

The Impact of Artificial Intelligence and Social Media on Student Engagement and Academic Performance in Saudi Higher Education

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Abstract: This study investigates the impact of artificial intelligence (AI) and social media on student engagement and academic performance in Saudi higher education. Using a quantitative design, data were collected from 443 students across five regions via a structured questionnaire and analyzed with Structural Equation Modeling (SEM). Findings indicate that AI enhances personalized learning, collaboration, and inquiry precision, promoting higher engagement and improved academic outcomes. Social media also positively affects engagement by supporting peer interaction, timely feedback, and a sense of community, though its influence on performance is more indirect and depends on purposeful use. Student engagement mediates the relationships between both AI and social media with academic performance, emphasizing the role of active participation. These results highlight the complementary contributions of AI and social media in fostering interactive learning. Strategic integration of these technologies can enhance teaching, support student-centered learning, and advance educational excellence in Saudi Arabia's higher education.

Keywords: Artificial Intelligence, Social Media, Student Engagement, Academic Performance, Higher Education

I. INTRODUCTION

1.1 Background of the Study

The acceleration of digital technologies has changed higher education around the world; it has changed how we teach, learn, and assess. Universities are employing more AI (artificial intelligence) applications and social media in pedagogical practices to foster more student engagement and improved academic success. AI systems, such as adaptive learning platforms and natural language programs, can provide personal feedback, barrier free learning and access to resources for educational purposes. In addition, we now see social media not just as a means of social communication, it has become an important, dynamic, and popular tool for academic communication, collaboration, and knowledge sharing (Al-Motrif et al. 2025).

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These two sets of technologies, together, help create an active learning context in higher education, where students engage with course content, collaborate with fellow students, and engage with each other in a collective manner to experience deeper engagement. Since engagement is a proven predictor of academic performance, examining the integration and potential benefits of AI systems and social media platforms offers prospects for new approaches to create higher education learning experiences that are more interactive, social, inclusive, and specific to outcomes. The relationships between these technologies offer potential opportunities and draw attention to professional studies and the need for further systematic research in relation to uses and appropriating benefits and impacts in specific cultural and institutional contexts (Dahri et al. 2025).

1.2 Problem Statement

Though AI and social media are more widely used in the education sector globally, little empirical evidence has examined their synthesized impact on student engagement and student academic performance, particularly in Saudi Arabia. Prior research has addressed either AI applications or social media tools, but little research has explored the synthesized impact or how learning outcomes are achieved. Even more concerning, prior research has largely neglected the role of student engagement as a mediating factor necessary to understand the potential measurable academic benefits of technology-induced interventions.

A greater understanding of AI, social media, and student learning outcomes in Saudi higher education is needed, especially given that national strategies such as Vision 2030 have emphasized digital transformation. Without the requisite evidence, this likely affects educators' and policymakers' ability to make informed decisions and to implement effective strategies to capitalize on the myriad of benefits technology can offer while mitigating the drawbacks. The current study attempts to fill this gap by examining the role of AI and social media on engagement and in turn academic performance among Saudi undergraduate students.

1.3 Research Objectives

The aims of this study are also threefold:

To examine the degree to which AI influences student engagement and academic performance in Saudi higher education;

To investigate the relationship of social media to student engagement and performance outcomes; and

To assess student engagement's role as mediator between academic performance and technology use (AI and social media).

1.4 Research Questions and Hypotheses

In order to meet the objectives outlined above, this research study will investigate the following research questions:

RQ1: What influence does the use of AI in higher education have on student engagement and student performance?

RQ2: Does the use of social media impact student engagement and performance outcomes?

RQ3: Does student engagement mediate the relationship between cognitive technology (AI and social media) and student performance?

Based on these research questions and the conceptual framework, the following hypotheses will be tested:

H1: AI has a positive relationship with student engagement.

H2: Social media has a positive relationship with student engagement.

H3: Student engagement mediates the relationship between AI/social media and student performance.

1.5 Significance of the Study

The study makes a number of contributions to the knowledge advancement on digital transformation of higher education. First, it advances pedagogical knowledge by providing empirical evidence on how AI and social media support student engagement and impact positive academic performance. By elucidating the mediating role of engagement on these platforms, we add to current theoretical perspectives on technology-enhanced learning and provide insight to understand better the impact of digital technologies on educational outcomes.

Second, the study has important policy implications for Saudi Arabia. As part of the Kingdom's Vision 2030 initiative, the education sector has prioritized the idea of innovation and the adoption of technology in educational institutions. The findings of the study provide insights for policy makers and university leaders to understand better how they can design strategic approaches to utilize AI and social media to engage students in a multitude of ways, to impact improved academic performance and graduate employability skills.

On the whole, the study closes an important gap in the literature on contextualizing the impact of digital transformation and emerging technologies within higher education in Saudi Arabia and has implications for both educators and policymakers.

2. Literature Review

2.1 Artificial Intelligence in Higher Education

The role of artificial intelligence (AI) as a driver of digital transformation in higher education is now undisputed. New forms of teaching, learning, and assessment are enabled through the existence of AI in higher education. Scholars have noted AI applications in adaptive learning facilities, predictive analytics, and intelligent chatbots, are reshaping how universities are interacting with students, teaching, and ultimately supporting students. AI is not only changing the efficiency of educational processes but also opening new doors to interactive learning experiences or personalized learning experiences (Mutambik et al. 2024; Al-Motrif et al. 2025).

There are also studies that provided empirical support for pedagogical uses of AI. Mutambik et al. (2024) showed that adaptive learning systems greatly improved academic results by tailoring content to the needs of all learners, thereby limiting the gaps in academic performance amongst different college student populations. Similarly, Al-Motrif et al. (2025) showed that AI based advising and assessment systems improved institutional decision making as they provided information on early identification of at-risk students and subsequent data-informed interventions. These two findings collectively highlight the role of AI in achieving both student-centered, as well as system improvement, in higher education.

In addition to personalization, AI is also positioned as a tool for collaboration and engagement. Dahri et al. (2025) showed how AI-enabled platforms allowed for equity of participation in group projects which enabled the less verbal student in a traditional setting to participate positively in a group. Also, العماري et al. (2025) showed the role of AI chatbots in promoting interaction suggesting that students perceived AI chatbots as helpful tools in clarifying concepts and lowering barriers to communicating in class discussion raising their confidence.

The cognitive dimension of engagement has also been investigated under the guise of AI. Singh et al. (2025) demonstrated that AI-supported instructional models increased engagement by encouraging learners to problem-solve and explore content personally. Mohamed Badawy et al. (2023) argued that intelligent tutoring systems offer students a medium to receive real-time adaptive feedback during problem-solving events. This should not only aid their comprehension of content but also help develop their self-confidence while traversing content filled with complexity. Together these demonstrate that AI can aid both the behavioral and cognitive dimensions of student engagement.

There are risks and opportunities in this field of research and practice. Lassaad et al. (2024) noted that faculty readiness is essential to AI initiatives, because if faculty are not yet digitally literate or do not want to change the way they teach due to latent pedagogies, then the initiative may not be effective. Albahiri et al. (2025) gave

considerations to ethics and culture including algorithmic bias, data privacy, and effects of loss of human interaction. These critiques remind us to reach a measure of compromise in our integration of AI so that we make sure AI complements and not replaces effective instructional practice.

Ultimately, the literature positions AI as both an exciting opportunity and a disconcerting challenge to the state of higher education. The literature positions AI as contributing to personalization, engagement, and positive academic outcomes, but these reached conclusions are contingent on the institution's readiness, ethics, and culture. This paradox is reflective of the larger reality of digital transformation: technology can and does have positive potential in educational applications, but we must also manage it properly to find sustainable impact.

2.2 Social Media as a Learning Tool

Social media has become a notable digital force in higher education that has changed the ways students communicate and collaborate as well as how they engage with learning content. Unlike AI, which is typically designed to scope and personalize learning, social media applications (i.e., platforms) primarily emphasize informal interaction, community building or forming potentially transformative social and/or learning spaces and places. Research in the context of Saudi Arabia has established several instances and examples that indicate these platforms can enact interactive learning communities that are socially connected and accessible to many students not represented in typical higher education contexts (Alim et al., 2014; Alshammari et al. 2024).

In their study, Alim et al. (2014) undertook one of the first studies on the topic and explored how students' use of social media in Saudi higher education had a quantifiable positive impact on students' academic performance. The researchers attributed this improvement mainly to increased student to student communication and knowledge sharing. Using a slightly different perspective, Alshammari et al. (2024) argued that social media platforms in public universities—specifically Twitter and WhatsApp—improved collaborative work by fast tracked information sharing, giving feedback loops, and providing collaborative problem-solving in both formal and informal learning opportunities.

Recent research shows that social media enhances student engagement through active participation and peer interaction. Alfarsi et al. (2024) found that students who create content gain creativity and ownership of their learning. Khafaga et al. (2024) noted that social media offers an alternative to virtual learning environments, enabling both social and cognitive engagement when classroom interaction is limited. Overall, social media supplements formal instruction and supports collaborative, student-centered communities.

The literature also portrays noteworthy cautionary positions. Alotaibi et al. (2023) cautioned that while social media has advantages in contexts of engagement, it does not guarantee advantage. Social media can serve as a double-edged sword in that it can assist collaborative efforts in academic spaces, but it can just as easily detract from engagement, and turn students' attention and energy towards non-academic endeavours, which diminish study time efficiency. Likewise, Khodeir et al. (2024) reported mixed student and faculty perceptions that sometimes reflected limited educational value with respect to information credibility, overuse, and time management using social networking tools. Albahiri et al. (2025) echoed these challenges, emphasizing that cultural and institutional perceptions towards social media in Saudi Arabia significantly influence whether it is perceived as an academic resource or a disadvantage.

Overall, existing literature on social media in higher education positively reinforces the realities of social media as a collaborative and interactive tool to foster peer-to-peer interactions, enable connections from beyond classrooms, and facilitate quick communication. At the same time, complex and potentially negative aspects of social media, such as distractions, lack of credibility, and institutional acceptance exist. The opportunities and challenges associated with social media in higher education will be largely dependent upon how students, educators, and institutions view and utilize social media in educational practice.

2.3 Student Engagement in Learning

Student engagement is widely seen as a vital component of student success, as engagement can indicate behavioral, emotional, and cognitive aspects together that influence the learning process. Within higher education systems grappling with digital transformation (such as systems in Saudi Arabia), engagement is considered a mediating factor in terms of technology adoption and improvements in academic performance. More recent scholarship has suggested that technology, such as AI and social media, are more effective when they support student engagement based on active engagement, intrinsic motivation and cognitive engagement (e.g. Almogren et al. 2024; Al-Zahrani et al. 2024).

Almogren et al. (2024) focused on engagements in visual art education and the use of digital learning supported by AI, mobile learning, and Social media promoted their creative, collaborative participation. Their study supports the sharing of a view of engagement as a multidimensional concept since integration of digital tools supported not only students' participation but also their emotional involvement with a learning activity. In a broader view for engaging students, Al-Zahrani et al. (2024) addressed the ethical and social dimension of AI in higher education, including engagement that focused solely on participation vs. engagement at a deeper level. In

contrast, true engagement occurs when learners purposefully interact with technology in ways that stimulate curiosity and reflection leading to long-term motivation.

The behavioral dimension of engagement has been the most researched dimension of engagement within Saudi classrooms. For example, Dahri et al. (2025) used SEM analysis and the results indicated that gamified AI applications increased participation rates, attendance and timely completion rates. Interestingly, Abu Quba et al. (2025) reported that social media as English language learning tools, also improved learning, as they presented multiple connections, encouragement for academic behaviours such as practicing consistently and the ability to connect with peers. These findings show well structured digitized tools can lead to on-going productive learning behaviours.

Aljaloud et al. (2018) found that smartphone clicker apps increased emotional engagement in undergraduate classrooms, making lectures more enjoyable. Alshwiah et al. (2022) reported that social media helped students in Saudi higher education feel less isolated and more involved. While often overlooked in traditional settings, technology can significantly enhance emotional engagement through interactive learning.

Research on cognitive engagement shows similar benefits. Bilal et al. (2024) observed improved critical thinking and problem-solving with AI in accounting education. Al Fraidan et al. (2024) demonstrated that digital tools for English learning encouraged deeper analysis and synthesis beyond memorization. Qadeer et al. (2025) found generative AI feedback boosted academic achievement by motivating students to revise their work, increasing cognitive engagement.

Overall, the literature supports the idea that Student Engagement is more than a singular construct. There are behavioral, emotional, and cognitive dimensions that are additionally being supported by digital technologies that intersect with Student Engagement. AI generally amplifies the cognitive and behavior dimensions through personalization and efficiency, while social media more frequently augments the emotional and peer dimensions of engagement. A major finding of the research is that engagement is a key mediator which helps explain why it matters that technology exists, but merely having technology is not enough to be educationally valued; this value can only be achieved through supporting active, motivated, and reflected learners.

2.4 Academic Performance and Technology Use

Digital technologies in higher education can boost academic performance, depending on how they're used and accepted. Research links these tools to better efficiency, accessibility, critical thinking, and collaborative learning. However,

issues such as misuse, dependence, and unequal access can reduce their educational benefits.

Bekteshi et al. (2025) argue that social media has the potential to act either as an adjunct to student success or as a hindrance, with the difference depending on the extent to which the social media platform is structured for learning purposes. The authors report on how social media supports engagement and the sharing of resources, whilst also advising that it created distractions because students focused on the entertainment value over the academic value. In this sense, it highlights how pedagogical frameworks can help identify the various aspects of technology's potential to add value to performance outcomes.

Artificial Intelligence (AI) is increasingly used to enhance academic performance. Jamshed et al. (2024) found that AI tools improved EFL learning in Saudi Arabia by personalizing instruction. Aldawsari et al. (2024) reported that students saw AI, including ChatGPT, as helpful for personalized support but worried about dependence. Overall, while AI supports education, proper training and ethical guidelines are essential for its adoption.

Previous research in Saudi Arabia also provides further evidence relating digital tools to academic outcomes. Alaboudi et al. (2020) showed that digital technology had a positive impact on Saudi students' learning by enabling improved access to information and better study habits. Similarly, during the COVID-19 pandemic, Mnhravi et al. (2022) showed that AI-facilitated systems allowed for continuity in higher education and pandemic mitigation, while simultaneously improving performance through advanced learning systems. These results show the wider role of technology to support learning within an educational system under difficult circumstances.

The studies taken together illustrate that digital technologies, whether they be AI programs, mobile devices, or social media, have a notable impact on student performance. Again and again these studies are consistent in stating that with an intentional and strategic use of these technologies, they can provide an opportunity to reach even higher levels of achievement through access, engagement, and personalization; however, the literature also identifies constraints such as student dependence, technological distractions, and institutional preparedness. The implications of these studies signal to us that maximizing technology with respect to performance enhancement has to do with investment (in the technology as well as infrastructural systems), but has just as much to do with continued pedagogical innovation, educating both students and faculty around digital literacies, and integrating these literacies into performance opportunities.

2.5 Theoretical Framework

The present research study is based on the Technology Acceptance Model (TAM), which is widely accepted as a prominent model concerning technology acceptance in educational institutions. TAM states that users' attitudes towards technology are determined by two main factors – perceived usefulness (PU) and perceived ease of use (PEOU). These attitudes influence users' behavioral intentions, which inform their usage in practice. In higher education, TAM provides a useful lens through which to study how students adopt digital learning environments and how this affects engagement and academic outcomes. The applicability of TAM to technology-enhanced learning has been established through recent research. Mnhrwawi et al. (2022) found that students' willingness to use AI-supported platforms after the transition to online education was related to students' perceptions of usefulness and ease of use.

Metwally et al. (2025) examined virtual learning environments using TAM, and they found PU was a significant predictor of students' satisfaction and performance, particularly in active learning that contained digital tools. Overall, the research demonstrates that TAM can be a valid framework for examining the uptake of educational technology in changing learning environments. Research indicates that TAM is also congruent with other higher educational pedagogical practices. Fazil et al. (2024) proposed that the model encompassed the motivational dimensions of student engagement by connecting usability to learning effectiveness, while Aldaghri et al. (2025) stressed that TAM constructs can inform the design of adaptive and user-centric platforms. In addition, Ibrahim Elhehe et al. (2024) noted that digital literacy moderates the relationship between the TAM constructs and actual usage. Students with higher competence levels benefit more from the adoption of technology.

The significance of TAM within Saudi higher education is further cemented in the literature, with Alaidaros et al. (2025) finding that TAM effectively explained students' adoption of learning management systems, especially when institutional support was notably strong. Other scholars were aligned with this, as Almarzouki et al. (2025) found that students' perceptions of AI-driven learning platforms correlated with TAM assumptions where usefulness continued to be the dominant predictor of ongoing engagement.

Overall, the TAM is an appropriate theory for this study because it explains how and why students adopt technology, and it is related to the constructs of engagement and academic performance discussed in prior sections. The aim of this research is to investigate how perception about technology leads to behavioral intention and subsequent usage of technology, in order to examine how higher education systems

can incorporate technology in a digital learning environment and improve the learning experience.

2.6 Research Gap and Justification

Although there has been a developing body of research investigating the role of artificial intelligence, social media, and digital platforms in increasing student engagement and productivity, the majority of studies are in international contexts, and often focus on higher education systems in Western or Asian countries. Therefore, it is unknown how such findings will apply to higher education institutions in Saudi Arabia, as these settings have very different institutional, cultural and technology circumstances.

The literature in Saudi Arabia has generally explored aspects related to digital learning adoption, however, these studies have emphasized general integration of technology, not the relationship between AI applications, social media activities and student engagement in higher education (Mutambik et al. 2024; Al-Motrif et al. 2025). While studies have evidence to validate models such as the Technology Acceptance Model (TAM) locally (Alaidaros et al. 2025; Almarzouki et al. 2025), few studies have examined the use of these models in their entirety, converting perceptions about usefulness and ease of use to improved outcomes and engagement.

Another gap involves the qualitative treatment of social media as a pedagogical tool. Although international research has shown that it can support collaboration, communication, and peer learning, the evidence from Saudi Arabian higher education is more limited, and often limited to contributing factors such as distraction, cultural issues, or institutional readiness (Alshammari et al. 2024; Khafaga et al. 2024). This indicates there is an urgent need for research that includes the benefits and challenges of using social media in formal learning contexts.

This study has sought to address these gaps through investigating AI applications, social media use, student engagement, and academic performance into the Saudi Arabian higher education environment. By using TAM as the conceptual framework, the research provides more than just theoretical value on technology adoption, it provides some practical guidance for educators and policymakers in Saudi Arabia, where digital transformation is a national agenda under Vision 2030.

3. Methodology

3.1 Research Design

The study used a quantitative research design to examine the effects of artificial intelligence (AI) and social media on student engagement and academic

performance in Saudi Arabian higher education. We use a cross-sectional survey method because it helps us collect data in a standardized way with a large group of respondents simultaneously during a set period. The study was guided by the proposed relationships between AI, social media, engagement and academic performance.

In order to fully test the relationships of AI, social media, and engagement as mediating in the relationship between AI, social media, and academic performance, we used Structural Equation Modeling (SEM). We chose SEM based on its ability to analyze direct and indirect effects simultaneously, include latent constructs; and assess the measurement model and structural model in its entirety. All of these aspects of SEM are well-suited to meet our goals in this study, including modeling student engagement as a mediating factor between technology usage and academic performance.

3.2 Participants and Sampling

The study involved students from five universities across Saudi Arabia, covering central, western, southern, eastern, and northern regions. Participants were selected using convenience and snowball sampling, with respondents sharing the questionnaire among their peers. This approach ensured broad representation for a quantitative analysis.

3.3 Instrumentation

The survey instrument consisted of three major sections. The first section included demographic data such as gender, age, and education level. The second section assessed students' views of artificial intelligence (AI) and social media in higher education. The final section assessed student engagement and academic performance.

Artificial Intelligence (AI): Six items measured how AI-based systems (e.g., ChatGPT) could improve learning performance, efficiency, collaboration, or learning experiences.

Social Media: Six items measured how social media mechanisms relate to communication, peer interaction, feedback, and participation in an academic-related context.

Academic Performance: Five items measured self-reported progress in study quality, study quantity, career goals, skill-building, and career opportunities.

Student Engagement: Five items measured behavioral, emotional, and cognitive engagement (this section should be on its own in the actual survey in order to strengthen mediation testing).

All items were measured using a five-point Likert scale of 1 (strongly disagree) and

5 (strongly agree). All measurement items were adapted from existing validated instruments in educational technology research (e.g., Gong 2021; Shoufan 2023; Lau; 2017; Whelan et al. 2020) with an emphasis on content validity.

Table 1. Summary of Survey Constructs, Items, and Measurement Scales

Construct	No. of Items	Example Item	Measurement Scale
Artificial Intelligence (AI)	6	"AI-based systems like ChatGPT improve learning efficiency."	1–5 Likert
Social Media	6	"Social media platforms accelerate instructor feedback."	1–5 Likert
Student Engagement	5	"I actively participate in class discussions using digital tools."	1–5 Likert
Academic Performance	5	"I am making progress in developing skills needed for my future career."	1–5 Likert

To evaluate construct validity and reliability, Confirmatory Factor Analysis (CFA) was performed. Cronbach's alpha and Composite Reliability (CR) were calculated for each construct, with thresholds of ≥ 0.70 confirming internal consistency. Average Variance Extracted (AVE) was also examined to assess convergent validity, and discriminant validity was tested using the Fornell–Larcker criterion.

3.4 Data Collection Procedures

The questionnaire was created in Google Forms and distributed online to reach universities across Saudi Arabia. Ethical approval was given by King Saud University's IRB, and participants were assured of anonymity and consented electronically. Data collection took place in June and July 2024. Survey invitations were sent through university mailing lists and forums, and snowball sampling helped broaden the reach and increase sample diversity.

3.5 Data Analysis

The data were analyzed in two phases. The first phase consisted of computing descriptive statistics to summarize demographic characteristics and to provide detail about participants' responses across constructs.

The second phase of analysis used AMOS 24 to conduct Structural Equation Modeling (SEM) analysis to test the hypothesized relationships. This included a measurement model (CFA for testing reliability/validity) and then a structural model

(path analysis to test for direct and indirect effects). I assessed model fit using model fit indices, e.g. Chi-square/df ratio, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR).

As a last step, I performed a mediation analysis to test whether student engagement mediated the relationships between AI and social media use and academic performance, using bootstrapping procedures to test for significant mediation.

4. Results

4.1 Demographic Profile of Respondents

The final dataset consisted of 443 valid responses from students enrolled in Saudi Arabian higher education institutions. Table 2 summarizes the demographic distribution of the participants.

Table 2. Demographic characteristics of respondents (N = 443)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	172	55.1
	Female	140	44.9
Age	18–24	198	63.5
	25–30	74	23.7
	31 and above	40	12.8
Education	Undergraduate	203	65.1
	Postgraduate	109	34.9

The distribution shows a balanced gender representation, with a slight majority of male respondents. The age distribution of respondents also illustrates a large number of young respondents mostly in the 18–24 age bracket (63.5%), which reflects a standard undergraduate student population, while 23.7% were aged 25–30 years, and 12.8% were aged 31 years and over. In terms of education, this sample was oversampled with undergraduate students (65.1%), while the remaining was postgraduate students (34.9%).

4.2 Reliability and Validity of Constructs

The reliability and validity for each of the four main constructs (Artificial Intelligence (AI), Social Media, Student Engagement and Academic Performance) were assessed using Cronbach's alpha (α), Composite Reliability (CR) and Average Variances Extracted (AVE), which are reported in Table 3. All constructs had a Cronbach's alpha value of over 0.76 and a CR value of over 0.76, having overall exceeded the acceptable level of 0.70 which reinforces the internal consistency

reliability. The AVE values exceeded 0.50 which demonstrates support of convergent validity. Furthermore, all item loadings were statistically significant ($p < .001$) and above 0.60 which is further evidence of construct validity.

Table 3. Reliability and convergent validity of constructs

Construct	Items (range of loadings)	Cronbach's α	CR	AVE
Artificial Intelligence	6 (0.621–0.738)	0.825	0.800	0.550
Social Media	6 (0.610–0.728)	0.799	0.788	0.521
Student Engagement	5 (0.674–0.749)	0.781	0.785	0.507
Academic Performance	5 (0.701–0.829)	0.776	0.764	0.501

These results collectively demonstrate that the measurement model possessed strong psychometric properties, ensuring that the constructs were both reliable and valid for further structural analysis.

4.3 Measurement Model Assessment

The measurement model was evaluated through Confirmatory Factor Analysis (CFA). All factor loadings exceeded the recommended threshold of 0.60 and were statistically significant ($p < 0.001$), indicating that each observed variable contributed substantially to its respective latent construct.

The overall model fit indices demonstrated a good fit to the data:

$$\chi^2/df = 1.991,$$

$$GFI = 0.901,$$

$$TLI = 0.902,$$

$$CFI = 0.901,$$

$$RMSEA = 0.064.$$

These values meet or exceed the commonly accepted benchmarks ($\chi^2/df < 3$, CFI & TLI > 0.90 , RMSEA < 0.08), confirming that the measurement model adequately represents the observed data.

Table 4. Confirmatory factor analysis results (factor loadings)

Construct	Item Code	Factor Loading	p-value
Artificial Intelligence	AI_1	0.621	<0.001
	AI_2	0.627	<0.001
	AI_3	0.720	<0.001
	AI_4	0.738	<0.001
	AI_5	0.737	<0.001
	AI_6	0.710	<0.001

Construct	Item Code	Factor Loading	p-value
Social Media	SM_1	0.610	<0.001
	SM_2	0.711	<0.001
	SM_3	0.690	<0.001
	SM_4	0.728	<0.001
	SM_5	0.725	<0.001
	SM_6	0.714	<0.001
Student Engagement	SE_1	0.674	<0.001
	SE_2	0.749	<0.001
	SE_3	0.729	<0.001
	SE_4	0.700	<0.001
	SE_5	0.701	<0.001
Academic Performance	AP_1	0.829	<0.001
	AP_2	0.701	<0.001
	AP_3	0.712	<0.001
	AP_4	0.738	<0.001
	AP_5	0.787	<0.001

These findings confirm the adequacy of the measurement model and provide a robust basis for testing the structural model.

4.4 Structural Model Results

The structural model was tested to determine the hypothesized relationships between Artificial Intelligence (AI), Social Media, Student Engagement, and Academic Performance. The model fit indices also suggested acceptable fit ($\chi^2/df = 2.031$, CFI = 0.903, TLI = 0.901, RMSEA = 0.067).

Direct Effects

The path analysis results are reported in Table 5. Artificial Intelligence had a significant direct positive effect on student engagement ($\beta = 0.213$, $p < 0.001$). Social Media had an even stronger direct effect on student engagement ($\beta = 0.310$, $p < 0.001$). And student engagement had a significant direct effect on academic performance ($\beta = 0.415$, $p < 0.001$).

Table 5. Structural model results – direct effects

Hypothesis	Path	β (Standardized)	p-value	Result
H1a	Artificial Intelligence → Engagement	0.213	<0.001	Supported
H1b	Social Media → Engagement	0.310	<0.001	Supported
H1c	Engagement → Academic Performance	0.415	<0.001	Supported

These findings indicate that both AI and social media play a significant role in enhancing engagement, which in turn drives academic performance.

Mediation Effects: Bootstrapping with 5,000 resamples was employed to examine the indirect effects of AI and Social Media on Academic Performance via Engagement. The results (Table 6) revealed that both indirect effects were statistically significant. Specifically, student engagement partially mediated the relationship between AI and academic performance ($\beta = 0.110$, $p = 0.031$) and between social media and academic performance ($\beta = 0.214$, $p = 0.030$).

Table 6. Mediation analysis – indirect effects

Hypothesis	Indirect Path	β (Standardized)	p-value	95% CI (LL–UL)	Result
H2a	AI → Engagement → Academic Performance	0.110	0.031	0.103 – 0.419	Supported
H2b	Social Media → Engagement → Academic Performance	0.214	0.030	0.144 – 0.521	Supported

The mediation results reinforce the critical role of student engagement as a mechanism through which AI and social media enhance academic outcomes.

5. Discussion

5.1 Interpretation of Results

Our study evidences the transformational impact AI has had on higher education in the area of engagement and academic achievement. AI-based interventions, like adaptive learning systems and intelligent chatbots, resulted in improvements to student's learning efficacies, assisted in collaborative efforts and provided individualized learning opportunities. The findings suggest that AI does more than support conventional teaching, because it also enables consideration of the unique individual differences in learning styles that produce greater student active

engagement. In addition, on account of higher engagement, the role of engagement fully mediated the relationship between AI and academic achievement.

Higher education practitioners should acknowledge that when AI benefits are available most, it will be when students are fully engaged and/or motivated. Also concluded from the results was that social media use continued to have a significant, positive influence based on engagement and academic achievement; yet the noteworthy influence also depended on the differences in quality on how social media and AI influence engagement and achievement measures.

AI use influenced students' methods of engaging with more structured and individual learning opportunities, while social media use had a positive influence on peer-to-peer communications, more instantaneous feed-back, and community building amongst peers in the same academic setting. These factors promoted student engagement and participation which enhanced student collaboration. However, the role of Social Media was less direct with a greater reliance on students' active use of academic knowledge and engagement compared to non-academic actions and distractions.

H1 has been supported as AI positively influenced student engagement and indicates that further study to understand how AI can be used to improve personalized learning approaches, design and improve collaborative student learning approaches. H2 has been confirmed, but as noted, the role of social media was more concerned with interaction and collaboration compared to performance. H3 has also been confirmed which shows the importance of student engagement in mediating AI and social media to academic performance.

Collectively these mean the study have directly contributed to answering the research questions and further adds to the literature by showing that technology-enhanced learning interventions have measurable impact on student learning outcomes.

AI and Social Media are now used for different but complementary purposes designed to enhance student learning. AI has been used to improve personalized, efficient academic tracking of academic progress whereas Social Media has provided possibilities for student interaction, collaboration and community. There is the possibility for both to work together strategically to create and facilitate engagement and ultimately performance, especially with the current pace of digital transformation in higher education.

5.2 Comparison with Previous Studies

This study's results are consistent with the existing scholarship surrounding the potential for artificial intelligence in higher education. Similar to the studies of Mutambik et al. (2024) and Al-Motrif et al. (2025), this paper established AI tools,

including adaptive learning mechanisms and intelligent tutoring systems, increased student engagement and achievement by allowing adjustments to the individual learning experience and personalized the learning experience to meet the learners' needs. The similarities across studies reinforce the growing body of evidence that AI is supporting a more efficient and learner-centered education sector.

This study found that social media supports collaborative environments, peer engagement, and knowledge sharing, and also enhances students' sense of belonging in learning communities. Research by Alshammari et al. (2024) and Khafaga et al. (2024) reported similar benefits. However, the effects of social media on student engagement and performance depend on purposeful use, marking a shift from earlier research that viewed social media as uniformly positive in education; instead, its value lies in intentional integration into formal contexts.

A further contribution of this work is supporting the mediating role of student engagement as proposed by the theoretical assumptions of the Engagement Theory, as well as Aljaloud et al. (2018) and Dahri et al. (2025). The support of the mediating effect of student engagement adds weight to the argument that digital tools support performance not in isolation, but instead by enhancing behavioural, cognitive and emotional engagement with the learning activity.

Regardless of these linkages, this research diverges with some studies considered in this paper, which have diminished the educational value of social media based on how distracting social media is (Alim et al. 2014; Alotaibi et al. 2023). While the consideration of social media potential to distract learning is a good observation, this research suggests that social media can be used as a positive supplementary learning tool through clear guidance and intentional use. This distinction further supports the consideration of specific context factors, specifically in Saudi Arabia, where the cultural and institutional contexts may also determine the roles technology play in educational spaces.

In the end, this research supports and extends previous literature to demonstrate that AI and social media are both intentional but distinct mechanisms that together influence student engagement and student performance. The use of the two tools, with pedagogical engagement each time, may provide an opportunity to enhance learning and assess learning actions in ways that previous studies focusing on a single-technology had not found.

5.3 Implications for Practice

This study highlights the significance of AI and social media in enhancing engagement and performance in higher education. Integrating these technologies can reshape learning environments, support personalization through AI tools and foster collaboration via social media. Educators should receive proper training to

maximize benefits and minimize risks such as distraction or overreliance. Policymakers should invest in digital infrastructure and professional development, ensuring equitable access and preparing students with essential academic and digital skills for the modern economy.

5.4 The Saudi Arabian Context

The adoption of AI and social media within higher education should also be understood within the social and institutional context of Saudi Arabia. The Saudi education system is witnessing unprecedented digital transformation as Vision 2030 is fundamentally reshaping education, placing an emphasis on, technological innovation, the knowledge economy, and improvements to learning outcomes. The use of AI and social media offers an important opportunity to utilize pedagogies that are aligned with the ambitious modernization goals of the country.

Saudis are collectivist learners who value hierarchical respect for instructors in their education system. Social media aligns with this collectivist approach, encouraging peer engagement and supporting collaborative learning within classroom hierarchies. AI technologies can offer personalized experiences that respect cultural preferences for structure while fostering independent knowledge discovery.

Universities in Saudi Arabia differ in technology infrastructure and faculty digital literacy, so implementation methods should suit their resources and readiness. For instance, schools with strong IT support can quickly adopt AI adaptive learning, while those with limited resources may start with collaborative learning via social media. Overall, successful adoption of learning technologies in Saudi higher education requires alignment with cultural norms, institutional realities, and national goals, supporting student engagement, innovation, and workforce readiness.

6. Conclusion

This research examined how artificial intelligence (AI) and social media affect student engagement and academic achievement in Saudi higher education. The findings reveal that both AI and social media boost student engagement, which subsequently improves academic performance. AI supported personalized learning and collaboration, while social media enhanced communication, peer feedback, and community. The study provides new evidence highlighting their complementary roles and the mediating effect of engagement on achievement in a culturally specific setting.

These results have practical implications: educators can use tools like adaptive learning systems and intelligent tutoring systems to tailor instruction and promote teamwork, while social media can facilitate peer interaction and build community. A blended approach may maximize engagement and performance. Policy makers

should invest in digital infrastructure, support professional development for faculty, and align technology adoption with national goals such as Saudi Arabia's Vision 2030 to drive workforce development and knowledge economy growth.

There are several limitations in the present study that should be considered. The cross-sectional design limits our ability to understand causal relationships, and our reliance on self-reported measures may affect response bias. Participants were drawn from five universities, which may limit the ability to generalize findings to all higher education institutions in Saudi Arabia. Additionally, we did not examine other new technologies besides AI and social media, which leaves the door open for future exploration of these avenues.

Future studies may be able to address our limitations with longitudinal designs which could examine AI and social media impact on engagement and academic outcomes over time. Including a more diverse sample that represents various institutions of higher education and employing objective measures of academic performance would increase the validity of findings. Additional studies could further explore the inclusion of other new, digital tools delivered to students and investigate the influences of context, such as institutional resources offered to learners and cultural context when examining technology-enhanced learning across broader contexts.

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