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Impact of Artificial Intelligence on Students' Academic Performance at Higher Education Level

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ABSTRACT

This study explores the influence of artificial intelligence (AI) on students' academic performance, with particular emphasis on its contribution to enhance achievement at the university level. The research seeks to evaluate how AI-driven tools and systems support and improve students' academic outcomes. An ex-post facto research design was adopted, and a multi-stage random sampling technique was utilized to select a sample of 1,843 respondents in accordance with predetermined criteria. The findings demonstrate that AI substantially addresses learners' individual academic needs, thereby fostering more comprehensive, efficient, and enriched learning experiences. AI technologies effectively identify students who experience academic difficulties and provide timely, targeted interventions designed to strengthen their performance. Results further indicate a positive and significant influence of AI on university students' academic achievement. These insights contribute meaningfully to the broader discourse on technology-supported education, underscoring that the integration of AI can enhance student performance in measurable ways. Moreover, the study reveals that AI systems not only assess but also improve students' attitudes toward learning, yielding deeper understanding of their learning processes. AI was also found to

bolster students' motivation, study habits, and overall learning behaviors. Additionally, its adaptive learning features guide students through personalized learning pathways and deliver constructive, real-time feedback. Collectively, these findings highlight the transformative potential of AI in promoting academic excellence within higher education.
Keywords: Artificial Intelligence, Academic Achievement, ICT, University Students

INTRODUCTION

Artificial Intelligence (AI) is increasingly revolutionizing multiple sectors, with education emerging as a key area experiencing substantial transformation. As AI technologies evolve, their capacity to redefine teaching and learning processes has become more evident (Yim & Su, 2024). Contemporary research highlights that AI holds immense potential to individualize instruction, refine pedagogical strategies, and elevate learners' academic performance (Khan et al., 2024; Raja et al., 2024). Through the analysis of extensive educational datasets, AI systems are able to customize instructional pathways, offer precise and timely interventions, and cultivate more interactive and effective learning environments (Wang et al., 2024). Despite its promising contributions, the incorporation of AI into educational contexts poses notable challenges. Concerns surrounding ethical use, data protection, algorithmic bias, and the risk of widening existing educational disparities remain central to ongoing debates (Eden et al., 2024). In light of these opportunities and constraints, the present study undertakes a comprehensive literature review to examine the influence of AI on student learning outcomes. By synthesizing current research, this study aims to delineate the advantages and limitations associated with AI integration in education and propose meaningful avenues for future inquiry.

Although the use of AI in educational settings is steadily increasing, its adoption remains in an early developmental stage(Khan et al., 2024). Nevertheless, AI particularly through its natural language processing capabilities has the potential to substantially enhance student engagement and academic achievement. AI facilitates personalized learning by aligning educational content with students' individual needs, prior knowledge, and learning trajectories, thereby improving their overall effectiveness and performance (Mallillin et al., 2023). It contributes meaningfully to the development of advanced and efficient learning environments by leveraging state-of-the-art technologies that support knowledge acquisition, cognitive engagement, and instructional delivery.

Moreover, AI positively shapes students' learning capacities by enabling them to maximize their academic potential and participate more deeply in the learning process (Altememy et al., 2023). The students of a developing country need to show high performance to compete in a global context. Pakistan is a developing country needing a youth with excellent academic performance. Therefore high academic performance and 21st century skills are much important for Pakistani students(Ullah & Akbar, 2021). Moreover, to meet with the challenges of modern world and to enhance students' performance, the adoption of innovative strategies to are of much importance(Khan et al., 2025; Ullah et al.,2023). The adoption of AI in higher

education in Pakistanis growing, driven by expanding digital infrastructure, government interest in technological innovation. However, the impact of these technologies in the Pakistani context remains under-explored. Given these developments, it is essential to assess the contribution of AI to students' learning outcomes. Therefore, this study aims to investigate the effect of Artificial Intelligence on academic performance at the higher education level in Pakistan.

Objectives of the Study

The research objectives are as follows:

1. To investigate the relationship of artificial intelligence with students' academic performance at university level.
2. To examine the impact of artificial intelligence on students' academic performance at university level.

Research Questions

Following were research questions of the study:

1. What is the relationship of artificial intelligence with students' academic performance at university level.
2. What is the impact of artificial intelligence on students' academic performance at university level?

REVIEW OF LITERATURE

Academic Performance

Academic performance defined by Kamara and Dadhabai (2022), refers to students' demonstrated ability to achieve specific learning objectives. In exploring the role of AI in education, Alshahrani (2023) examined academic performance by collecting data through focus groups and assessments of student achievement, with a particular focus on interactions with a chatbot. The study found that students who engaged with the chatbot exhibited significantly higher academic performance compared to those who primarily interacted with the course instructor. Moreover, Alshahrani (2023) suggested a potential correlation between the frequency of chatbot interactions and students' academic outcomes, indicating that learners who engaged more frequently with the AI tool tended to achieve better results than those with less frequent engagement. These findings highlight the impact of AI-mediated interaction on enhancing student learning and suggest that both the quality and quantity of engagement with educational technology are important factors in academic achievement.

Furthermore, Alshahrani (2023) emphasizes the effectiveness of Intelligent Tutoring Systems (ITS) in delivering relevant content, promoting student engagement, and enhancing academic achievement, although some limitations in domain coverage may exist. Similarly, Ouyang et al. (2023) highlight the predictive capabilities of Artificial Intelligence in Education noting its potential to identify students at risk of underperformance, personalize learning pathways, and optimize the design and development of instructional materials. In this context, scholars argue that AI can play a pivotal role in addressing barriers to learning, fostering equitable

access to educational resources, and ultimately enhancing the overall capacity and effectiveness of educational systems (Hwang, 2022).

Unlike traditional computer technologies, which operate according to predetermined sequences without considering individual learners' needs or prior knowledge, artificial intelligence (AI) analyzes patterns in collected data such as students' comprehension levels and errors to make informed decisions and deliver subsequent tasks aimed at optimizing learning outcomes (Paek & Kim, 2021). By continuously learning from past performance and analyzing instructional results, AI is capable of generating novel strategies that adapt to students' evolving needs. Consequently, AI has the potential to positively influence academic performance, enhance creative thinking, and strengthen problem-solving abilities (Paek & Kim, 2021). Moreover, AI can further support academic achievement by providing personalized learning experiences and offering immediate, context-specific assistance to students, thereby fostering more effective and engaging learning processes.

Artificial intelligence and academic performance

Artificial intelligence (AI) has emerged as a transformative force in education, significantly enhancing individual learning outcomes (Naser et al., 2015). Empirical research indicates that AI contributes to improved academic performance by enabling personalized learning experiences, streamlining administrative processes, and providing targeted support tailored to students' needs (Yu, 2023). Previous studies have not only identified these challenges but have also offered best practices for the responsible integration of AI, highlighting its long-term implications for academic performance and overall educational success (Tsai et al., 2023). Generative AI platforms, such as ChatGPT, provide immersive and experiential learning environments that simulate real-world scenarios, allowing students to apply theoretical knowledge and develop critical problem-solving skills (Ma & Huo, 2013; Salas-Pilco & Yang, 2022). These AI-driven tools have the potential to meaningfully enhance learning outcomes by fostering interactive, student-centered experiences.

Effective implementation of AI in education, however, requires comprehensive deployment strategies, faculty training, and rigorous ethical and privacy safeguards (Pang, 2024). Importantly, the human element remains central to education; AI should complement rather than replace human instruction and mentorship. The integration of generative AI, such as ChatGPT, offers opportunities to improve academic performance through personalized learning pathways tailored to individual students' abilities, preferences, and interests (Dimitriadou & Lanitis, 2023; Yu & Guo, 2023). Adaptive learning algorithms can identify gaps in understanding and provide targeted interventions, supporting mastery of key concepts and enhancing engagement, motivation, and conceptual comprehension (Yu, 2023).

Moreover, AI has the potential to relieve educators of routine administrative responsibilities, allowing them to devote greater attention to instructional and pedagogical activities (Arunachalam & Velmurugan, 2018). Its ability to generate

educational resources including quizzes, exercises, and study materials further enhances its utility by providing high-quality, curriculum-aligned content while reducing the workload of teaching staff (Hu et al., 2023). The transformative impact of AI in education extends beyond technological sophistication; it lies in its capacity to integrate adaptive and personalized learning experiences that fundamentally improve academic performance. Exploring AI's role in education requires an examination of how its applications such as personalized learning, real-time feedback, intelligent tutoring systems, automated assessments, data-driven analytics, and immersive simulations can empower students, enhance engagement, and optimize learning outcomes (Zacharis, 2016). Research indicates that when AI is implemented with strategic planning and sustained focus, its full potential can be realized, substantially contributing to improved student learning and academic achievement (Salas-Pilco & Yang, 2022). In this context, AI not only supports instructional efficiency but also facilitates a reimagining of educational paradigms, linking technological innovation with enhanced student performance and educational empowerment.

Methods and Procedures

Research Design

This study employed a causal-comparative descriptive research design to examine impact of artificial intelligence on students' academic performance. As noted by Fraenkel et al. (2009), a causal-comparative research design involves identifying distinct groups based on a specific variable and subsequently comparing them on another variable to determine potential differences or relationships. This approach enables researchers to explore the impact of independent variables on outcomes without experimental manipulation, providing insights into naturally occurring variations among participants.

Sampling Procedure

In research, the term population refers to the complete set of individuals from which a study's sample is drawn (Fraenkel et al., 2009; Hutchings, 2021). For this study, the population consisted of students enrolled in education programs at public universities in Lahore. Among the seven government universities in Lahore, only four offer B.Ed. and M.Phil. programs. Consequently, the study focused on students from these four universities, encompassing both male and female learners across various academic levels. A multi-stage sampling technique was utilized for this study. In the first stage, three out of the four public universities offering education programs were selected randomly. During the second stage, two departments from each selected university were chosen, and students were then sampled from the final departmental lists. The resulting sample consisted of 1,843 students, including 902 male and 941 female learners, all of whom were enrolled in either the four-year B.Ed. program or M.Phil. degrees.

Research Instruments

Artificial intelligence (AI) refers to the development of algorithms and computational systems that emulate human cognitive functions, including reasoning, problem-solving, and pattern recognition (Gong, 2021). In this study, AI was

measured using an eight-item scale adapted from established research in the field (Li, 2023; Shoufan, 2023). All AI-related items were rated on a five-point Likert scale, consistent with the study's methodological framework. Academic performance, defined as students' scholastic achievement, represents a fundamental construct in educational research (Giunchiglia et al., 2018). To assess this variable, we employed a validated scale developed by authoritative scholars. Responses were captured using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to evaluate all items related to academic performance.

Data Collection and Data Analysis

The researchers visited the selected universities and formally approached the heads of the relevant departments to obtain permission for conducting the study. Once consent was granted, students were briefed on the purpose and objectives of the research and invited to participate voluntarily. Questionnaires were then administered in classroom settings, with clear instructions provided to ensure proper completion of the printed forms. The collected data were analyzed using inferential statistical techniques, including the Pearson correlation coefficient and linear regression.

Data Analysis and Interpretation

Table 1

Correlation between Artificial Intelligence and Academic Performance

Variables	*n*	*r*-value	*Sig.*
Artificial Intelligence and Academic Performance	1843	.902**	.000

** $p < .001$ (2-tailed)

Table 1 presents the results indicating a significant relationship between artificial intelligence and students' academic performance ($r = .902^{**}$, $n = 1{,}843$, $p < .001$). The findings demonstrate a strong and statistically significant positive association, suggesting that higher engagement with AI is closely linked to improved academic performance. Accordingly, it can be inferred that artificial intelligence has a robust and meaningful impact on students' academic outcomes within the study sample.

Table 2

Effect of Artificial Intelligence on Academic Performance

Variables	*B*	*t*-value	*Sig.*	Model *R* Square
Artificial Intelligence & Academic Performance	.902	89.868	.001	.814

The linear regression analysis presented in Table 2 indicates that the independent variable, artificial intelligence, accounts for a substantial proportion of the variance in students' academic performance, with an R^2 value of .814. This suggests that 81.4% of the variability in academic performance can be explained by the level of engagement with AI. The analysis yielded a significant beta coefficient ($\beta = .902$, $p = .001$), highlighting a strong and statistically meaningful effect of artificial

intelligence on academic outcomes. These results demonstrate that higher levels of AI utilization are associated with enhanced academic performance, underscoring the considerable influence of AI on students' learning achievements within the study sample.

DISCUSSION

The factors associated with artificial intelligence (AI) in relation to students' academic performance emphasize the facilitation of essential learning tasks and the promotion of deeper, more effective learning. AI supports and encourages students to articulate ideas, engage in critical thinking, and actively participate in the learning process. Moreover, it provides accurate assessments of the learning journey, offering valuable insights and adaptive mechanisms that allow instructional plans to be customized according to individual student needs. By leveraging AI, anticipated academic outcomes can be projected, and learner support can be tailored to enhance performance. The integration of AI fosters innovation in student learning by combining information-driven guidance with natural process engagement, thereby strengthening students' academic capabilities (Pacheco-Mendoza et al., 2023). In addition, AI contributes to increased student motivation, improved study habits, and positive learning behaviors. It encourages active engagement, autonomy, collaboration, and sustained effort, all of which support the development of adaptive learning strategies and provide timely feedback to guide the learning process. By transforming instructional approaches, AI has the potential to significantly influence academic achievement, student motivation, and overall learning experiences. Nevertheless, the integration of AI into educational settings remains a complex endeavor, requiring careful planning, resource allocation, and alignment with pedagogical objectives to maximize its impact (Pertiwi et al., 2024).

The use of AI tools has been shown to enhance student performance by identifying struggling learners and providing targeted interventions to support academic improvement. Beyond individualized support, AI streamlines the educational process by managing tasks, assignments, and research projects, positioning students' work as central to the learning experience. By addressing longstanding challenges in conventional education, AI systems deliver timely and relevant information that facilitates effective learning, ultimately enhancing both process and outcomes. The integration of AI not only supports improved academic performance but also encourages technological advancement within educational institutions (Shrivastava, 2023). Moreover, AI-driven approaches reinforce positive learning behaviors, fostering student motivation and engagement in classroom activities. These systems adapt to diverse learning processes, accommodating complex factors that influence academic achievement. By providing tailored strategies and insights, AI enables educators to address the limitations of traditional teaching methods while optimizing student outcomes. The integration of AI tools into educational decision-making and instructional design empowers both teachers and students, offering empirical and data-driven guidance to monitor, evaluate, and enhance academic performance (Bressane et al., 2024).

CONCLUSION

The factors associated with artificial intelligence (AI) in relation to students' academic performance emphasize optimizing essential learning tasks and fostering deeper, more effective learning experiences. AI encourages students to articulate ideas and engage in critical thinking while providing accurate assessments and insights into the learning process. By offering adaptive learning mechanisms and personalized experiences, AI enables the customization of learning plans according to individual student needs, enhancing overall academic outcomes. AI also plays a pivotal role in identifying struggling learners, delivering targeted interventions, and supporting improvements in academic performance. It streamlines educational processes, including tasks, assignments, and research projects, positioning students' work as central to the learning experience. These functions reinforce positive learning behaviors, boost motivation, and encourage students to enhance performance in classroom settings. Moreover, AI contributes to the development of students' attitudes toward learning by promoting consistent engagement, aspiration, and the achievement of academic goals. It strengthens motivation toward study habits by guiding students in effectively managing their learning processes, fostering independent learning, and encouraging critical thinking. AI further provides adaptive learning mechanisms, guiding students through tasks, analyzing responses to assessments, and offering personalized feedback. By facilitating automated and inclusive learning, AI enhances both instructional delivery and student participation, ultimately contributing to improved learning outcomes and academic achievement.

Research Implications

As Artificial Intelligence (AI) technologies continue to advance rapidly, their integration into education and related sectors necessitates evidence-based policy guidance. The findings of this study, grounded in robust empirical analysis, provide a nuanced framework for policymakers to develop strategies that balance technological innovation with the promotion of human welfare. A critical area for policy intervention is the integration of AI within educational systems. The study highlights that students perceive AI as a tool capable of substantially enhancing academic performance. Consequently, policymakers should not only focus on allocating resources for AI adoption but also on establishing national standards that govern its implementation in education. Such standards could address curriculum personalization, ethical data use, and student privacy, ensuring that AI functions as a mechanism for educational equity rather than exacerbating disparities. Existing educational frameworks can be adapted to incorporate AI-specific guidelines, informed by current research and best practices. Notably, this study primarily examined the use of Generative AI, specifically ChatGPT, as a means to enhance academic performance. While this focus provides valuable insights, it limits the exploration of the broader spectrum of AI technologies. Future research should expand to include other AI applications, such as machine learning algorithms, predictive analytics, and adaptive learning systems, to evaluate their relative

effectiveness in improving student learning outcomes. By doing so, policymakers and educators can make more informed decisions regarding AI integration, maximizing its benefits while addressing potential challenges.

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