Does ChatGPT Add Value to University Students' Academic Performance?

Parveen Kaur[1*], Arif Jawaid[2], Rochelle Ooi Jin Qi[3], Raes Dashreen bin Che Mohd Rokman[4], Sadra Selmah Anak Awai[5], Samantha Suntie Liew[6], Seri Nurellisa binti Mohd Yunus[7]

[1]*Associate Professor, University Malaysia Sarawak, Malaysia; E-mail: sspkaur@unimas.my*

[2]*Professor, Lahore Garrison University, Pakistan*

[3,4,5,6,7]*University Malaysia Sarawak, Malaysia*

Abstracts: The researchers were concerned about the effectiveness of ChatGPT with respect to students' educational performance. This was because a lot of students were producing the assignments with little substantial evidence drawn from their own effort. To examine the extent of their personal contribution in academic work, a randomly selected group of university students were administered a questionnaire. The questionnaire comprised demographic information of the students, ChatGPT validity, reliability, advantages, disadvantages, and recommendations. The data analysis was carried out using Microsoft Excel. It was found out that the ChatGPT is useful academic resource. However, it should be used appropriately without compromising academic standards and honesty. More research with large diverse student community may bring useful results.

1. INTRODUCTION

A modern Artificial Intelligence (AI) chatbot called ChatGPT enables its consumers to communicate with a virtual assistant using machine learning and natural language processing (King, 2023). Its foundation is the GPT-3.5 architecture, an enhanced version of the GPT-3 architecture that is programmed for a sizable quantity of text data, including web pages, novels, and other materials. With the capacity to comprehend and answer complicated requests in a way that seems natural and easy to understand.

ChatGPT, a product of Open AI, is made to be extremely intelligent and intuitive (Cotton et al., 2023). In addition, ChatGPT's capabilities are revolutionizing how we engage with technology and ushering in a new era of interactive intelligent AI. According to Cotton et al. (2023), as of 2021, ChatGPT is one of the biggest language models in use, has 175 billion parameters. It has shown outstanding results on several natural languages processing tasks, such as text generation, query resolution, and language translation. It has been utilized in several applications, including text completion, content production, and chatbots.

Chatbots like ChatGPT have the potential to be utilized for educational purposes despite the fact that they might be used with dishonesty. By entering the essay question and having ChatGPT produce a whole essay as a response, students might theoretically utilize ChatGPT to cheat on essay writing assignments. This would enable students to submit an essay that has already been completed without having to conduct any original research or writing. According to Abdelaal (2019), higher education officials are becoming more concerned about the usage of AI-powered essay writing services, which are becoming more complex and challenging to identify.

The use of AI essay writing tools in higher education may encourage plagiarism. This implies that it is possible for students to utilize these systems to submit essays that are not their own to complete assignments, which would undermine the goal of higher education, which is to challenge and educate students (Cotton et al., 2023). Additionally, relying too heavily on chatbots may discourage the use of critical analysis and research techniques,

instead of delving further into and conducting a more in-depth examination of the material, students could become overly reliant on getting immediate responses from a chatbot.

2. PROBLEM STATEMENT

ChatGPT is a comprehensive tool for raising the fears of cheating on assignments and homework. Whereby, it is capable of writing and composing an essay answer that might be giving misleading and biased answers. ChatGPT has put the educator in fear due to the increased usage of ChatGPT, which might threaten academic integrity. This will encourage more plagiarism in an assignment. Due to the convenience and the availability of ChatGPT, students are more reliant on Open AI writing instead of doing their own skills thus, resulting in the lack of ability on doing critical thinking skills, the ability to be creative, and developing capabilities in brainstorming.

Furthermore, the ChatGPT will generate a higher language comprehension for the assignment, therefore the consequences of writing standard will affect them in relying on the software chatbot for answers whereby it can limit their learning and knowledge on the problem solving and enhancing their skills. As the outcome of their work, it will be much better than the normal work done by students that are not using the software and this will lead on decreasing the quality of education standard. This may lead to lack of exercising cognitive skills and imaginations in their project required from the writing literature work and describing a major topic.

3. RESEARCH OBJECTIVES

The project's goals are outlined in its research objectives. Every phase of the research procedure, such as the data collection, argument construction, and conclusion development, should be guided by them. The purpose of one's study should be clear in order to define its breadth and depth, inform research design, and show how it will advance previously conducted research (Ryan, 2022).

The first objective of this research was to examine how ChatGPT negatively affects students' education. As technology advances, lots of applications, software, websites, etc. are created to ease the human workload in their daily lives. However, the cultivation of technology is not always a good thing for us. This is why it is important for us to know how AI technology can negatively affect other people.

Next, identifying the factors that made students use ChatGPT in the education world was the research's second objective. Lots of tools were made for students to help lighten the burden they faced while doing their assignments. As ChatGPT being one of the popular tools being used, this research aimed to know the extent of choosing ChatGPT to help them academically.

Finally, the third objective of this research was to analyse whether the contents made with the use of ChatGPT are academically correct. ChatGPT is known to produce answers sought by its users, likewise, students would use this application to find answers for their given tasks. For a student to graduate with flying colours, they need to score their assignments. This is why it is important to know if ChatGPT can accurately produce contents.

4. METHODOLOGY

The researchers applied a methodology that examined and clarified the data gathering and analysis procedures employed in this research.

A minimum of 30 respondents (UNIMAS students) were interviewed in this research. Interview method was used to ensure that we got the findings regarding the use of ChatGPT. Other than that, interviews helped in getting a better understanding of information delivered by the students. To avoid biasness, random sampling technique was used.

Moreover, questionnaires via Google Form were also administered to the respondents. This helped the researchers to easily arrange and analyse the data gathered. After the data was collected, researchers then created graphs with Microsoft Excel to help visualise the data.

5. LITERATURE REVIEW

5.1 Artificial intelligence (AI)

The rapid advancement of artificial intelligence (AI) is significantly changing the labour market in which education functions, prompting worries about what to teach and how to teach future generations. Such issues underscore the importance of education in providing future individuals with the necessary skills and competencies to thrive in a fast-changing world (Zhai et al., 2021). It is crucial to comprehend what AI is capable of handling this issue. In order to save time and money, AI is projected to take the place of human effort in completing everyday work. The recent advancement of AI has also demonstrated its ability to replace or partially replace creative labour that is often carried out by experienced people, such as academic writing, coding, and the arts (Li Y et al., 2022). According to Lock (2022) Natural Language Processing (NLP) is a prime example of a branch of AI that has revolutionised several facets of civilization. Researchers have created chatbots and conversational AI systems, like ChatGPT, to give a new method of generating conversational replies to human inputs, especially with the availability of massive datasets.

5.2 Chatbots and ChatGPT

One example of how these technologies is being used in real-world applications is chatbots, which are computer programmes that simulate human dialogue (Adamopoulou & Moussiades, 2020a). These chatbots employ artificial intelligence (AI) methods including machine learning and Natural Language Processing to comprehend user inquiries and provide relevant answers. Additionally, Chatbot offers a variety of information on schools, universities, or colleges as well as student-specific data (Patel et al., 2019). The main topic of this paper is ChatGPT, a potent tool for managing human work. ChatGPT is a public tool created by OpenAI that is based on the GPT language model technology (Kirmani, 2022). Because it can provide solutions for every issue, this platform is thought to be able to take the role of Google. OpenAI's ChatGPT can provide thorough responses to challenging inquiries. These systems assist students achieve better learning outcomes by understanding their learning preferences and tailoring the material and instructional strategies to suit their requirements.

5.3 ChatGPT's Advantages on Academic Publication

It is crucial to emphasise the advantages that ChatGPT and comparable big language models (BERT, XLNet) may offer to this field before going into some of the ethical challenges and concerns that arise with utilising ChatGPT in academic publication. Journals may support peer review and review ethics by serving as the foundation of academic databases and the research environment. ChatGPT can help editors finish time-consuming or repetitive jobs (such fixing grammar mistakes) and prevent them from having preconceived notions about certain articles (Hosseini et al., 2023). It is important to note that it is not obvious whether or how ChatGPT resolves existing problems if biased people teach ChatGPT. ChatGPT may increase review report availability by proposing options depending on the contents. (Woods et al., 2023). The beneficial function of ChatGPT in the process may benefit the academic community, the research environment, and society (Thigpen & Funk, 2019).

6. Ethical Concerns

Research articles generated by ChatGPT may be viewed as unoriginal and perhaps harmful from an ethical aspect. Several studies have found that the training data and coding process of language models such as GPT-3, are often drawn from big web-based datasets, can contain gender, race, ethnicity, and disability status bias (Basta et al., 2019). The growing use of AI-generated research articles, which can be swiftly produced in enormous quantities, jeopardises the integrity of science, by adding possible biases and flaws that are hard to spot (Muller,

2021). As a result, research findings may become even more unequal, and the tenets of science may be threatened.
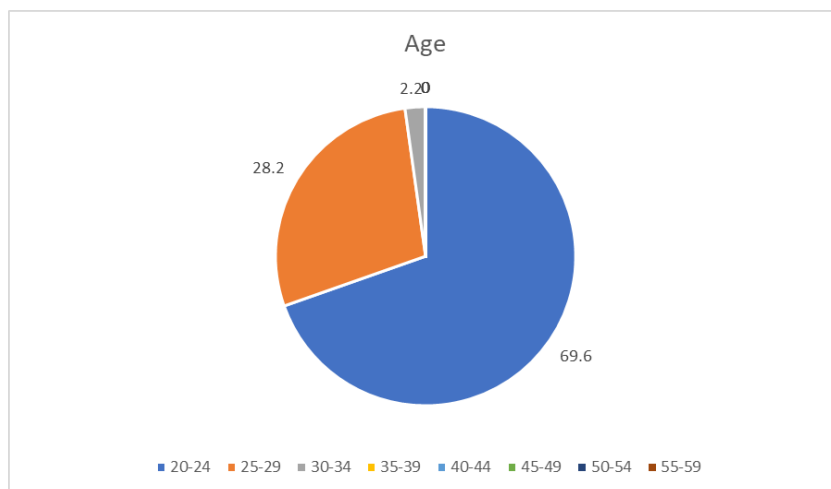
7. DATA ANALYSIS

Figure 1: Respondents' Age

Figure 1 reveals that 69.9% of respondents are generally between the ages of 20 and 24, while 28.8% are between the ages of 25 and 29. 30–34-year-old responders make up just 2.2% of the total. This research shows that 60.9% of respondents are female and 39.1% are male.

The first question in the questionnaire was related to the reliance on ChatGPT and would it reduce a student's ability to think critically and do problem-solving. According to the respondents (82.6%) agreed that ChatGPT can reduce a student's ability to think critically and do problem-solving. This is because the reliance on ChatGPT make students unable to think critically and solve problems given in the assignments. This also has impact on their academic performance. Lo (2023) stated the issue occurs when a student relies on ChatGPT in his studies.
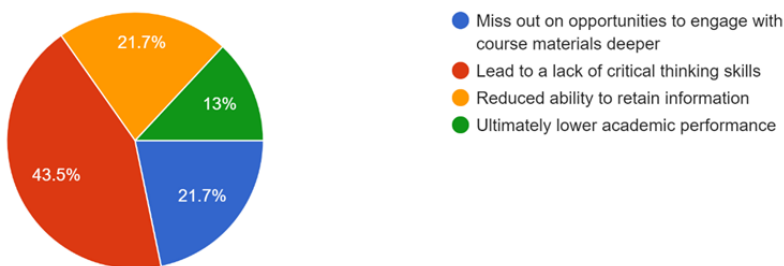

Figure 2: The over reliance on ChatGPT for answers, negatively impacts a student's academic performance.

Figure 2 presents that there are four negative impacts on the student's academic performance if they over rely on ChatGPT. 43.5% of respondents agreed that over reliance on ChatGPT can lead to lack of critical thinking skills. According to Qadir (2023), over reliance is one of the potential dangers for students who are using the ChatGPT or other AI tools because this issue will be leading the student to lack of critical thinking and problem-solving. There

are only 21.7% respondents that agreed over reliance can miss out on opportunities to engage with course materials deeper and can reduce ability to retain information. Additionally, it is preferable for students to use ChatGPT to support their original ideas and works rather than merely copying and pasting to rely on those resources (Qadir, 2023).
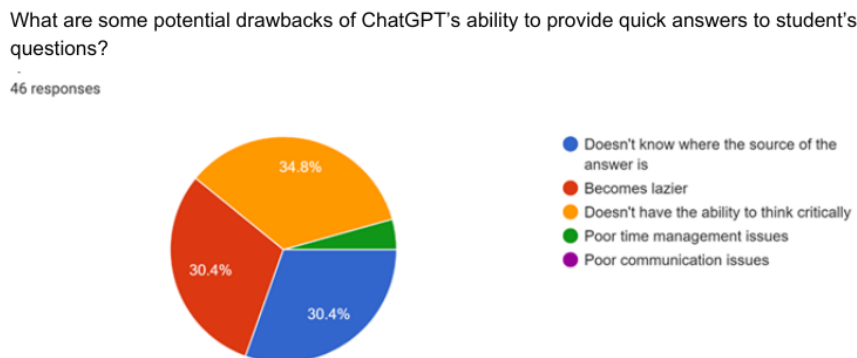

Figure 3: Potential drawbacks of ChatGPT's ability to provide quick answers to student's questions.

Figure 3 demonstrates that 34.8% respondents agreed that the potential drawbacks of ChatGPT's ability to provide quick answers to student's questions are the students do not have the ability to think critically. In addition, the students do not know where the source of the answer is and becoming lazier are the potential drawbacks of using ChatGPT that has 30.4% respectively. According to AlAfnan et al., (2023), when students become dependent on artificial intelligence, this would eventually cause them to be less interested in attending lessons. They become less motivated to do their projects on their own, as a result this y affects their capacity for critical thinking and makes it more likely that they do not know the source of the information.
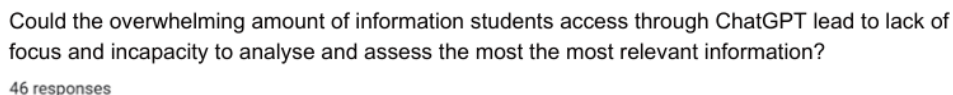

Figure 4: The overwhelming amount of information students' access through ChatGPT lead to lack of focus and incapacity to analyse and assess the most relevant information.

According to Figure 4, 84.8% of respondents concur that ChatGPT's information overload may cause a loss of attention and make it difficult to identify and assess the most pertinent data. Laziness and lack of concentration go hand in hand because lack of focus may result from being lazy. This makes it possible for students to use ChatGPT to obtain responses right away. They simply copy and paste ChatGPT's response. The students' failure to think critically is the cause of their inability to analyse and assess the most pertinent information. In this situation, students may depend on ChatGPT because they are unable to analyse and incorporate the most pertinent material into their projects.

Could students have lack of motivation in active learning and idea exploration if they become increasingly dependent on ChatGPT for information?
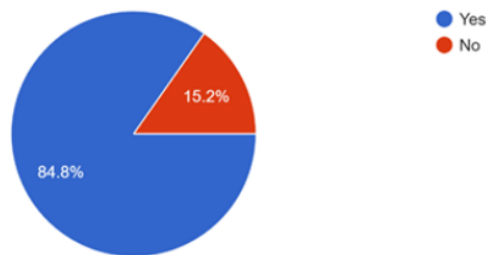
46 responses

Figure 5: Students lack motivation in active learning and idea exploration if they become increasingly dependent on ChatGPT for information.

According to Figure 5, 84.8% of respondents chose 'Yes' as the answer, indicating that students lack motivation to learn and explore ideas if they increasingly depend on ChatGPT for information. This happens because they don't push themselves to think critically, leading to laziness. Lack of motivation to study is one of the reasons that makes students use AI tools to complete assignments without spending time in researching and writing appropriate articles. They simply submit it without giving any thought to the information they applied and thinking that they are doing what the lecturer wants. This situation makes students more confident in ChatGPT as long as they are not caught by teachers and teaching staff.

What is the main factor that influences a student's decision to use ChatGPT to get their work done?
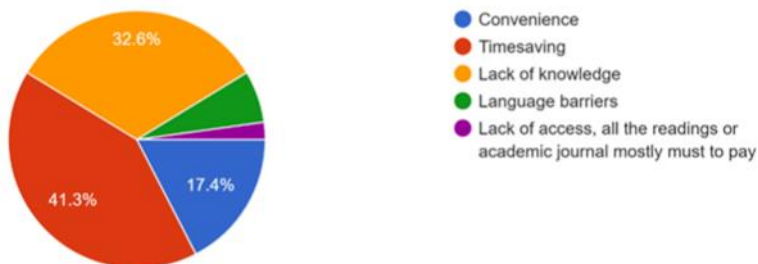
46 responses

Figure 6: Main factor that influences a student's decision to use ChatGPT to get their work done.

Figure 6 describes that there are five main factors that influence a student's decision to use ChatGPT to get their work done. The most popular factors that have been chosen from the respondents is time saving (41.3%). Lack of knowledge and convenience were most important impacts chosen by respondents, with 32.6% and 17.4%, respectively. According to AlAfnan et al., (2023), from the perspective of the students, this AI tool is one of the opportunities for students to complete their assignments in last-minute submissions before the deadline. This means saving time, which respondents think is one of the reasons they use ChatGPT.

It was shown that 89.1% of respondents agreed that the pressure to perform well academically influences a student's decision to use ChatGPT. This may be that students want to succeed, to finish their studies. They want to graduate on time, but they lack the motivation to study well. It puts more pressure on them if they can't complete the assignments given to them by the instructor. The easiest ways to organize all these tasks is to use AI tool as their

platform to submit their assignments without knowing what the task is. The 10.9% respondents that answer 'No' may be using ChatGPT as their benchmark to get some idea. So, they don't use all the responses from this AI tool.

What are some of the benefits that ChatGPT provides to students who use it for their academic writing?
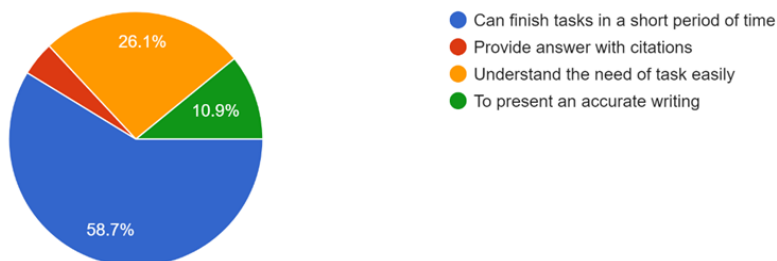46 responses

Figure 7: Benefits that ChatGPT provides to students who use it for their academic writing.

Figure 7 shows that the benefits that ChatGPT provides to students who use it for their academic writing. 58.7% of respondents agree that ChatGPT can complete the tasks in a short period of time. Relating to Figure 8, saving time is the most important factor which respondents agree. So, ChatGPT was chosen to be used because this tool shortens the time for students to complete their assignments. According to Frye (2022), academic writing includes citations and references, to ensure accuracy and transparency. It is applicable in many academic fields, including the social sciences, humanities, and sciences (Frye, 2022).

Are there specific scenarios or situations where students are more likely to use ChatGPT for their academic writing?
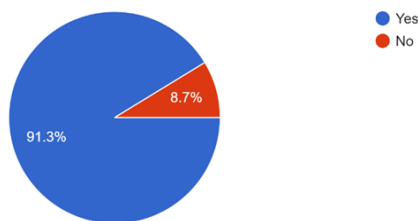46 responses

Figure 8: Specific situations where students are more likely to use ChatGPT for their academic writing.

According to Figure 8, there are specific situations where students are more likely to use ChatGPT for their academic writing. Most respondents (91.3%) agree that students have their own reasons or situations that need them to use ChatGPT. AlAfnan et al., (2023) state that students may be tempted to ask ChatGPT for help with writing their tests, especially those who do not complete their work on time. The benefit that ChatGPT provides to students make them use it and submit their work without hesitation. Based on a thorough situation, ChatGPT can create extremely correct theory-based responses, fairly accurate application-based replies, and well-structured essays or business letters (AlAfnan et al., 2023).

How does the use of ChatGPT compare to other methods of generating content for academic writing, in terms of efficiency and accuracy?
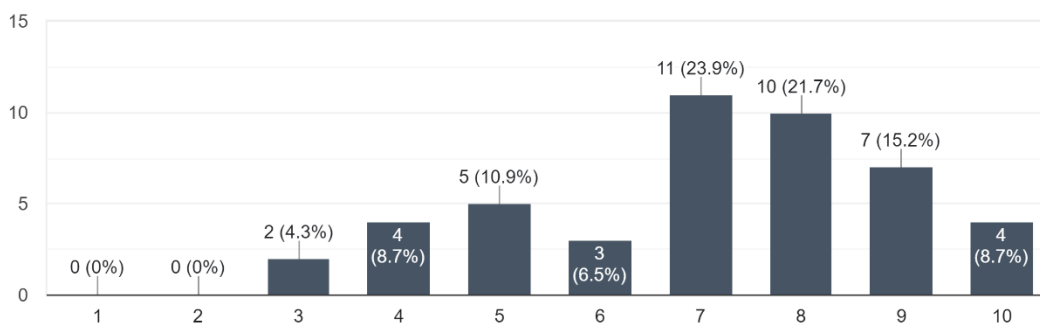
46 responses

Figure 9: The use of ChatGPT compared with other methods of generating content for academic writing, in terms of efficiency and accuracy.

Figure 9 indicates the efficiency and accuracy of ChatGPT in academic writing. The highest percent of respondents (23.9%) chose 7 out of 10 points for the efficiency and accuracy of ChatGPT. Only 8.7% of respondents chose ChatGPT as completely (10 out of 10 points) efficient and accurate for their use. But some studies indicate that ChatGPT is not 100% accurate and valid for research purposes. Lo (2023) states ChatGPT may be biased or inaccurate because it is programmed on a vast corpus of data. OpenAI claims that ChatGPT occasionally responds negatively to commands, exhibits discriminatory behaviour, and occasionally constructs reasonable but absurd responses (Haleem et al., 2023). Students also need to be aware of the sources that they use from AI tools. Qadir (2022) stated that students must ensure the accuracy and reliability of the response given by ChatGPT because it is important for them to use diverse sources for their research.

How reliable is ChatGPT when it comes to generating academically correct content?
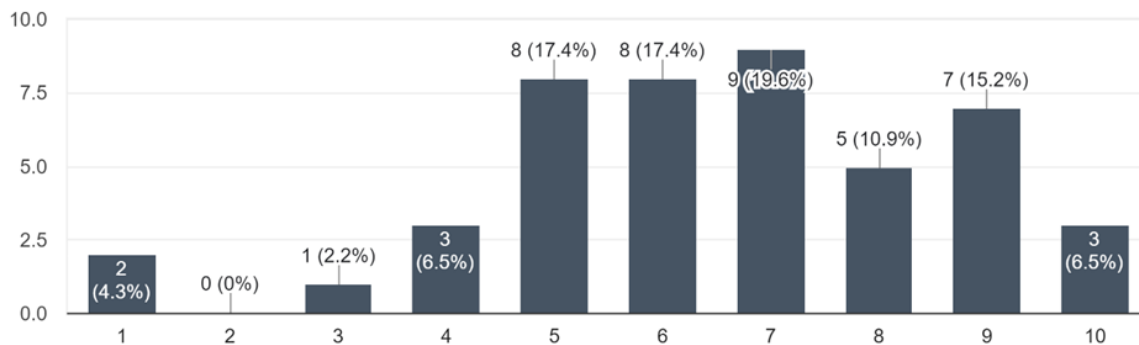
46 responses

Figure 10: Reliability of ChatGPT when it comes to generating academically correct content.

Figure 10 illustrates that ChatGPT is reliable in generating academically accurate contents. The findings show that 19.6% of respondents chose ChatGPT as trustworthy. Only 6.5% agree that ChatGPT is fully reliable. According to Lo (2023), the information provided by ChatGPT is restricted. Thus, ChatGPT's responses are not

always reliable, it can produce incorrect and fake information, especially for the questions that need most recent data.
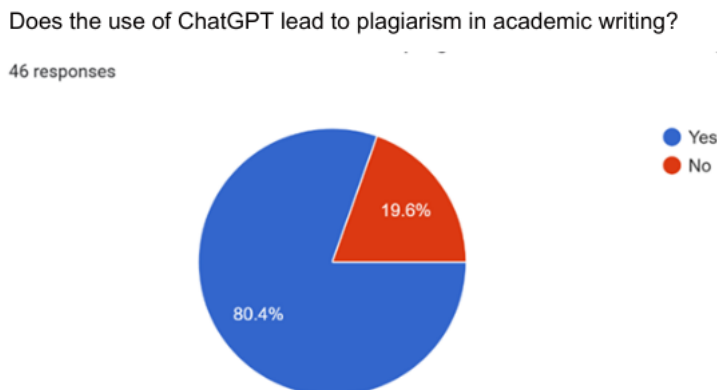
Does the use of ChatGPT lead to plagiarism in academic writing?

46 responses

Figure 11: The use of ChatGPT lead to plagiarism in academic writing.

Figure 11 represents that the use of ChatGPT lead to plagiarism in academics. Most of the respondents (80.4%) agreed that the use of ChatGPT leads to plagiarism. Plagiarism is one of the risks for students that use the ideas from ChatGPT or other AI tools and present them as their own ideas without citing the sources (Qadir, 2022). 19.6% of respondents think that ChatGPT does not lead students to the plagiarism in academic writing, the situation maybe they use this tool as their help to generate the main ideas and construct the point with their own ideas. So, this situation does not lead to plagiarism if they can use it competently. Even today, there are applications for detecting plagiarism, which are Turnitin and iThenticate (Lo, 2023).
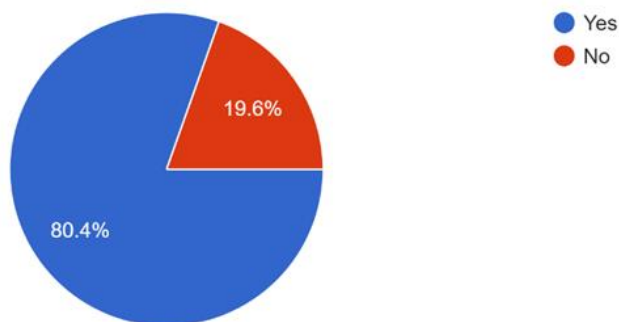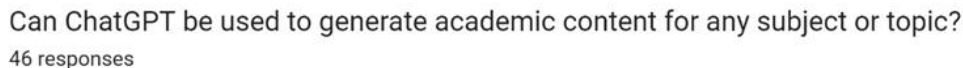
Can ChatGPT be used to generate academic content for any subject or topic?

46 responses

Figure 12: ChatGPT can be used to generate academic content for any subject or topic.

As shown in Figure 12, ChatGPT can be used to generate academic contents for any subject or topic. 80.4% of respondents chose that ChatGPT can generate any subject or topic that they wanted. However, according to Mhlanga (2023), ChatGPT is incapable of understanding the context around it. Indeed, ChatGPT is an AI model that operates in accordance with preprogrammed algorithms and lacks the originality and creative abilities of human educators (Mhlanga, 2023). Thus, ChatGPT does not provide every subject or topic. This tool only generates the information that can be obtained from digital resources.

What are the potential consequences of using ChatGPT to generate academically incorrect content?
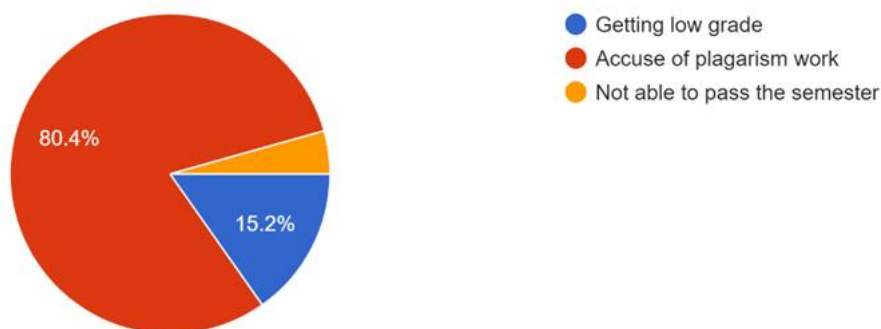46 responses

Figure 13: The potential consequences of using ChatGPT to generate academically incorrect contents.

Figure 13 indicates the potential consequences of using ChatGPT to create academically incorrect contents. The three consequences of using ChatGPT were plagiarism (80.4%), getting low grades (15.2%) and not passing the semester (4.3%). These consequences occur because the student may be too dependent on ChatGPT and have been caught plagiarizing. It affects their academic performance if teachers act against them seriously. But often, the lecturer cannot tolerate plagiarism because they see the students as merely copy and paste the assignment and it is not fair to other students who work hard to complete assignments with their own ideas.

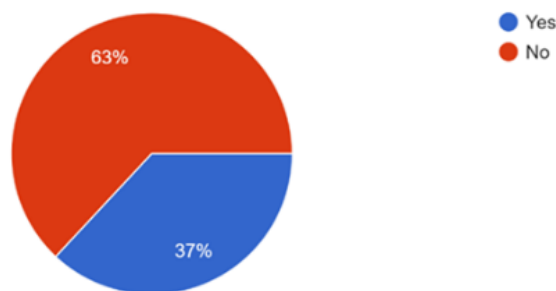Is the use of ChatGPT in academic a responsible and ethical?

46 responses

Figure 14: Is ChatGPT in academic utilised in a responsible and ethical?

Figure 14 shows that the majority (63%) says that ChatGPT in academics is not utilised in a responsible and ethical. However, 37% agreed that ChatGPT is utilised in a responsible and ethical. Mhlanga (2023) stated that the use of ChatGPT in education is considered responsible and ethical if the user understands its biases and limitations. It suggests that students should only utilise ChatGPT as a backup and it is not intended to be used as the primary source of assignments.

CONCLUSIONS

To sum up there are four negative impacts on the students' academic performance if they over rely on ChatGPT. Majority respondents agreed that over reliance on ChatGPT can lead to lack of critical thinking skills. It was agreed that ChatGPT's ability to provide quick answers to students' questions. However, an overwhelming amount of information leads towards lack of focus and incapacity to analyse and assess the most relevant information.

It was also found that ChatGPT's overloaded information may cause a loss of attention and make it difficult to identify the most pertinent data. Majority of respondents informed that students lack motivation to learn and explore ideas if they increasingly depend on ChatGPT for information. It was found that there are five main factors that influence a student's decision to use ChatGPT to get their work done. The most popular factor is time saving, lack of knowledge, convenience, language barriers and inaccessibility of paid. journal. It was shown that majority of respondents agreed that the pressure to perform well academically influences a student's decision to use ChatGPT. Most of them agreed that ChatGPT can complete the tasks in a short period of time, and they have their own reasons to use ChatGPT. The highest percent of respondents stated the problem of ChatGPT is efficiency, accuracy, and trustworthiness. Moreover, most of the respondents agreed that the use of ChatGPT leads to plagiarism because of its convenience to generate any topic that they wanted. Many indicated the potential consequences of using ChatGPT in creating academically incorrect contents. The three consequences of using ChatGPT were plagiarism, getting low grades and not passing the semester. Majority believed ChatGPT in academics is not utilised in a responsible and ethical manner.

ChatGPT has its pros and cons. It has many advantages such as it is easily retrievable and can save time of those who want to do their work at the last minute. These tools must not be used blindly without any references. It can be used just for additional ideas. If the users take the main ideas without explicitly citing the sources, it may pose a risk to them in failing their assignment. Today, teachers are exposed to students' plagiarism, so they are better prepared in verifying the plagiarism rate. Undoubtedly, the use of ChatGPT also has its effects, influences, benefits, etc.

The accuracy and reliability of ChatGPT are also questioned based on the sources not provided by the system. So, students must be smart to use this tool. They should not just copy and paste but use it as a tool to help them, absorb ideas that need to be developed with their own creativity. Therefore, Frye (2022) asserted that it is preferable for learners to create authentic and reliable academic writing using their own knowledge, abilities, and research.

REFERENCES

[1]   Abdelaal, E. S., Gamage, S. H., & Mills, J. E. (2019, January). Artificial intelligence is a tool for cheating academic integrity. In 30th Annual Conference for the Australasian Association for Engineering Education (AAEE 2019): Educators becoming agents of change: Innovate, integrate, motivate. Research Gate. https://www.researchgate.net/profile/Elsayed-Abdelaal/publication/339375213_Artificial_Intelligence_Is_a_Tool_for_Cheating_Academic_Integrity/links/5e6759d792851c7ce0578899/Artificial-Intelligence-Is-a-Tool-for-Cheating-Academic-Integrity.pdf

[2]   Adamopulou, E., & Moussiades, L. (2020). Chatbots: History, technology, and applications. Chatbots: History, Technology, and Applications, 2, 100006. https://doi.org/10.1016/j.mlwa.2020.100006

[3]   Basta, C., Costa-Jussà, M. R., & Casas, N. (2019). Evaluating the Underlying Gender Bias in Contextualized Word Embeddings. https://doi.org/10.18653/v1/w19-3805

[4]   Cotton, D. R. E., Cotton, P. A., Shipway, J. R. (2023). Chatting and Cheating: Ensuring Academic Integrity in the Era of ChatGPT. Taylor and Francis Group. https://www.tandfonline.com/doi/epdf/10.1080/14703297.2023.2190148?needAccess=true&role=button

[5]   Ethics of Artificial Intelligence and Robotics (Stanford Encyclopedia of Philosophy/Summer 2021 Edition). (2020, April 30).https://plato.stanford.edu/archives/sum2021/entries/ethics-ai/

[6]   Frye, B. L. (2022, December 3). Should Using an AI Text Generator to Produce Academic Writing Be Plagiarism? Papers.ssrn.com. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4292283

[7]   Haleem, A., Javaid, M., & Singh, R. P. (2023). An era of ChatGPT as a significant futuristic support tool: A study on features, abilities, and challenges. BenchCouncil Transactions on Benchmarks, Standards and Evaluations, 2(4), 100089. https://doi.org/10.1016/j.tbench.2023.100089

[8]   Hosseini, M., & Horbach, S. P. (2023). Fighting reviewer fatigue or amplifying bias? Considerations and recommendations for use of

ChatGPT and other Large Language Models in scholarly peer review. Research Square (Research Square). https://doi.org/10.21203/rs.3.rs-2587766/v1

[9] King, M. R. (2023). Cellular and Molecular Bioengineering: A Conversation on Artificial Intelligence, Chatbots, and Plagiarism in Higher Education. Spring Nature. https://link.springer.com/content/pdf/10.1007/s12195-022-00754-8.pdf?pdf=button

[10] Li, Y., Choi, D., Chung, J., Kushman, N., Schrittwieser, J., Leblond, R., Eccles, T., Keeling, J., Gimeno, F., Dal Lago, A., Hubert, T., Choy, P., de Masson d'Autume, C., Babuschkin, I., Chen, X., Huang, P. S., Welbl, J., Gowal, S., Cherepanov, A., Molloy, J., … Vinyals, O. (2022). Competition-level code generation with AlphaCode. Science (New York, N.Y.), 378(6624), 1092–1097. https://doi.org/10.1126/science.abq1158

[11] Lo, C. K. (2023). What Is the Impact of ChatGPT on Education? A Rapid Review of the Literature. Education Sciences, 13(4), 410. https://doi.org/10.3390/educsci13040410

[12] Lock, S. (2023, February 6). What is AI chatbot phenomenon ChatGPT and could it replace humans? The Guardian. https://www.theguardian.com/technology/2022/dec/05/what-is-ai-chatbot-phenomenon-chatgpt-and-could-it-replace - humans

[13] Lund, Brady. (2023). A Brief Review of ChatGPT: Its Value and the Underlying GPT Technology. 10.13140/RG.2.2.28474.06087.

[14] McCombes, S., George. T. (2022). What Is a Research Methodology? | Steps & Tips. Scribbr. https://www.scribbr.com/dissertation/methodology/

[15] Mhlanga, D. (2023). Open AI in Education, the Responsible and Ethical Use of ChatGPT Towards Lifelong Learning. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4354422

[16] Patel, B. A., Rosenberg, L. B., Willcox, G., Baltaxe, D., Lyons, M., Irvin, J., Rajpurkar, P., Amrhein, T. J., Gupta, R. T., Halabi, S., Langlotz, C. P., Chu, C. H., Mammarappallil, J. G., Mariano, A. J., Riley, G. M., Seekins, J., Shen, L., Zucker, E. J., & Lungren, M. P. (2019). Human–machine partnership with artificial intelligence for chest radiograph diagnosis. Npj Digital Medicine, 2(1). https://doi.org/10.1038/s41746-019-0189-7

[17] Pew Research Center. (2020, August 27). Most in U.S. say science has benefited society, will make lives better | Pew Research Center. https://www.pewresearch.org/short-reads/2019/08/27/most-americans-say-science has-brought- benefits-to-society- and-expect-more-to-come/

[18] Qadir, J. (2022). Engineering Education in the Era of ChatGPT: Promise and Pitfalls of Generative AI for Education. ResearchGate. https://doi.org/10.36227/techrxiv.21789434

[19] Ryan, E. (2022). Research Objectives | Definition & Examples. Scribbr. https://www.scribbr.com/research-process/research-objectives/#:~:text=about%20research%20objectives-What%20is%20a%20research%20objective%3F,argument%2C%20and%20develop%20your%20conclusions.

[20] Stokel-Walker, C., & Van Noorden, R. (2023). What ChatGPT and generative AI mean for science. Nature, 614(7947), 214–216. https://doi.org/10.1038/d41586-023-00340-6

[21] Zhai, X. (2021). Practices and Theories: How Can Machine Learning Assist in Innovative Assessment Practices in Science. ResearchGate.https://www.researchgate.net/publication/348355734_Practices_and_Theories_How_Can_Machine Learning_Assist_in_Innovative_Assessment_Practices_in_Science_Education