

“The Impact of Artificial Intelligence Usage on Academic Performance among University Students in Saudi Arabia”

Problem Statement

The rapid adoption of Artificial Intelligence (AI) technologies in higher education has opened new opportunities for enhancing learning experiences and academic performance. AI tools, including adaptive learning systems, intelligent tutoring, and generative AI applications, offer personalized learning, real-time feedback, and data-driven insights that can support student achievement (Chen, Chen, & Lin, 2020; Holmes, Bialik, & Fadel, 2019). Globally, studies indicate that AI can improve academic outcomes, particularly for students who require tailored learning support (Susnjak, Bakhshov, & Mathrani, 2025). However, evidence regarding the actual impact of AI on academic performance remains inconsistent. While some studies report positive effects, others highlight risks such as over-reliance, reduced critical thinking, and challenges in ethical use (Sajja, Sermet, Fodale, & Demir, 2025).

In the Saudi Arabian context, research on AI in higher education has primarily focused on students' perceptions, awareness, and adoption of AI tools (Almarsaad, Alajlan, & Alebaikan, 2024; Alharbi et al., 2024). Although these studies show high engagement and favorable attitudes toward AI, they rarely measure its direct impact on academic performance. Moreover, there is limited differentiation between types of AI applications, and few studies consider moderating factors such as digital literacy, motivation, or self-regulated learning that may influence the effectiveness of AI tools (Alotaibi et al., 2025; Alshammari et al., 2024).

Consequently, a significant research gap exists: the relationship between AI usage and actual academic outcomes among Saudi university students is not well understood. There is a critical need for empirical research that examines not only the frequency and types of AI tools used but also how these technologies interact with student-related factors to influence performance. Addressing this gap will provide evidence-based

insights that can guide educators, policymakers, and institutions in effectively integrating AI to enhance student learning and achievement in Saudi higher education.

Research Objectives

The overarching aim of this study is to empirically examine the impact of Artificial Intelligence (AI) usage on academic performance among university students in Saudi Arabia, while considering the type of AI tools used and the individual and contextual factors that may moderate their effectiveness. Building on this aim, the study establishes the following specific objectives, each divided into two complementary dimensions:

1. To assess the extent and patterns of AI usage among university students.

- Descriptive dimension: Identify the frequency, duration, and types of AI tools (e.g., generative AI, adaptive learning platforms, intelligent tutoring systems) utilized by students in academic activities.
- Analytical dimension: Explore how different usage patterns relate to students' engagement with learning tasks and academic behaviors.

2. To examine the relationship between AI usage and students' academic performance.

- Quantitative dimension: Measure the impact of AI usage on academic outcomes, including GPA and course performance.
- Interpretive dimension: Analyze whether AI usage enhances, diminishes, or has a neutral effect on academic achievement, considering the broader learning context.

3. To investigate the differential effectiveness of various AI tools in supporting learning outcomes.

- Comparative dimension: Compare the relative impact of different types of AI applications on students' academic performance.
- Contextual dimension: Assess which tools are most effective in specific academic tasks and disciplines.

4. To evaluate the role of student-related factors in moderating the impact of AI on academic performance.

- Behavioral dimension: Examine how digital literacy, motivation, self-regulated learning, and prior academic experience influence the effectiveness of AI usage.
- Cognitive dimension: Explore the extent to which students' skills in critical thinking, problem-solving, and information synthesis mediate the relationship between AI engagement and learning outcomes.

5. To identify challenges, limitations, and ethical considerations associated with AI usage in higher education.

- Practical dimension: Examine issues such as over-reliance on AI, accessibility, and integration challenges in academic workflows.
- Policy dimension: Evaluate the implications for ethical use, institutional guidelines, and strategies to maximize benefits while minimizing risks to academic integrity.

Literature Review

The integration of Artificial Intelligence (AI) in higher education has emerged as a transformative force, reshaping teaching methodologies, learning experiences, and assessment practices. As a researcher, I find that the existing body of literature reflects both optimism regarding AI's potential and concern about its implications for students' academic performance. However, a critical synthesis of prior studies reveals significant gaps, inconsistencies, and contextual limitations—particularly within the Saudi Arabian higher education landscape.

From a global perspective, AI has been widely recognized as a tool capable of enhancing personalized learning and improving academic outcomes. Chen, Chen, and Lin (2020) argue that AI-driven educational systems, such as adaptive learning platforms, enable the customization of instructional content according to individual learner needs, thereby improving learning efficiency and academic achievement. Their review highlights that AI facilitates real-time feedback, predictive analytics, and

intelligent tutoring, all of which contribute to improved learning performance. Similarly, empirical evidence from recent experimental and quasi-experimental studies indicates that AI-supported interventions can positively influence students' academic trajectories by reducing failure rates and enhancing cumulative grades, particularly among at-risk students (Susnjak et al., 2025).

Despite these promising findings, the literature also presents a more complex and sometimes contradictory picture. While AI tools are associated with improved accessibility and efficiency in learning, scholars have raised concerns about their potential negative effects on higher-order cognitive skills. Research examining AI-powered learning assistants suggests that although students perceive these tools as useful for completing assignments and understanding concepts, there are significant concerns related to over-reliance, reduced critical thinking, and ethical ambiguity in their use (Sajja et al., 2025). This duality positions AI as a “double-edged sword,” where its benefits are contingent upon how it is integrated and utilized within the learning process.

Within the Saudi Arabian context, research on AI in higher education is rapidly evolving but remains relatively fragmented. A growing number of studies have explored students' perceptions, awareness, and acceptance of AI technologies. For instance, Almassaad, Alajlan, and Alebaikan (2024) found that Saudi university students demonstrate high levels of awareness and positive attitudes toward generative AI tools, recognizing their role in improving understanding, enhancing skills, and facilitating learning outcomes. Similarly, large-scale survey-based research involving students from multiple Saudi universities indicates that learners perceive AI tools as valuable for improving academic performance and completing assignments more efficiently (Alharbi et al., 2024).

However, these perception-based studies do not necessarily translate into evidence of actual academic improvement. More recent empirical investigations have attempted to bridge this gap. For example, a study examining AI tool usage in the Ha'il region of

Saudi Arabia found a significant relationship between AI-enabled student engagement and academic performance, mediated by psychological factors such as motivation and self-efficacy (Alotaibi et al., 2025). This finding suggests that AI does not directly influence academic outcomes in isolation but operates through complex behavioral and cognitive mechanisms.

In a similar vein, research focusing specifically on generative AI tools such as ChatGPT within Saudi universities indicates that students' academic performance is influenced by how effectively these tools align with their learning tasks and technological competencies. A recent study employing the Technology-to-Performance Chain framework demonstrated that the effectiveness of AI tools depends on the fit between technology capabilities and user needs, rather than mere usage frequency (Alshammari et al., 2024). This reinforces the argument that AI usage alone is not a sufficient predictor of academic success.

Moreover, studies examining AI-based assessment systems in Saudi universities highlight both opportunities and challenges. Alenezi and Alenezi (2025) found that AI-powered formative assessment can enhance students' writing performance and engagement by providing immediate and personalized feedback. However, their findings also reveal limitations related to cultural adaptation, language processing accuracy, and unequal access to digital infrastructure across institutions. These results underscore the importance of contextual factors in determining the effectiveness of AI in education.

Another important strand of literature focuses on the broader institutional and pedagogical implications of AI adoption. Research conducted across Saudi higher education institutions indicates that AI integration is positively associated with student engagement, academic performance, and retention rates ($\beta = 0.25, p < 0.01$), suggesting a statistically significant but moderate effect (Alharbi et al., 2025). However, this relationship is not uniform and may vary depending on institutional readiness, faculty support, and students' digital competencies.

Despite these contributions, several critical gaps remain evident. First, many studies in the Saudi context rely heavily on cross-sectional survey designs, limiting their ability to establish causal relationships between AI usage and academic performance. Second, there is insufficient differentiation between types of AI technologies, with most studies treating AI as a homogeneous construct rather than examining the distinct effects of tools such as generative AI, adaptive learning systems, and predictive analytics. Third, there is a lack of longitudinal and mixed-methods research that captures both quantitative outcomes and qualitative experiences of students.

Furthermore, the existing literature often overlooks key moderating variables such as self-regulated learning, ethical awareness, and digital literacy, which may significantly influence how students interact with AI tools and how these interactions affect academic performance. As highlighted in recent international research, the effectiveness of AI in education is deeply embedded in the socio-technical context, where human, technological, and institutional factors interact dynamically (Sajja et al., 2025).

In synthesizing the literature, it becomes evident that while AI holds substantial promise for enhancing academic performance, its impact is neither straightforward nor universally positive. The relationship between AI usage and academic achievement is complex, context-dependent, and mediated by multiple factors. In the Saudi Arabian context, although awareness and adoption of AI technologies are high, there remains a lack of comprehensive empirical evidence that directly links AI usage to measurable academic outcomes.

This review thus highlights a critical need for a more nuanced and context-specific investigation that goes beyond perception-based analyses and examines the actual impact of AI usage on academic performance among university students. Such an investigation should account for different types of AI tools, incorporate relevant moderating variables, and employ robust methodological approaches to provide a deeper understanding of this evolving phenomenon.

References

- Alenezi, A., & Alenezi, A. (2025). AI formative assessment in Saudi education: A study across universities. *Journal of Teaching and Learning*, 19(4).
<https://doi.org/10.22329/jtl.v19i4.10012>
- Almarsaad, A., Alajlan, H., & Alebaikan, R. (2024). Student perceptions of generative artificial intelligence in higher education. *Systems*, 12(10), 385.
<https://doi.org/10.3390/systems12100385>
- Alotaibi, F., et al. (2025). The impact of AI tools enabled student engagement on academic performance, employability, and empowerment in Saudi Arabia. *Acta Psychologica*.
<https://doi.org/10.1016/j.actpsy.2025.106103>
- Alshammari, M., et al. (2024). Artificial intelligence powering education: ChatGPT's impact on students' academic performance. *Journal of Applied Research in Higher Education*.
<https://doi.org/10.1108/JARHE-04-2024-0179>
- Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264–75278. <https://doi.org/10.1109/ACCESS.2020.2988510>
- Susnjak, T., Bakhshov, K., & Mathrani, A. (2025). Stabilising learner trajectories: AI-guided student support. *arXiv*. <https://arxiv.org/abs/2512.11154>
- Sajja, R., Sermet, Y., Fodale, B., & Demir, I. (2025). Evaluating AI-powered learning assistants in higher education. *arXiv*. <https://arxiv.org/abs/2506.05699>
- Alharbi, M., et al. (2025). AI integration in higher education: Trends and implications from Saudi Arabia. *International Journal of Human–Computer Interaction*.
<https://doi.org/10.1080/10447318.2025.2526578>
- Alharbi, S., et al. (2024). AI applications and student usage in Saudi higher education. *Eurasian Journal of Educational Research*.
<https://ejer.com.tr/manuscript/index.php/journal/article/view/1854>