



Examining ChatGPT Usage Effect on Students' Engagement, Student Performance and E-learning Satisfaction: Empirical Investigation in Pakistan

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ABSTRACT

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Keywords:

ChatGPT, Student performance, E-students through answered adopted questionnaires. Findings learning satisfaction, Student engagement indicate that ChatGPT is positively associated with student engagement, student performance, and e-learning satisfaction.

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Higher education transformed traditional learning through integrating ChatGPT, for academic results and student engagement. The investigation follows the empirical approach to analyze how ChatGPT affects student engagement, student performance, and e-learning satisfaction among higher education students. A cross-sectional research study utilized 353 university students. A cross-sectional research study utilized 353 university students through answered adopted questionnaires. Findings indicate that ChatGPT is positively associated with student engagement, student performance, and e-learning satisfaction. The research demonstrates how ChatGPT enhances e-learning satisfaction because it develops customized interactive digital platforms that support varied student learning requirements. AI research verdicts provide vital support to advancing educational discussions about using AI technology in learning environments to improve results and educational practice methods. This analysis demonstrates a need to examine long-term effects along with ethical dimensions in AI-fueled educational systems to guarantee responsible and sustainable integration.



Introduction

ChatGPT engenders responses based on human input, enhancing writing and, academic tasks in education worldwide (Motlagh et al., 2023). ChatGPT was introduced OpenAI in 2022 to

facilitate students learning and achievement. The models mentioned above have gained a lot of traction since they were put using the GPT architecture (Pradana et al., 2023). Further, Zhu et al. (2023) argue that the potential for ChatGPT to enhance student's educational experiences has made its inclusion into the classroom extremely appealing. ChatGPT can assist students learn complex ideas, provide primary feedback, and meet their particular requirements by providing timely and customized responses. This technology demonstrates promise in encouraging active student cognitive development by adapting students' unique learning and continuous support. AI integration in education has generally resulted in several advantages, including increased effectiveness in educational practices, the potential for global learning, and improved efficiency in educational management (Wood et al., 2021).

Modern technologies are essential for enhancing the process of teaching and learning. Beyond simply gaining knowledge, education is a continuous process. In this regard, artificial intelligence (AI) is a better educational tool since it can offer individualized instruction and cater to each student's particular requirements (Fitria, 2021). Using AI technologies i.e. ChatGPT, will enhance problem-solving in these tasks. It can present various methods to articulate a problem, provide helpful information for solving it, and develop prototype solutions. The future of educational institutions adopting higher education problem-solving activities raises significant considerations, especially regarding students' experiences and understanding. Another extremely pertinent application of ChatGPT has been investigated (Calderon, 2025). Addressing its use in learning and translating the English language. Flexible learning settings that accommodate a range of requirements are becoming more and more crucial. Due to its effectiveness and ease of use, ChatGPT's incorporation into language instruction has drawn a lot of interest. Students organize their knowledge from multiple sources and retrieve information using ChatGPT.

Lower et al. (2023) remarked that ChatGPT's role as a comprehensive and rapid information source opens up numerous prospects for medical education. Its ability to instantly consolidate and synthesize medical knowledge, as well as the prospect of real-time updates, has the potential to transform how medical students and educators access information. Thus, the ChatGPT application in education has piqued students' interest because it can improve their learning experiences. Prompt and personalized responses can meet the needs of individual students, provide direct feedback, and aid in the comprehension of complex subjects. It emerges as a beneficial tool that fosters active student involvement and cognitive development by adapting to their learning pace and giving constant assistance in their information acquisition journey (Rasul et al., 2023). Therefore, ChatGPT is one of the most advanced and widely used artificial intelligence language models, as well as one that provides cutting-edge natural language processing capabilities. As a result, this particular research project emphasis is being paid to ChatGPT. Hence, ChatGPT production is particularly useful for producing human characteristics literature which makes significant tool for educational and academic purposes.

More in-depth research into the impact that ChatGPT has on a wide range of student demographics is made possible as a result of the platform's widespread appeal. Since English acts as the official language used in Pakistani educational institutions, continues to be utilized extensively in academic topic instruction as well as in communication within higher education systems. Particularly in the fields of science, technology, business, and international studies, English is frequently used as the primary medium of instruction at practically all schools of higher education. By utilizing English in educational settings in a comprehensive manner, students will be adequately prepared for academic and professional environments that are more global in scope. Recently artificial intelligence models, i.e. ChatGPT are extremely pertinent and

helpful in the Pakistan context, taking all of this into consideration. The crucial role of English in education drives research that focuses on the efficiency and impact of artificial intelligence applications in English-only educational contexts.

According to Zhai (2022), ChatGPT is "critical in improving students' learning experiences, facilitating students' ability to customize their educational tracks and obtaining responses created for those requirements.". Its impact spans various dimensions of learning, including information retrieval, handling unique questions, learning many topics, fostering open discussions, assisting in paper writing and editing, programming, providing sample data, and solving statistical issues (Dempere et al., 2023). ChatGPT's importance in higher education is highlighted by its utilization. ChatGPT helps students with information, summarization, text generation, and more. Starting these duties saves time and increases higher education work quality (Almogren et al., 2024). ChatGPT can be further determined in terms of its ability to understand natural language queries and its responses corresponding to human-like interactions that affirm it to be a very practical tool in answering questions, from general topics to intricate topics (Ansari et al., 2024). The present study solves this problem by focusing on how the features and functionalities of ChatGPT directly impact these critical aspects of student learning.

Literature Review

ChatGPT and student engagement

Student involvement measures how deeply students immerse themselves in their educational learning process. The academic concept extends across behavioral aspects along with emotional aspects and cognitive aspects. Student involvement shows their self-assurance along with their interest in learning activities enjoyment of educational work and their membership in the educational community. (Bhardwaj et al., 2021; Zhao et al., 2023). Generative AI technology specifically ChatGPT receives the global spotlight because of its uncanny ability to create textual content resembling human-generated work mainly for student interaction purposes. ChatGPT proves highly effective within several application domains. ChatGPT shows the ability to produce natural text while operating as a conversational interface that translates between languages and supplies answers to inquiries as well as programming support and literature analysis. Beyond helping students create assessments, write essays, and translate their language ChatGPT manages a range of capabilities and functions. It allows users to pose and respond to a wide range of inquiries, structure texts, engage in dialogue, and collaborate with colleagues (Venkateswaran et al., 2024). Further, Leelavathi & Surendhranatha (2024) describe ChatGPT gives information that is both quick and relevant, but it cannot think critically like a human. This raises doubts about how accurate and reliable information (Phutela et al., 2024). ChatGPT offers several opportunities for learners, including enhanced intrinsic motivation, and a deeper grasp of subjects. ChatGPT's automation is essential for speeding up lesson design, which enables teachers to generate learning materials that are both interesting and effective in a more efficient manner. Hence, proposed that:

H1: ChatGPT positively impacts on student engagement.

ChatGPT & Student Performance

Academic integrity has long been a concern in education, & AI-powered chatbots add new complexities and also impact learning. Studies indicate that the use of ChatGPT positively

correlates with improved student performance (Alshater, 2022). The system works as an additional educational resource to strengthen conventional academic teaching approaches through an interactive learning format. The efficiency ChatGPT provides to academic tasks leads to improved student satisfaction while students feel they perform better academically. ChatGPT produces comprehensive answers that incorporate multiple assessment methods that teach students problem-solving abilities and communication skills. Effects of using ChatGPT on student performance arise from setup variations in learning environments and from combining ethical AI practices with critical thinking and academic integrity principles. The performance and satisfaction levels of students depend heavily on the operational effectiveness of ChatGPT. Different learning elements experience better student achievement outcomes when institutions adopt ChatGPT effectively according to research findings from recent times. (Chaudhry et al., 2023). The educational development process benefits significantly from ChatGPT's capability to address knowledge deficiencies. ChatGPT serves educators and learners as an important tool that helps improve both educational experiences and performance outcomes. (Alshater, 2022). The tool operates as an artificial instructional assistant that provides educational guidance during learning tasks. (Alshater, 2022). ChatGPT also facilitated the assessment process by enhancing student performance. (Chen et al., 2023). ChatGPT plays a valuable role in education by assisting students in developing course materials and providing insightful suggestions. Academic performance is achieved through various indicators, including higher grades, and enhanced abilities and standards. Hence, proposed that:

H2: ChatGPT positively influence on student performance

ChatGPT and E-learning Satisfaction

ChatGPT and students' academic e-learning satisfaction are linked to academic context learning goals. (Pabreja & Pabreja, 2024). Through customized feedback and student motivation support, ChatGPT helps students improve their academic performance. Students develop better critical thinking abilities through ChatGPT since the system delivers guidance and advisory information. AI through ChatGPT generates a platform that allows students to learn from a secure educational environment. The real-time question-answering capability of ChatGPT improves student satisfaction in e-learning programs. An immediate response system is highly appreciated by students because it reduces their frustration while enabling better study progress. The dynamic format of ChatGPT both attracts students' attention and develops a more interactive learning experience. The capability of ChatGPT helps teachers customize their answers to provide tailored instruction that meets the requirements of individual students. These specific adjustments provide the best benefits to the learning experience. ChatGPT research capabilities grant students complete freedom and investigate educational materials that offer extensive knowledge on various subjects. Also, the ChatGPT educational tool promotes inclusive learning adjustment via various student learning styles and assists in supporting students. Students learn to sustain lifelong learning and customized guidance supported via educational resources (Leelavathi & Surendhranatha, 2024). Overall, ChatGPT uses adjustable instruction methods and helps educational levels learners. Future students will interact with AI-based virtual tutors who can modify their instructional approaches and unique desired teaching methods.

H3: ChatGPT has a positive impact on e-learning satisfaction

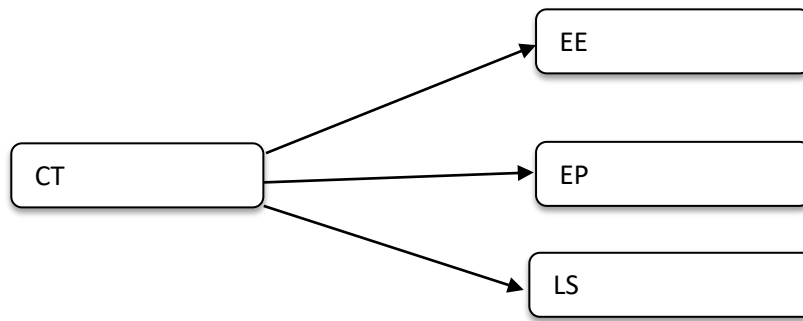


Figure 1: Conceptual framework

Research Methodology

The research employed a cross-sectional design that provides outcomes that can be generalized to a given period. Data collection was conducted from April to June 2024. The data was gathered through structured questionnaires with a five-point Likert scale as advised by (Zhao et al., 2023). After receiving approval from their respective colleges, the respondents were able to access the directory. Notably, all respondents gave their informed consent after being made aware of the main research ethics. Additionally, they were informed that the researchers would not utilize their data for commercial purposes and that it would only be used for this study. Following collection, the data was assessed and classified for further examination. Further, AMOS-25 and SPSS-23 are utilized in current research.

Sampling and Design

The target population for the current study comprises university students in Pakistan. To align with research requirements, the population was further refined into a sample that met the study criteria. Specifically, the total population consisted of 6540 students from two public sector universities in Islamabad, Pakistan. Utilizing Yamane's formula for sample size calculation, a sample of 376 students was selected. (Ansari et al., 2024). More, for data collection, researchers personally visited selected institutions and distributed participants questionnaires. However, the data collection process took place between January 13 and March 5, 2024. The questionnaires were distributed randomly, without considering factors i.e. age, education, and gender. After data collection, the completed questionnaires were carefully reviewed, and 23 were found incorrectly filled. Thus, 353 questionnaires were finalized for analysis, resulting response rate of 93.8%. Table 1 presents the results of demographics.

Measure Scale

The current study adopted a quantitative approach and cross-sectional survey design. However, the study adopted 8- an item measurement scale for ChatGPT, 5- an item measurement scale for EE, 5- an item measurement scale for EP, and 5- an items measurement scale for LS from a prior study. (Valeri et al., 2024; Appleton et al., 2006, Yu et al., 2010; Almulla, 2024). Moreover, the questionnaire was divided into two main sections. The first section collected demographic information, and the second focused on the key study variables. In Section B, a 5-point Likert scale was utilized, enabling participants to indicate agreement or disagreement level (ranging from strongly disagree to strongly agree) with provided statements.

Table 1: Demographics Analysis

Demographics	Frequency	%
Gender		
Male	223	63.17
Female	130	36.83
Age		
20 – 23 Years	124	35.13
23–26 Years	168	63.17
27 and above	61	17.28
Education		
Lower than Bachelors	112	31.73
Bachelor Degree	92	63.17
Master’s Degree	77	21.81
Doctoral Degree	72	63.17

Table 2: CR, AVE, and Cronbach alpha

	Items	F. L	CR	AVE	Cronbach alpha
ChatGPT	CT1-CT8	0.806	0.758	0.510	0.728
Student Engagement	SE1-SE5	0.801	0.836	0.664	0.832
Student Performance	SP1-SP5	0.759	0.766	0.558	0.718
E-learning satisfaction	LS1-LS5	0.821	0.889	0.667	0.835

Analysis

The research utilized AMOS resources to verify the model structure based on questionnaire responses from 353 participants. The researchers executed their data analysis through SPSS and AMOS version 25. Previous research has demonstrated SEM as an appropriate framework for visualizing the adaptable regression patterns found within a single analytical model (Kline, 2023). (Hair et al., 2020), assert that SEM proves effective for analyzing interaction effects according to the researchers. This study used SEM along with maximum likelihood methods for assessing the proposed hypothesis through an SEM framework.

Results

Reliability and Validity

Table 2 shows Cronbach’s alpha values for ChatGPT, SE, SP, and e-learning satisfaction were 0.728, 0.832, 0.718, and 0.835, respectively, exceeding the critical threshold of 0.7. These results confirm the questionnaire's reliability. CFA was conducted using MPLUS 8.0. Among various

competing models, the theoretical four-factor model—comprising ChatGPT, SE, SP, and e-learning satisfaction—demonstrated the best fit to the data [$\chi^2/df = 2.14$, CFI = 0.902, TLI = 0.911, RMSEA = 0.057, SRMR = 0.048]. The CFA results confirmed theoretical four-factor model exhibited strong discriminant validity.

CMB

To evaluate the potential for common method bias, Harman’s one-factor test was conducted utilizing SPSS software.(Kaltsonoudi et al., 2022). However, despite its known limitations, this method remains widely utilized in research due to its simplicity and effectiveness. (Podsakoff et al., 2003). The analysis showed that a single factor explained only 19% of the variance, which was well below the 50% threshold that signals common method bias. (Chin et al., 2012). These results suggest that common method bias is unlikely to affect the study's validity.

Correlation Analysis

Table 2 presents correlation analysis results. Furthermore, findings reveal a positive correlation between ChatGPT and SE ($r = 0.748$, $p < 0.01$), SP ($r = 0.515$, $p < 0.01$), and e-learning satisfaction ($r = 0.234$, $p < 0.01$). These correlations offer preliminary support for the direct effects proposed.

Table 3: Discriminant Validity

	(1)	(2)	(3)	(4)
ChatGPT	(0.84)			
Student Engagement	0.748	(0.87)		
Student Performance	0.515	0.554	(0.77)	
E-learning satisfaction	0.234	0.312	0.598	(0.82)

Hypotheses Test

The results show that ChatGPT has a significant degree of association with student engagement ($\beta = 0.409$, $t = 8.645$). ChatGPT also has a positive link with student performance ($\beta = 0.321$, $t = 5.473$). ChatGPT has a positive impact on e-learning satisfaction ($\beta = 0.210$, $t = 3.619$).

Table 4: Hypothesis Testing

Casual Path	Path Coefficient	t-statistics	p-values
CT – SE	0.409	8.645	(p-value <0.05)
CT – SP	0.321	5.473	(p-value <0.05)
CT – LS	0.210	3.619	(p-value <0.05)

Discussion

The current study looks at the significant ChatGPT influence on SE, SP, and e-learning satisfaction in public universities. The quantitative research design was utilized as relevant to the

study. Empirical research confirms significant ChatGPT contribution to SE. The study confirmed previous results presented by Bhardwaj et al. (2021), on how AI-powered gamification increases student engagement. The study confirms that ChatGPT creates better student involvement because it provides interactive instruction methods. Through its AI-driven interface students can obtain immediate responses that promote continuous academic participation. Research by Diwan et al. (2023) Shows how AI-based learning systems strengthen digital learner involvement during educational sessions. The customized learning experiences provided by ChatGPT allow students to maintain focus while conducting their coursework which creates an environment of active student participation.

Academic performance shows a positive relationship with the implementation of ChatGPT. Students who utilized ChatGPT for educational support achieved better grades while showing enhanced problem-solving abilities and enhanced comprehension of difficult learning material. Research results support the context that cognitive burden reduction tools positively affect learning success (Hussain & Anwar, 2024). Students face authenticity issues when using AI-generated content for their assignments to a significant degree. However, ChatGPT utilization for understanding purposes might both enable plagiarism and stop students from doing their independent analytical work. Educational institutions need to create regulations that establish ChatGPT as an additional resource for students but forbid its use as a substitute for traditional learning materials. Further, the data reveals how student satisfaction with e-learning depends on three main factors which include the ChatGPT accessibility as well as its efficiency and tailored assistance capabilities. Students enjoyed ChatGPT because it showed immediate concept explanations together with help for their schoolwork which improved their learning experience. The findings also support prior research results that AI-enhanced e-learning platforms progress student satisfaction by making more flexible learning (Almulla, 2024).

Implication for Teaching and Learning

To answer RQ: How will the ChatGPT improve student engagement, student performance, and e-learning practices in public Universities? The research findings will produce at least four practical applications regarding university usage of ChatGPT. ChatGPT produces a more stimulating learning environment that increases student participation because of its ability to enhance engagement. The typical lecture-teaching approach makes it difficult for students to participate especially across crowded classrooms because teachers provide limited student-to-teacher interaction. The available interface of ChatGPT enables students to pose inquiries to receive immediate explanations about their course material while needing no delay. Such initiatives create engaging learning environments because students actively participate in discussions and solve problems while developing critical thinking abilities. The system generates stimulating queries through ChatGPT while integrating case studies to deliver students enhanced learning methods for a deep understanding of subjects. Closer academic support tailored to individual needs that ChatGPT offers becomes an educational tool that increases student performance. School topics remain difficult for students to grasp because learning processes differ from student to student. The explanations provided by ChatGPT to students enable the system to change information complexity while converting advanced concepts into basic linguistic explanations suitable for student comprehension. The personalization services of ChatGPT generate specific educational content with quizzes along with adapted revision materials that allow students to conduct individualized practice. Through the use of ChatGPT students can receive evaluation feedback that helps them in writing analysis along with feedback for reports and research documents. ChatGPT establishes educational requirement connections

with individual students allowing stronger academic achievement and complete educational success. ChatGPT strengthens e-learning techniques through its role as an educational tool that assists with studying tasks. Students face two main difficulties in online learning which include minimal direct student-instructor contact and ongoing motivation challenges. ChatGPT resolves these problems by supplying prompt help for students while guiding them through digital materials and responding to standard academic inquiries. The system should enable discussion forum activities through the generation of pertinent information to encourage continued inquiry. The features of online education create knowledge access with more immediate and effective delivery which benefits learners located in remote areas specifically. The fourth use of ChatGPT involves various academic operations automation that support teaching faculty. The educational utility of ChatGPT exists in supplementary learning instead of complete teaching replacement to enhance academic standards for public universities.

Limitations

First, the lack of contextual reasoning and critical analysis within ChatGPT leads to incorrect or insufficient explanations because it cannot fully understand the question. Since it does not fully comprehend complex or nuanced questions, most responses might miss essential details to provide deep insights. Second, the speed of its responses prohibits ChatGPT from understanding complete student questions properly resulting in unclear responses or misinterpretations. This limitation necessitates careful validation of AI-generated content. ChatGPT's excessive use reduces students' ability to think critically along with their ability to solve problems. Third, the implementation of ChatGPT faces ongoing ethical problems because of student data protection and academic ethics violations. ChatGPT utilization creates plagiarism issues since students sometimes employ AI to produce their assignments by not providing proper source recognition. Fourth, the functionality of ChatGPT connects tightly to the technology framework as well as digital user understanding. ChatGPT acceptance in public higher education institutions throughout developing nations is hindered by difficulties with internet connectivity and insufficient digital resources alongside differences in student capability with AI technology.

Future Direction

Firstly, future research focuses on developing AI-enhanced learning models that foster deeper contextual understanding and improve reasoning abilities. Secondly, the ChatGPT's reliability as an educational tool will increase that gains generate more precise, context-driven responses. Thirdly, academic studies must explore ChatGPT's impact on students' cognitive development and its influence on critical thinking skills. Fourthly, further investigations should systematically evaluate how AI systems affect students' ability to work independently. This research would help determine whether AI improves analytical thinking. Finally, studies should examine integrating ChatGPT implications into educational settings. Research on AI collaboration with conventional classroom instruction would provide valuable insights into optimizing educational technology.

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