



THE PREDICTIVE INFLUENCE OF CHATGPT USE ON UNDERGRADUATE STUDENTS' ACADEMIC ENGAGEMENT AND MOTIVATION: A CATEGORICAL DATA ANALYSIS

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Abstract

Nowadays the use of the most prevalent tool of artificial intelligence, ChatGPT, makes the online learning environments more interesting, interactive, collaborative, and personalized. It helps to bridge the educational gap between educators and students by providing more advanced academic knowledge and instant feedback. Therefore, the main objective of the study is to explore the use of ChatGPT as a predictor of undergraduate students' engagement and motivation. The study utilized the quantitative research approach. The population of the study consisted of all undergraduate students of private and public-sector universities in Karachi. The sample of 400 students was obtained through the snowball and purposive sampling design. A questionnaire was constructed to assemble data and analyzed it through IBM SPSS (v. 22) software. The major findings of the study recognised ChatGPT as a good predictor of students' educational engagement and motivation. Based on this fact, the study suggested that educators, politicians, and educational practitioners should integrate the AI-based curriculum and provide technology to all departments within the higher education system. It would help to ensure equity among students. Hence, every student has access to digital literacy by taking the ethical considerations. Moreover, hybrid learning makes learning settings more resourceful and engaging. Policymakers should also arrange workshops for lecturers for cognizance of AI technology that might benefit university students with their online learning.

Keywords: ChatGPT, Online learning environments, Students' educational engagement, Students' motivation, Private & public universities

Introduction

Artificial intelligence, the most advanced personalized technology, has revolutionized the whole world and converted it into the global village. Therefore, the increasing demand of AI in every field of life has made AI more popular. Almost all of its thirty different tools have been used to improve human intellectual abilities by giving more automation, novelty, personalization, decision-making, and efficiency (Chen et al., 2020).

In the field of education, the AI technologies were used by students for their personalized learning in the form of specific, knowledgeable content along with instantaneous feedback. The students have the bulk of information and are more interested to learn through hybrid classrooms (Bagunaid et al., 2022).

In the academic field, the students mostly used Bard AI (Google), BERT (Google), ChatGPT (OpenAI), and ELECTRA (Google). The most popular and frequently used AI tool in the teaching-learning process is ChatGPT (Owan et al., 2023). It assists students to improve their problem-solving skill by attaining educational concepts efficiently and effectively round the clock (Owan et al., 2023).



Despite the fact, less research literature is available to ensure the role of ChatGPT as the predictor of students' academic engagement and motivation. Therefore, the study filled a research gap by providing detailed data. It gives systematic statistics on the encouragement of students in Karachi's public and private higher education institutions to participate in AI, particularly ChatGPT.

Significance of the Study

The study is noteworthy for the predictive significance of ChatGPT use on students' educational engagement and motivation, as measured by a binary logistic regression technique. It provides positive and useful information for educators, curriculum developers, and academic policymakers looking to employ AI tools in pedagogically communicative ways. Furthermore, the study supports the idea that AI-powered online learning environments serve as a basis for developing students' digital literacy skills in preparation for future technological advancements. As a result, digital literacy will increase with the increased use of AI tools.

Research Questions

1. Does the use of ChatGPT predict students' academic engagement?
2. Does the use of ChatGPT predict students' academic motivation?
3. Do the higher academic engagement and motivation among students enhance the increased use of ChatGPT?
4. What is the likelihood of the use of ChatGPT as a predictor for private and public university students' engagement and motivation?
5. Do the observed frequencies of the sample relate to the expected frequencies of the population?

Objectives of the Study

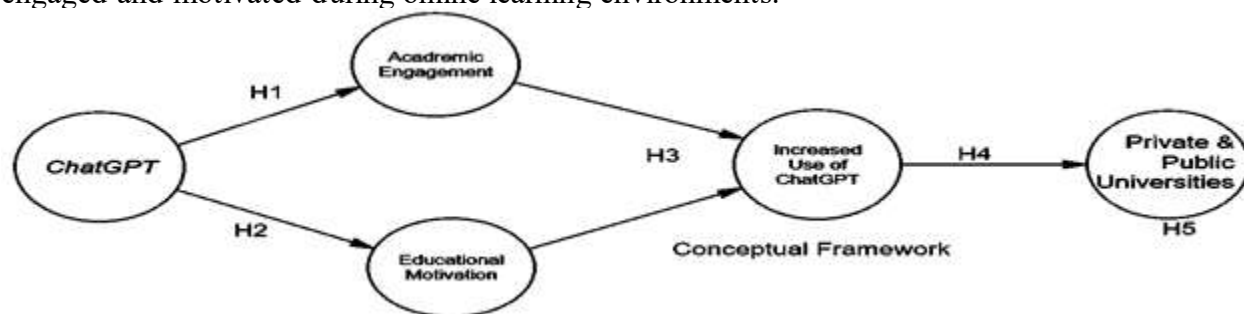
1. To assess the effectiveness of ChatGPT as a predictor of students' educational engagement.
2. To investigate the role of ChatGPT as a predictor of undergraduate motivation.
3. To determine the enhancement in the use of ChatGPT due to students' academic engagement and motivation.
4. Determine the likelihood of using ChatGPT as a predictor for students' enthusiasm and motivation at private and public universities.
5. Investigate the link between the observed sample frequencies and the population's expected frequencies.

Hypotheses

1. The use of ChatGPT does not significantly predict students' academic involvement.
2. The use of ChatGPT does not significantly predict students' academic involvement.
3. There is no significant enhancement in the use of ChatGPT due to students' academic engagement and motivation.
4. The likelihood of ChatGPT increased use as a predictor of students' motivation and participation in both public and private universities is negligible.
5. The sample's observed frequencies and the population's expected frequencies are not significantly the same.

Theoretical Framework

The theoretical framework is an essential component to elaborate hypotheses, literature reviews, research methodology, and conceptual frameworks. The study used three conceptual frameworks, including the Flow Theory, the Self-determination Theory, and the ASCR Model. According to Csikszentmihalyi (1990), whenever the students interact with ChatGPT, they get many innovative and adaptive scheming methods that initiate a “flow” state for the learners. It would be helpful to get learners engaged and motivated towards their learning attitudes. According to Desi & Ryan (2000), intrinsic and extrinsic motivations lead us to attain three basic needs, including autonomy, competence, and relatedness. ChatGPT in turn provides all the needs of the students to get autonomy through personalized learning to enhance their competence in the related discipline in educational chores. Likewise, Keller’s Model of Motivation (1987), known as the ARCS Model of Motivation, plays an energetic role in increasing the engagement and motivation levels of university undergraduate students. According to this model, ChatGPT has the potential to ensure the sustained attention, relevance, confidence, and satisfaction of students in order to make them engaged and motivated during online learning environments.



Literature Review

ChatGPT has a prominent effect on various disciplines of life, especially in the discipline of education. ChatGPT is the strong language model invented by OpenAI on November 30, 2022. It provides the bulk of advanced educational material, interactive conversation, instant feedback, and evaluation of the students' work along with interesting approaches for their learning process. Moreover, ChatGPT is the Large Language Model (LLM) of AI that can develop human-like text responses upon given input. It can respond to different languages and develop more intellectual and well-refined responses based on sophisticated modeling (Fitria, 2023).

Roumeliotis and Tselikar (2023), therefore, emphasized the significance of obtaining fruitful outcomes from ChatGPT. The student's insertion of instructions or questions was one of the main



steps. Then after processing, ChatGPT develops a response through its understanding of the language patterns. After getting the appropriate response, the student continues to ask follow-up questions to maintain the sequence of the learning chain.

Haleem et al. (2022), further, mentioned some other benefits of the use of ChatGPT. It can produce human-like answers and create a more interactive and excited learning environment with students, and they enjoy their learning process for a long span of time without interruption. Therefore, learners show more academic engagement with ChatGPT. Additionally, the scalability of ChatGPT makes it more reliable to handle various conversations at the same time and create responses more swiftly. As a result of this flexibility, ChatGPT is a highly versatile and adaptive device.

In brief, ChatGPT creates a more attractive and innovative learning situation for students, allowing them to complete their educational accomplishments more effortlessly and effectively. As a result, ChatGPT transforms teaching and learning approaches and elevates them to a higher order of thinking. It streamlines the educational and learning process for both teachers and students by providing adaptive personalized learning with speedy feedback.

Nguyen et al. (2024) pointed out that ChatGPT kept students more engaged during their academic learning. The students' academic engagement means willpower, ambition, obligation, and enthusiasm to actively engage and achieve academic accomplishment. Furthermore, engaged students steadily show behavioral, emotional, and cognitive features to reproduce their ideas, arrogances, and performances during the learning process. Lo (2023) further explained that the learners' educational engagement is a fourfold construct of behavioral, emotional, cognitive, and agency proportions. The main aim of behavioral engagement is to determine the learners' determination, consistency, and passion for completing the assigned tasks within the time frame provided. Cognitive engagement demonstrates the learners' intellectual capacity to apply deliberation and metacognition effectively to finish educational activities efficiently. Emotional engagement, on the other hand, refers to the educators' feelings of gratification and consummation with their educational achievements. Furthermore, Zhao et al. (2023) identified an agency as something that takes action to develop their experiences and academic settings. ChatGPT acts as an agent to increase agency engagement, which in turn increases the behavioral, cognitive, and emotional engagement of educators by making them more involved and participatory in learning. Lo (2023), on the other hand, considers that students' intellectual engagement and motivation are critical to their success and advancement. Ryan and Deci (2022) define two types of motivation: extrinsic and intrinsic motivation. Extrinsically motivated learners pursue to complete academic activities to earn external encouragements. In contrast, intrinsically determined students are typically more enthusiastic and endeavor to complete their educational tasks without the advantage of extrinsic rewards. Caratiquit (2023) judged ChatGPT to be the most essential factor that instructors might employ to boost students' academic engagement and motivation.

The Shehri (2023) study revealed that ChatGPT is also becoming more widely used in private and public higher education institutions in Pakistan. Recurrent studies have documented its use and impact on private and public sector universities. According to a survey of lecturers of both universities, the majority of them believed ChatGPT had progressive pedagogies. It has massive potential and may benefit educators and students of public and private universities in different ways.



Scope of the study

The scope of the study was delimited to students from both public and private universities of Karachi who had admittance to ChatGPT.

Limitations of the study

The study applied a cross-sectional research approach instead of a longitudinal approach due to the rapid upgrading of ChatGPT. It was limited to educators who have access to ChatGPT.

Methodology

The Binary Logistic Regression Test will be used to determine ChatGPT's role as a predictor of undergraduate students' academic engagement and motivation. Therefore, the researcher employed the quantitative research approach with a descriptive research design. The study's population included undergraduate students from Karachi's private and public universities. The 400-student sample was selected using the snowball and purposive sampling designs. The research instrument has three sections. Section A provided demographic information about the respondents. Section B addressed observational questions. Section C included twenty-nine study attitude-measuring items utilizing a five-point Likert scale.

Research Paradigm

The combination of research philosophy and research methodology constitutes the research paradigm. For quantitative research, the study utilized the research paradigm called positivism. According to Park et al. (2019), the hypotheses were accepted if the epistemology (knowledge) was consistent with ontology (reality); otherwise, they were rejected. The study used the reality as the predictive role of ChatGPT for students' academic engagement and motivation.

Data Collection

The researcher personally collected the data from public and private universities in Karachi by using the survey method. The Cronbach alpha value ($\alpha = 0.925$) for twenty-nine research items indicated a strong index of reliability. The data cleaning consisted of no miscoding, missing values, or unengaged responses. Broeck et al. (2005) mentioned the non-existence of outliers on the five-point Likert scale having probable values from 1 to 5. The Shapiro-Wilk test was performed to establish the normality of the data with a p-value = .08. The data was analyzed by IBM SPSS (v. 22).

Exploratory Factor Analysis (EFA)

EFA was executed to get the acceptable value of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (.936). The Bartlett's Test of Sphericity ($400, 406 = 4733.68, p = .000$), was statistically significant, validating that the correlation matrix was factorable. The EFA was performed by using principal component analysis with Varimax rotation. The factors were observed on the basis of eigenvalues more than 1.0. The analysis created three factors, which together explained 14.56%, 14.35%, and 11.23% of the total variance with the cut-off value of .40. These factors were named as academic engagement, motivation, and online learning settings respectively.

Ethical Considerations

They are considered the crucial element in working out the research studies to keep the respondents away from any kind of ethical annihilation. Hence, the following important considerations were taken by the researcher.

1. The HODs of all departments signed the consent letter to know the actual purpose of the research study and the role of subjects related to this study.



2. The appellations and addresses of the participants were kept intimate.
3. The data from this research study was kept confidential.
4. The researcher followed the rules, regulations, and standards of universities.

Descriptive Statistics

The sample of the study constituted 400 students. There were 212 female and 188 male students, making up 53% and 47% of the total sample size. The gender of the subjects was positively skewed and followed a platykurtic with high peaks. Out of a sample of 400 students, 70 were taken from Hamdard University, 118 from Iqra University, 98 from Karachi University, and 114 from Sindh Madressatul Islam. The number of students selected from various departments is 68 from Business Administration, 118 from Social Sciences, 37 from Media Studies, 35 from English, 33 from Computer Science, 26 from Mathematics, 24 from Chemistry, 28 from Physics, 8 from Fashion Designing, and 23 from Psychology. The leptokurtic design resulted in a favorable skew in department distribution.

Data Analysis

Table 1

Binary Logistic Regression Predicting the Likelihood of Students' Academic Engagement & Motivation with the Use of ChatGPT

	B	df	p-value	OR	95% C.I. for OR	
					Lower	upper
Students' engagement	.003	1	.000	1.003	.934	1.175
Students' motivation	.006	1	.000	1.896	.998	1.106

Note: N = 400

Binary logistic regression was used to determine the relationship between the dependent variable (dichotomous, such as yes or no for ChatGPT as a valuable tool) and the independent variable (scale variables such as students' educational engagement and motivation).

The Omnibus Test of Model Coefficient was implemented to inspect the model fit. The model was a considerably good fit ($\chi^2(4, 400) = 78.819, p = .000$), and it supported the relationship between the use of ChatGPT and students' academic engagement and students' motivation.

The Hosmer and Lemeshow tests also showed a good model fit, $\chi^2(8, 400) = 9.048, p = .348$, and the model sufficiently fit the statistics. Hence, the observed and predicted models were different by exhibiting approximately equal values.

The model summary elucidated 17.5% (Cox and Snell R^2) and 28% (Nagelkerke R^2) of the variance. The Nagelkerke R^2 was normally used as the adjusted version of the Cox & Snell R^2 to cover the full range from 0 to 1. Here, Table 1 showed the 28% change in the dependent variable could be accounted for in the predictor variables in the model. The model correctly categorized 76.7% of cases overall.

The percentages of 'Yes' and 'No' delivered information on the true positive rate, also known as sensitivity, for those who anticipated using ChatGPT as a valued source of improving students' academic engagement and motivation. The sensitivity of this model is 95.4%, and the true negative rate, also known as Sphericity, refers to those who would not estimate using ChatGPT as a primary source of enhancing students' educational engagement and motivation. The sphericity of this model is 30.5%. Overall, this model has a very high rate of accuracy (80.0%).



Table 1 presented the relationship between the predictor (ChatGPT) and the outcome ((educands' academic engagement and motivation). Therefore, the odds of a 'yes' making $OR > 1$ are selecting ChatGPT as an important tool offering students 'academic engagement and motivation. Those odds showing $OR < 1$ are those not electing ChatGPT as a useful source of increasing educational engagement and motivation of students. It had a 95% confidence interval (CI) of .000 to 1.175 and .000 to 1.106, respectively.

Therefore, the table confirmed that undergraduate students' academic engagement and motivation are predicted by the use of ChatGPT. Besides, ChatGPT is a useful tool of AI to enhance learners' online learning habits along with their educational engagement and motivation.

Table 2

Chi-Square Test of Independence for Association between Students' Engagement & Motivation with the Increased Use of ChatGPT

	Recent Trend of Use of ChatGPT		Chi-square	df	p-value	Cramer's V
	Increased	Decreased				
Engagement & Motivation Of students	121	10	20.905	2	.000	.54

Table 2 highlighted the chi-square test of independence to determine whether there is a significant relationship between academic engagement, motivation, and the use of ChatGPT. The results of Table 2 established a significant relationship among them, $\chi^2(2,400) = 20.905$, $p = .000$, Cramer's $V = .54$. The impact size indicated a surprisingly substantial association between the increased usage of ChatGPT by students at the university for their academic accomplishment.

Table 3

Chi-square Test of Independence for Association between the ChatGPT Used in Private & Public General Universities of Karachi

University Type	Frequency of ChatGPT Use			chi-square	df	p	C's V
	Frequently	Occasionally	Rarely				
Private	88	82	38	.728	2	.000	.42
Public	84	91	37				

Note: C's V = Cramer's V, $p = .05$

The purpose of accompanying the chi-square test of independence was to perceive the association between the use of ChatGPT by private and public-sector universities in Karachi. The results of table 3 supported a substantial relationship between the private and public universities in Karachi for the frequent, occasional, and rarely use of ChatGPT by the students $\chi^2(2,400) = .728$, $p < .05$, Cramer's $V = .42$. The impact size was large, indicating undergraduate students at public and private universities utilizing ChatGPT more frequently and occasionally in Karachi.

Table 4

Chi-Square Goodness of Fit Test for the Engagement & Motivation of Students of Private & Public Universities Karachi

	Observed N	Expected N	Residual	Chi-square	df	p-value
Private	188	200	12.0	1.440	1	.000
Public	212	200	12.0			
Total	400					



The primary goal of performing the chi-square goodness-of-fit test was to determine if the observable frequencies of the sample matched the expected frequencies of the population for increased use of ChatGPT by undergraduates studying at various public and private universities in Karachi. Table 4 revealed the private and public sector university-based frequencies. The sample observed frequencies are similar to the expected frequencies of the population for academic engagement and motivation with the usage of ChatGPT, $\chi^2 (1, 400) = 1.440, p < 0.05$.

The findings of the results suggested that it made no difference if the students are studying at private or public universities. Therefore, they all showed the same academic engagement and motivation for applying ChatGPT for their personalized educational learning.

Results & Findings

Summary of the Hypotheses

Statistical Tests	Null Hypotheses	p-Value	Decision Taken
Binary Logistic Regression	H ₀₁	.000	Unsupported
Binary Logistic Regression	H ₀₂	.000	Unsupported
Chi-square Test of Independence	H ₀₃	.000	Unsupported
Chi-square Test of Independence	H ₀₄	.000	Unsupported
Chi-square test of Goodness of Fit	H ₀₅	.000	Unsupported

p=.05

Discussion

ChatGPT has a robust, optimistic, and highly noteworthy impact on students' academic engagement and motivation. It is corresponding with Shahzad's (2024) study, which was accompanied in an industrial situation and focused on the development of professional capabilities and proficiencies. This study, however, accentuates the personal development of individual proficiencies through the use of specific machines and technology.

The binary logistic regression predicted the probability of students' educational engagement and motivation with the use of ChatGPT. Likewise, the learners' motivation and the undergraduates' extent of involvement in their online learning environments were predicted by ChatGPT's use in educational situations. These findings are aligned with Alseddiqi's (2023) study, which observed ChatGPT's ability to provide personalized feedback, resulting in increased scholastic engagement. As a result, the study concluded that students' online learning practices, academic involvement, and motivation can easily be predicted by ChatGPT.

Bhujanga's (2024) study found that university students were more passionate and interested in using ChatGPT since it presented more advanced-level adaptive learning chances, helping to reduce their workload. This enhanced enthusiasm and motivation improved academic success but also gave students more self-confidence in their talents.

Al-Zoubi (2023) discovered a positive and significant relationship between educators' engagement and motivation for ChatGPT, indicating that it increased students' autonomy by allowing them to create personalized learning tracks, self-directed learning goals, and problem-solving through communication and interaction with advanced technologies. It implies that ChatGPT is an adaptable tool that can improve learning engagement across various student populations in higher education.



Nazir and Gul's (2019) study underscored that public and private-sector higher education organizations are smearing artificial intelligence to escalate effectiveness, improve facility excellence, and improve policy-making academic measurements. Therefore, technology adoption in public and private-sector universities is increasing day by day.

Conclusion

The results of the study elaborate on the increasing attention of university students towards the use of AI tools, especially ChatGPT. ChatGPT creates attractive, exciting, and engaging online learning environments to uplift the motivational level of students. It would be supportive for future researchers to expose more evidence about the increased trend of AI technologies among educands in higher education in Karachi. The increasing trend of ChatGPT would transmute traditional teaching-learning pedagogies into hybrid learning in the educational field. This would augment cooperative teaching and learning approaches to decrease the digital gap between teachers and learners. Furthermore, it would be helpful in the evaluation of AI-based information. ChatGPT will be a useful AI teaching and learning tool by giving contextual acquaintance and speedy responses to students' explorations. AI-integrated classrooms enhance traditional educational settings with AI technologies. This exclusive integration has the capability to revolutionize standard scholastic methods by opening up new prospects for information attainment and heartening more modified and immersive learning contributions in higher education in Karachi.

Recommendations

By perceiving the heightened scholastic engagement and motivation of university students in Karachi, this study suggested educators, policymakers, and educational practitioners consider the potential of providing technological facilities, encompassing equipment, infrastructure, and systems, to every department in the higher education of Karachi.

The study's findings would also embolden educators and academic practitioners to take more inclusive stages to advance the functionality and efficacy of online learning settings by incorporating AI-powered technologies into the classroom. It improves cooperative learning and promotes more engaging formal learning.

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