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Effects of ChatGPT on Students Academic Performance:Mediating Role of Prompt Engineering

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Abstract

This paper focuses on the use of advanced machine learning models, ChatGPT in education. ChatGPT, a language learning model by OpenAI, has shown potential in reshaping education through enhanced teaching methods, increased student engagement, and personalized learning experiences. Despite these promising features, potential drawbacks of the technology remain unclear. This paper seeks to examine the impacts of ChatGPT on students' academic performance, with a special emphasis on the role of 'prompt engineering' in this context. This research employs a quantitative method to examine the impact of ChatGPT on student academic performance in various universities across Pakistan. An online survey was distributed, garnering responses from 37 students at several institutions. The questions focused on demographic details and the impact of ChatGPT on academic performance parameters such as learning, quality of work, and creativity, with the role of prompt engineering as a mediating factor. Data was analysed by using SPSS, with Cronbach's alpha used to ensure reliability and internal consistency of the responses, which showed a high degree of correlation among responses. The results indicated a positive relationship between the use of ChatGPT and academic performance (Naveed et al, 2023). However, while most students were aware of ChatGPT's capabilities, the majority did not use it for examination preparation. The study also found that prompt engineering played a mediating role between ChatGPT usage and student academic performance, highlighting the importance of effective prompt design in optimizing the benefits of AI in educational settings.

Keywords ChatGPT, Academic Performance, Prompt Engineering.

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INTRODUCTION

New technologies are always emerging, and they have the potential to drastically change how we teach and learn. Advanced machine learning models like ChatGPT is one of these technologies that have been demonstrated to have a substantial impact in a number of industries, particularly education. A deep learning approach is used by ChatGPT, an artificial intelligence language model created by OpenAI, to produce responses to user input that are human-like. Its powers in natural language processing have made it a useful tool in education, with the ability to enhance teaching methods, increase student engagement and personalize learning experiences. But like with any new technology, there are also possible drawbacks to take into account. (Castro, 2023).

According to (OpenAI, 2022) ChatGPT is an Artificial intelligence AI chatbot and the word "GPT" stands for Generative Pre-trained Transformer, which is a language learning model of AI. It has only been a year since the initial release of this disruptive technology. (Duarte, 2023) stated that it first launched in 30th November 2022 and was able to create a record breaking user base within 5 days. As of April 2023, it has 1.8 billion visitors and currently there are 100 million users. This technology has a lot of use cases such as it can create content for Youtubers, it can write, debug and document codes for programmers, it can also act as a translator and can also be used as a marketing tool to conduct SEO on blogs and articles (Farah, Naveed & Ali, 2023).

In order to fully utilize ChatGPT, it is important for the users to give the right prompts for the task in hand. If one's won't give a detailed and specific prompt, it will give a very generic and repeated answer. For giving the right prompt users must have proper knowledge about prompt engineering. It is a key component when using ChatGPT, prompt engineering is a process where one's constantly review and guide the (LLM) language learning model to create human like content for the task. There are a few factors involved in proper prompt engineering such as specificity, when writing a prompt one's have to be very specific, instruction is another factor of prompt engineering, proper tone and and style, context and the length of the prompt impacts the output and results of ChatGPT For example, a general prompt that all users give can look like this:

- "Make a 10-item quiz for performance management subject."

This will create a very generic response and would not satisfy the user. Here is an example of a more refined prompt:

- "Think of yourself as a PhD professor, you're tasked to create a quiz for performance management subject. I want you to create MCQ's for these topics "Topic 1" and "Topic 2". Before generating these MCQ's. I want you to ask me questions about these topics if you're confused."

The use of ChatGPT in educational contexts has prompted concerns about its impact on student learning results. ChatGPT, as an AI-based conversational agent, has the ability to assist students with a wide range of academic duties, from clarifying concepts and offering assistance to enabling debates and producing innovative ideas. According to (Yu, 2023) understanding the intricacies of its impact on academic achievement, on the other hand, necessitates a thorough investigation of the factors that moderate its efficiency. It is an important component to consider while employing ChatGPT for instructional purposes. (Firat, 2023) states that educators can improve academic achievements by designing prompts to maximize the utility and relevance of ChatGPT output. As a result, the mediating role of Prompt engineering in determining the impact of ChatGPT on students' academic achievement becomes critical.Understanding the influence of ChatGPT on students' academic achievement has far-reaching ramifications for educators, politicians, and researchers. One can gain significant insights on the integration of AI-based tools into educational environments by understanding the mediating role of prompt engineering.

- What is the impact of ChatGPT on students' learning?
- What is the impact of ChatGPT on students' quality of work?
- What is the impact of ChatGPT on students' creativity?

- What is the mediating role of prompt engineering on ChatGPT and students' academic performance?
- To understand the impact of ChatGPT on students' academic performance.
- To examine the mediating role of prompt engineering on ChatGPT and students' academic performance.

Literature Review

ChatGPT name is combines two things, "chat" refers to the artificial intellegence AI chatbot and GPT stands for generative pre-trained transformer which is a language learning model (WIKIPEDIA, 2023). Language learning model also refers as machine learning model that is trained to do probability distribution through words. In simpler words, it predicts the best possible response and words to fill in blank spaces, phrases, and sentences. (Altexsoft, 2023). Current ChatGPT's foundation is built on GPT 3.5 and GPT 4 models, it has been optimized and fine-tuned for the public to use. Its prototype was initially launched in 30th November 2022, and within 5 days they were able to reach 1 million users as compared to other online services which is record breaking. In April 2023 they had 1.8 billion visits, currently ChatGPT has 100 million users. (Duarte, 2023).

Currently ChatGPT has a lot of features such as it can mimic the tone of a famous in its text, it can also help in coding and debugging a code, it can also help in writing fantasy stories, essays, answering questions and answers of a test, proof read and translate and summarize a text in simpler terms these are just basic features, one can also get creative with your prompts and give it a more complex and creative task to create (WIKIPEDIA, 2023). Along with its features there are some limitations to this AI, such as it can give incorrect answers even though they sound right, it is also sensitive to prompts for example if one ask a question with certain phrases, it will claim that it does not know the answers but if one tweak the phrases, it can answer the question correctly (Muhammad, Atia & Shoaib, 2022). ChatGPT frequently uses certain phrases which is another limitation. Sometimes it will also answer to inappropriate and harmful instructions from the users, however OpenAI is using Moderation API to block these unsafe request (OpenAI, 2022).

According to (Firat, 2023) ChatGPT can be considered a valuable tool for education. He also states that it can promote independent learning as well as autodidactic experiences which means a person's ability to learn a subject without a formal education or training. (Firat, 2023) also considers it to be an adaptable and practical approach by further providing more personalized feedback and support, it can create more engagement and motivation among the self-taught learners (Ali, Yousaf & Naveed, 2020). Dr. Mehmet Firat further suggested five ways to improve autodidactic learning. One, it can provide "personalized support" meaning each learner's response and suggestions would be tailored according to their level. Two, "real-time guidance and feedback" self-motivated learners can get instant feedback and guidance on the course material they're going through (Naveed, Sindhu & Ali, 2020). It can help them keep on track and also assist in guiding against a problem. Third, "Accessibility" learners can have more access to content and learning material. Fourth, "Flexible learning" autodidactic learners can study at their own pace. Fifth "Assessment" can be used to self-assess their progress and can also guide where their weak area may be (Firat, 2023).

Aside from its benefits (Debby R. E. Cottona et al., 2023) pointed out a few risks and challenges ChatGPT and other language learning models pose. Using ChatGPT increases the chances of plagiarism meaning a student would use specific prompts to generate their assignments and submit that AI-generated work as their own. This is a colossal challenge for higher education as it could affect the critical and creative thinking of the student and would belittle their degrees. Another challenge that ChatGPT poses is unfairness during assessment which means a person who has done his honest hard work on his written assignment would be marked unfairly because the other students might have used ChatGPT to create a well-written assignment. (Debby R. E. Cottona et al., 2023) pointed out a challenge for the teachers: it would make it very difficult for the teacher to identify whether the answer submitted by the student is actually written by him or her or is it written by ChatGPT. (Debby R. E. Cottona et al., 2023) also stated were some opportunities regarding ChatGPT, one of which can be used for remote learning, which can be beneficial for those who're physically or mentally ill (Naveed, Farah & Hasni, 2021). Another opportunity that can be used is the creation of personalized assessments through ChatGPT. It can also be used to create game-based assignments by creating chatbot that ask challenging questions from the students.

(Shidiq, 2023) discussed in his article about the impact of ChatGPT on students' creativity in writing skills. The results state that ChatGPT can be used as a mentor, voice assistant, and in smart classrooms (Naveed et al,2023). Aside from the plenty of benefits, ChatGPT provides, such as the ease of getting answers, which can help students in their assignments, the main challenge it poses is the development of student's creative writing skills. (Shidiq, 2023) pointed out a few drawbacks such as emotional connection, and creativity, it also can't imitate the learning styles, and relying too much on ChatGPT can make a person socially inferior. Another major drawback is too much reliance on the technology as it will create problems in one's critical thinking. In his article (Shidiq, 2023) states that it can affect students' creative writing, and suggested teachers use paper assignments instead of online assignments. This technology has made a lot of tasks easy, but it is creating a challenge for teachers and students in their educational learning.

THEORETICAL FRAMEWORK

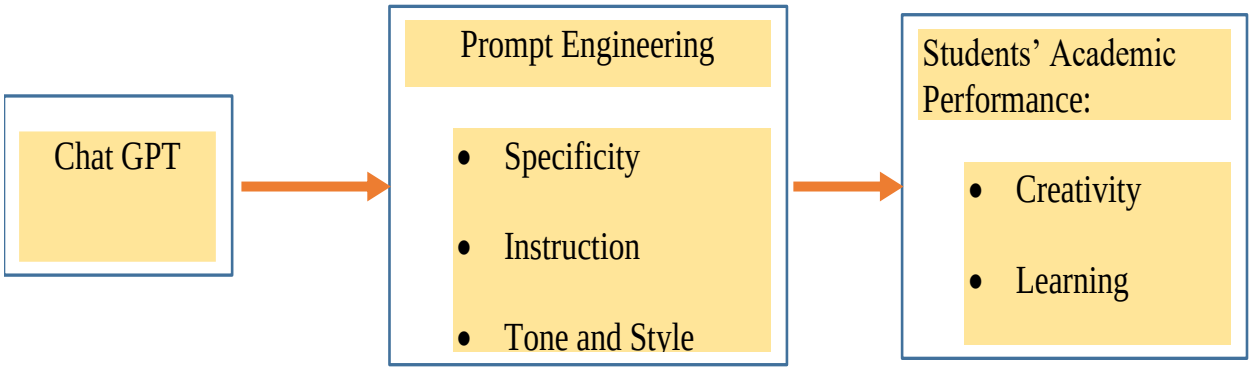

Figure 1.
Theoratical framework

DEFINITION OF VARIABLES

Prompt Engineering

Prompt engineering is the process of developing and arranging the input prompts given to Chat GPT to guide its answer creation. It entails selecting or creating appropriate inquiries, instructions, or contextual information to elicit desirable language model outputs. Prompt engineering has the potential to alter the relevance, coherence, and quality of generated responses.

Specificity

It refers to uniquely identifying or relating to a specific subject.

Instruction

Instruction can be simply defined as an order or a command for direction . It can be a comprehensive information on how to do something.

Tone and Style

Tone refers to an expression or an attitude of the autho. Style on the other hand, refers to traits or characteristic of an individual writing.

Context

Context is a situation or event or an idea. It is how certain circumstances creates an event. One have to give certain context to ChatGPT to enhance one's responses.

Length

Length depends on many situations as it can be distance, amount of time, or an action, however this study refers to the length of prompt.

Students' Academic Performance

Creativity

The ability of pupils to develop novel and innovative ideas, approaches or solutions in their academic work. It entails thinking beyond the box, connecting disparate ideas, and developing innovative and valuable results.

Learning:

Students' acquisition, assimilation and comprehension of new knowledge, skills and concepts. It entails internalization of information and the ability to apply it in a variety of circumstances, resulting in significant changes in knowledge, behavior or thinking.

Quality of Work:

The general standard, precision and proficiency displayed by students in their academic assignments, projects or output. Attention to detail, logical coherence, clarity of speech, adherence to guidelines and the absence of errors or contradictions are all considerations.

HYPOTHESIS FORMULATION

H1. The use of ChatGPT has a positive impact on students' academic performance.

H2. The use of ChatGPT has a negative impact on students Academic performance.

H3. Prompt engineering mediates the relationship between the use of ChatGPT and students' academic performance.

H4. Prompt engineering does not have a direct effect on the use of ChatGPT and students academic performance.

METHODOLOGY

The research method is based on quantitative techniques which is based on online survey to gather data from respondents. The survey comprised of the questions in statement form considering the demographic details and questions from variables by using predetermined questionnaires used in the previous studies. This study has used questionnaires developed by (Ahn & Suh, 2022). Population was the students who are currently studying in all universities of Pakistan. Due to time bound and restriction, the study relied more on convenience sampling and got the results from IOBM Karachi, Bahria University Islamabad, Iqra University Karachi, and Comsats Islamabad. Set a sample of at least 100 students from above mentioned universities.

Survey was cut short at 37 respondents who represented above mentioned universities to have good fit sample size. The data analysis tool that have been used to measure the statistical results of these respondents is through SPSS and also used ethical considerations as well. It also provided a note in which it was assured to audience about their privacy and responses will be used only for research purposes. The research tools (survey and interview guides) were pretested and revised as necessary to ensure that they are reliable and valid.

DATA ANALYSIS

Table 1.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	23	62.2	62.2	62.2
	Female	14	37.8	37.8	100.0
	Total	37	100.0	100.0	

The data was analyzed through SPSS and the following results show that majority of the sample in our study were male whereas female respondents were less as seen on the table.

Table 2.

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-30	36	97.3	97.3	97.3
	31-40	1	2.7	2.7	100.0
	Total	37	100.0	100.0	

As you can see from this table out of all the 37 respondents only one sample was in the age between 31-40 and rest of sample were in the age of 18-30 years.

Table 3.

Marital Status					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	35	94.6	94.6	94.6
	Married	2	5.4	5.4	100.0
	Total	37	100.0	100.0	

Majority of the respondents in their marital status showed that they were single, where as 2 respondents were married.

Table 4.

Qualification					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelors	22	59.5	59.5	59.5
	Masters	15	40.5	40.5	100.0
	Total	37	100.0	100.0	

Here in the qualification section we can see that there were a lot of respondents whose qualification were 22 and the rest of the sample had a masters qualification.

Table 5.

Academic Discipline					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Natural Sciences	2	5.4	5.4	5.4
	Management Sciences	26	70.3	70.3	75.7
	Social Sciences	3	8.1	8.1	83.8
	Other	6	16.2	16.2	100.0
	Total	37	100.0	100.0	

In the 'Other' section we found out that there were 4 respondents who opted a computer science discipline whereas there was also a pharm-D discipline and biomedical engineering as well.

Table 6.

Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Self Employed	4	10.8	10.8	10.8
	Employed	12	32.4	32.4	43.2
	Unemployed	21	56.8	56.8	100.0
	Total	37	100.0	100.0	

Here we can see that majority of the respondents are unemployed and some are employed and only few are self employed.

RELIABILITY STATISTICS

Usage and Familiarity with ChatGPT

Table 7.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.809	.806	5

We conducted separate reliability tests on each sections of our questionnaire and the results shows cronbach's alpha of 0.809 which shows there is a high consistency and relation with the items. This section of the question asked about the usage and familiarity with ChatGPT and covered topics related to different academic situations such as academic assistance, researching and sourcing etc.

Perception of ChatGPT's Impact on Academic Performance

Table 8.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.888	.888	5

Here the score shows Cronbach alpha of 0.888, this section of our questionnaire covered topics related to academic performance as well its main factors such as learning, quality of work and creativity.

Mediating Role of Prompt Engineering

Table 9.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.905	.908	5

In this section we had high Cronbach Alpha score, and here we covered the mediating role of prompt engineering which also covered factors such as specificity of the prompt, instruction, word choice, context and length of the prompt.

Overall Assessment

Table 10.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.865	.868	4

In the final section of our questionnaire, questions are related to independent variable, dependent and mediating variable as well. It covered all the aspects of research and final Cronbach Alpha score is 0.865.

FINDINGS

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.926	.928	19

The value of 0.926 mentioned is quite high, indicating a high degree of internal consistency among the items in our scale. This suggests that our items are highly correlated and are likely measuring the same underlying factor.

RESULTS

The main purpose of the study was to see how ChatGPT had an impact on students' academic performance. Where certain factors were considered for academic performance, such as learning, quality of work, and creativity. The mediating role of prompt engineering was also considered, which is a critical component when using ChatGPT. The concept of understanding prompt engineering helps us achieve more

beneficial and optimized results. Looking at the direct relation between ChatGPT and students' academic performance, it is found a positive relationship between the use of ChatGPT and academic performance, thus accepting hypothesis 1. For instance, students relied heavily on it for their academic assistance and also for research and source purposes for their quizzes and assignments to improve their quality of work. Furthermore, in order to enhance the learning level, they used ChatGPT to explain complex concepts that were difficult to understand. However, the majority of the respondents did not use ChatGPT to prepare for their assessments and examinations; the majority of the respondents knew its capabilities and usage, while only a few were unaware of it. To conclude the first relation between the independent and dependent variables, it could be said that there is a positive impact on students' academic performance.

In this study, it was also examined, how prompt engineering played a mediating role between ChatGPT and student academic performance. For this prpose, hypothesis 3 was tested, we found out that prompt engineering had mediated relation between ChatGPT and student academic performance (Ali et al, 2022). Hypothesis 2 was not accpeted because majority of the respondents had a positive impact with ChatGPT and students academic performance and hypothesis 4 which explored that it did not have direct impact on ChatGPT and students academic performance was also proven wrong because it had a direct effect on ChatGPT and students academic performance.

RECOMMENDATION

At the end of the survey, few recommendations from respondents are given:

Respondent 1:

"Chatgpt should be used ethically, if one use it to just get things done it will not improve the learning, quality of work and creativity of the individual. It should be used as a mean of learning platform."

Respondent 2:

"ChatGPT should be used for academic purposes, and it has more positive effects than negative."

Respondent 4:

"Use ChatGPT only for study purpose not for cheating purpose."

DECLARATIONS

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Consent to Participate: Yes

Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

REFERENCES

Ahn, S., & Suh, W. (2022). Development and Validation of a Scale Measuring Student Attitudes Toward Artificial Intelligence. *Sage Journals*.

Altexsoft. (2023, January 18). *Language Models, Explained: How GPT and Other Models Work*. Retrieved from altexsoft software and engineering.

Ali, S., Yousaf, I., & Naveed, M. (2020). Role of credit rating in determining capital structure: Evidence from non-financial sector of Pakistan. Studies of Applied Economics, 38(3).

Ali, S., Naveed, M., Saleem, A., & Nasir, M. W. (2022). Time-frequency co-movement between COVID-19 and Pakistan's Stock Market: Empirical evidence from wavelet coherence analysis. Annals of Financial Economics, 17(04), 2250026.

Castro, C. A. (2023). A Discussion about the impact of ChatGPT in Education. *Journal of Business Theory and Practice*, 34.

Debby R. E. Cottona et al., P. A. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1-12.

Duarte, F. (2023, May 16). *Number of ChatGPT Users (2023)*. Retrieved from EXPLODING TOPICS: https://explodingtopics.com/blog/chatgpt-users

Firat, M. (2023, January). *How Chat GPT Can Transform Autodidactic Experiences and Open Education?*

Farah, M. F., Naveed, M., & Ali, S. (2023, May). Blockchain-Enabled Banking Services and Customers' Perceived Financial Well-Being: A Structural Nexus. In National Brand and Private Label Marketing Conference (pp. 41-49). Cham: Springer Nature Switzerland.

Haleem A Javaid, M. Q. (2022). Understanding the role of business technologies in education. *Journal of Business Management*, 60.

Muhammad, N., Atia, B., & Shoaib, A. (2022). Role of broker's information transparency in determining individual investor's financial wellbeing: A transformative service research (TSR) perspective. Contaduría y administración, 67(1), 7.

Naveed, M., Ali, S., Gubareva, M., & Omri, A. (2023). When Giants Fall: Tracing the Ripple Effects of Silicon Valley Bank (SVB) Collapse on Global Financial Markets. Research in International Business and Finance, 102160.

Naveed, M., Farah, M. F., & Hasni, M. J. S. (2021). The transformative role of firm information transparency in triggering retail investor's perceived financial well-being. International Journal of Bank Marketing, 39(7), 1091-1113.

Naveed, M., Sindhu, M. I., Ali, S., & Wong, W. K. (2023). To Invest or Not to Invest? Determinants of Low Stock Market Participation: Qualitative Perspective from Pakistan Stock Exchange. Advances in Decision Sciences, 27(1), 113-171.

Naveed, M., Sindhu, M. I., & Ali, S. (2020). Role of financial and non-financial information in shaping trading behavior: A retail investor's perspective. Studies of Applied Economics, 38(3).

OpenAI. (2022, Novemeber 30). *Introducing ChatGPT*. Retrieved from OpenAI: https://openai.com/blog/chatgpt

Yu, H. (2023). Reflection on whether Chat GPT should be banned by academia from the perspective of education and teaching. *Frontiers in Psychology*, *14*.

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