echo the view of Kooli who believed that ChatGPT can lead to instances of plagiarism and devalue the learning experience for all students (Kooli, 2023).

RQ4: What are the Impacts of ChatGPT on Information Security?

Privacy Breaches

There is a risk of exposing personal information in the interaction with ChatGPT. ChatGPT, along with other generative AI platforms, can be incredibly powerful productivity tools (Borger et al., 2023). The privacy issues is particularly concerning as LLMs-based innovations work with stakeholders’ natural languages that may contain personal and sensitive information regarding their private lives and identities (L. Yan et al., 2023). Consequently, if stakeholders shared their personal information on these platforms in natural language (eg, sharing phone numbers and addresses with group members via digital forums), such information could be used as training data for fine-tuning LLMs. This usage could potentially expose private information as LLMs are incapable of understanding the context and sensitivity of text, and thus, could return stakeholders’ personal information based on semantic relationships (L. Yan et al., 2023).

Malicious Uses

There is a risk that the collected data could be accessed or misused by third parties. As mentioned above, ChatGPT, like other AI models, requires an enormous amount of data to refine its language generation abilities. Users may express personal thoughts, emotions, and experiences while using ChatGPT, therefore, there exists risks of misuse of such individual data (Vaccino-Salvadore, 2023). As Gupta et al. put it, The GenAI tools like ChatGPT can be used by cyber defenders to safeguard the system from malicious intruders (Gupta et al., 2023).

Several studies have pointed out that vulnerability of malicious uses of personal information due to the interactivity of ChatGPT, that is to say, during the conversation between users and chatbot, it will inevitably collect information about the users (Gupta et al., 2023; Lambert & Stevens, 2023; Piñeiro-Martín et al., 2023). This usage could potentially expose private information as LLMs are incapable of understanding the context and sensitivity of text, and thus, could return stakeholders’ personal information based on semantic relationships (L. Yan et al., 2023). Thus, there is a fear that personal and sensitive information shared with ChatGPT could be vulnerable to unauthorized access or misuse, leading to potential privacy breaches and identity theft.

The potential uses of personal data raise questions about consent (Alawida et al., 2023; Vaccino-Salvadore, 2023). ChatGPT may generate sensitive information without the consent of the individuals involved. For example, ChatGPT could be used to generate fake conversations or emails that appear to be from real people, which could be used to commit fraud or impersonate individuals. Additionally, ChatGPT could be used to generate sensitive information such as medical records, financial information, or personal details, which may then be used to track and profile individuals

(Lambert & Stevens, 2023). In addition, the potential for security breaches or hacking incidents could compromise the integrity and confidentiality of student data (Johnson, 2023).

RQ5: What are the Implications for the Use of ChatGPT in Education?

Implications for Teachers

There are a few strategies that teachers can use to prevent plagiarism using ChatGPT, and they including educating students on plagiarism, accessing the assignments by tracking process and using plagiarism detection tools (Cotton et al., 2023; Jarrah et al., 2023). Besides, teachers can also teach students to develop a distinctive writing voice and identity, which is difficult for ChatGPT to replicate. Encouraging students to incorporate their personal experiences and share their own stories in their writing can help achieve this objective. Additionally, teachers can leverage ChatGPT's editing capabilities to teach students correct language forms and style. Students can then review the changes made by ChatGPT and decide whether to accept or reject them based on their own judgment (Barrot, 2023). As for citation, it is necessary for teachers to ask students delineate which ideas are their original thoughts, and which ideas are borrowed from chatbot (Johinke et al., 2023).

Implications for Policy Makers

There is an urgency to develop or update institutional policies and guidelines to address the potential misuse of ChatGPT, which is in line with existing literature (Chan, 2023; Vilalta-Perdomo et al., 2023). By establishing and implementing clear policies around AI use, including ethical guidelines and legal responsibilities, and developing mentorship and collaboration, institutions can empower students while mitigating the risks of academic dishonesty (Chaudhry et al., 2023; Jarrah et al., 2023). Equity and accessibility issues must also be addressed to ensure that AI tools are accessible to all, regardless of geographical location or income level. By promoting inclusivity and equal opportunities, AI's potential benefits can be harnessed fairly and equitably.

DISCUSSION

Leveraging ChatGPT in Higher Education

ChatGPT can be a valuable tool for providing personalized learning experiences. By analyzing the large amount of data obtained before, ChatGPT can provide learning resources tailored to students' specific needs. Therefore, it is beneficial for both teacher and student if they fully utilize this chatbot, which can significantly increase efficiency. The results suggest that ChatGPT can also improve writing performance. Akiba et al. suggested that ChatGPT gives inspiration to those students who are at a lose in writing. It is a good tool for students to generate research questions . Other than that, Yan noted that ChatGPT is “good at giving examples” from “many disciplines and fields”. What's more, ChatGPT can also facilitate writing by editing errors and giving advice about revising vision. According to Shaikh et al., learners admitted that ChatGPT can expand their vocabulary, enhance their grammatical and syntactical structures, and thus improve their written and conversational skills.

Challenges and Threats Posed by ChatGPT in Higher Education

Every coin has its two sides. Given the benefits ChatGPT can provide, there are also some concerns caused by it in higher education settings. Michel-Villarreal et al. argued that plagiarism is one of the most cited concerns in existing academic literature. Students could potentially misuse the model to generate plagiarized content or cheat on assignments and assessments, which could pose great threat to academic integrity. In addition, according to Vaccino-Salvadore, the availability of the standard answers could undermine the fairness of education, thereby devalues the efforts of other students (Vaccino-Salvadore, 2023). The use of GenAI also raised privacy and ethical concerns. The results suggest that ChatGPT collect private information during the conversation, and may expose users'

privacy without their consent. Worse still, the personal information is probably be used maliciously by third parties such as convicting fraud and so on.

Immediate Action in Response to the Impact of ChatGPT

Immediate action must be taken to mitigate the impact of ChatGPT on higher education. Assessment methods and institutional policies need to be updated to address the challenges posed by the emergence of AI-generated content in student assignments. For the pedagogical part, instructors could adjust the design of their assessment tasks by incorporating multi-facet ways to reduce the risk of plagiarism such as oral presentations into their assessment tasks (Kelly et al., 2023). These multi-facet assessment tasks require students to demonstrate their abilities in real-time and in person. At the institutional level, AI-based writing detection tools should be made available to instructors. Furthermore, anti-plagiarism guidelines should be established to clarify the boundaries of ChatGPT's involvement in student learning.

Instructor training and student education are also critical in responding to the impact of ChatGPT. It is essential to train instructors on how to identify the use of ChatGPT in student assignments, which can be achieved by using AI detection tools. Instructors should also be trained on how to fully use ChatGPT in their teaching preparation and course assessment. For students, it is crucial to introduce them to the limitations of ChatGPT. It is also important to increase students' awareness of academic integrity and their understanding of the consequences of academic misconduct. To achieve this goal, instructors should openly discuss ChatGPT in their courses and emphasize the importance of academic honesty.

CONCLUSION

Major Findings

This systematic review investigates potential benefits of ChatGPT when serving as an assistant for personalized learning and writing for university students. However, its use raises various concerns, such as posing threat to academic integrity and causing breaches of private information. The findings of this review call for immediate action by schools and universities to update their guidelines and policies for academic integrity and plagiarism prevention. Furthermore, instructors should be trained on how to use ChatGPT effectively and detect student plagiarism. Students should also be educated on the use and limitations of ChatGPT and its potential impact on academic integrity.

Limitations

Several limitations of this study should be noted here. Firstly, the study may not cover all relevant publications due to limited library resources. Secondly, most of the included articles were written in the Western context. Thus, the findings of this review may be biased towards these specific contexts. Finally, some of the suggestions made in the included articles were based on the researchers' intuitive beliefs rather than empirical evidence. For example, some researchers suggested designing assessment tasks that focus on creativity and critical thinking. However, specific strategies to achieve this goal were not always thoroughly discussed.

Future Research Directions

Corresponding to the limitations of this review, further studies in other education contexts (e.g., primary and secondary education) are recommended in order to gain a more comprehensive view of ChatGPT and its impact on higher education. Additionally, more rigorous studies are needed to provide evidence-based recommendations for using ChatGPT in higher education. Only in this way can researchers conclude the related implications and give suggestions about how to handle the potential issues and maximize the utilization of ChatGPT.

CONFLICTS OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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