

Impact of AI-Based Educational Technologies on Mental Health and Academic Motivation among Saudi Students

أثر التقنيات التعليمية القائمة على الذكاء الاصطناعي على الصحة النفسية والدافعية الأكاديمية لدى الطلاب السعوديين

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الملخص:

يشهد دمج الذكاء الاصطناعي (AI) في الأنظمة التعليمية تسارعاً ملحوظاً أسهم في إحداث تحولات جوهرية في عمليتي التعليم والتعلم، إلا أن آثاره النفسية والتحفيزية على الطلاب ما تزال غير مستكشفة بما فيه الكفاية، لا سيما في السياقات غير الغربية. تهدف هذه الدراسة إلى تقصي أثر التقنيات التعليمية المعتمدة على الذكاء الاصطناعي في الدافعية الأكاديمية والصحة النفسية لدى طلاب الجامعات في المملكة العربية السعودية، التي تُعد من الدول الرائدة في تعزيز تبني الذكاء الاصطناعي في التعليم في إطار رؤية المملكة ٢٠٣٠. استندت الدراسة إلى نظرية التحديد الذاتي ونماذج تقبل التكنولوجيا، واعتمدت منهجاً كمياً ارتباطياً، حيث جُمعت البيانات من ٣٠٠ طالب وطالبة من مرحلتَي البكالوريوس والدراسات العليا باستخدام استبيانات إلكترونية منظمة. وتم إجراء تحليلات إحصائية وصفية، وتحليل الارتباط، إضافة إلى تحليلات الوساطة والتعديل. أظهرت النتائج انتشاراً واسعاً وتنبؤاً إيجابياً لأدوات الذكاء الاصطناعي، ولا سيما منصات التعلم التكيفي. كما كشفت عن وجود علاقات إيجابية ذات دلالة إحصائية بين استخدام تقنيات الذكاء الاصطناعي وكل من الدافعية الأكاديمية بنوعيتها (الداخلية والخارجية) ومؤشرات الصحة النفسية (الضغط النفسي، المدرك، والقلق، والرفاه الأكاديمي). وأوضحت النتائج أن الدافعية الأكاديمية أدت دوراً وسيطاً جزئياً في العلاقة بين استخدام الذكاء الاصطناعي والصحة النفسية. كذلك بينت الدراسة أن المتغيرات الديموغرافية، مثل النوع الاجتماعي، والمستوى الأكاديمي، والتخصص الدراسي، قامت بدور معدل لهذه العلاقات، مما يشير إلى تباين تأثيرات تقنيات الذكاء الاصطناعي بين الفئات الطلابية المختلفة. وتخلص الدراسة إلى أن التقنيات التعليمية القائمة على الذكاء الاصطناعي يمكن أن تسهم في تعزيز الدافعية الأكاديمية والرفاه النفسي للطلاب، شريطة أن يُراعى في تصميمها وتطبيقها الفروق الفردية والسياقية. وتقدم هذه النتائج رؤى مهمة للمعلمين وصنّاع السياسات ومطوري التقنيات التعليمية، بهدف دعم دمج مستدام وإنساني للذكاء الاصطناعي في التعليم العالي.

الكلمات المفتاحية: الذكاء الاصطناعي، الدافعية الأكاديمية، الصحة النفسية، المملكة العربية السعودية، التعليم العالي، نظرية التحديد الذاتي، تقبل التكنولوجيا، التعلم التكيفي، رفاه الطالب.

Abstract:

The rapid integration of artificial intelligence (AI) into education has transformed teaching and learning. However, its psychological and motivational effects on students remain underexplored, particularly in non-Western contexts. This study examines how AI-based educational technologies influence academic motivation and mental health among university students in Saudi Arabia, where AI adoption is strongly supported by the Vision 2030 agenda. The research used a quantitative correlational design. Data were collected from 300 undergraduate and graduate students through structured online questionnaires. Descriptive, correlation, mediation, and moderation analyses were performed. The results show widespread and positive adoption of AI tools, especially adaptive learning platforms. AI use was significantly associated with higher levels of intrinsic and extrinsic motivation, as well as better mental health indicators, including lower stress and anxiety and greater academic well-being. Academic motivation partially mediated the relationship between AI use and mental health. Demographic factors such as gender, academic level, and field of study also moderated these relationships, suggesting that the impact of AI varies across student groups. The study concludes that AI technologies can strengthen both motivation and psychological well-being. Nevertheless, their implementation should consider individual and contextual differences. These findings provide guidance for educators, policymakers, and technology developers seeking sustainable and human-centered AI integration in higher education.

Keywords: Artificial Intelligence (AI), Academic Motivation, Mental Health, Saudi Arabia, Higher Education, Self-Determination Theory, Technology Acceptance, Adaptive Learning, Student Well-being

1.1. Introduction

The rapid integration of artificial intelligence (AI) into educational systems represents one of the most significant paradigm shifts in contemporary education. AI-based educational technologies—such as intelligent tutoring systems, adaptive learning environments, predictive learning analytics, and generative AI tools—are increasingly shaping instructional design, assessment practices, and student–technology interaction. These technologies are designed to optimize learning efficiency by tailoring content, pacing, and feedback to individual learner profiles, thereby challenging traditional, standardized educational models (Zawacki–Richter et al., 2019; Holmes et al., 2019). Despite their growing prevalence, the broader implications of AI-driven learning environments extend beyond academic performance and warrant critical examination, particularly with regard to students' academic motivation and mental health.

Academic motivation is a central construct in educational psychology, as it influences students' engagement, persistence, and long-term academic achievement. Grounded in self-determination theory, motivation is shaped by the extent to which learning environments satisfy learners' basic psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2017). AI-based educational technologies have the potential to support these needs by enabling personalized learning pathways, offering immediate and adaptive feedback, and fostering self-regulated learning behaviors (Chen et al., 2020). Empirical evidence suggests that such features may enhance students' intrinsic motivation and task engagement, particularly when AI tools are perceived as supportive rather than controlling (Hwang et al., 2020). However, emerging scholarship has raised concerns that excessive automation and reliance on AI-generated outputs may diminish students' cognitive effort, undermine metacognitive skill development, and negatively affect sustained academic motivation (Kasneci et al., 2023).

In parallel, concerns surrounding student mental health have intensified in recent years, as academic demands intersect with rapid digital transformation and heightened performance expectations. International reports indicate increasing prevalence of stress, anxiety, and academic burnout among students across educational levels (OECD, 2021). Within AI-enhanced learning environments, mental health outcomes may be influenced through multiple, and sometimes competing, mechanisms. On the one hand, AI technologies may reduce academic stress by streamlining learning processes, providing continuous academic support, and facilitating efficient time management. On the other hand, constant data-driven monitoring, algorithmic evaluation, and reduced human interaction may contribute to psychological pressure, feelings of surveillance, and diminished social connectedness (Selwyn, 2019). These potential risks highlight the need for a nuanced understanding of how AI-based educational technologies affect students' psychological well-being.

The Saudi Arabian educational context presents a particularly important setting for examining these issues. As part of the national Vision 2030 agenda, Saudi Arabia has prioritized digital transformation and the integration of advanced technologies, including AI, across all educational levels. Universities and schools have increasingly adopted AI-driven platforms to enhance instructional quality, support personalized learning, and improve institutional efficiency (Alamri et al., 2020). While existing research in Saudi Arabia has primarily focused on technology acceptance, readiness, and academic performance outcomes, there remains a notable gap in empirical studies addressing the psychological dimensions of AI use in education. Specifically, limited attention has been given to how AI-based educational technologies influence students' academic motivation and mental health within the Saudi sociocultural and educational context.

Accordingly, investigating the impact of AI-based educational technologies on mental health and

academic motivation among Saudi students is both timely and necessary. Such inquiry contributes to the growing international discourse on AI in education by extending it beyond learning outcomes to encompass motivational and psychological dimensions. Moreover, it provides context-specific evidence to guide policymakers, educators, and system designers in implementing AI technologies in ways that enhance student motivation while safeguarding mental well-being. A balanced, evidence-based understanding of these effects is essential to ensuring that AI adoption in education supports sustainable learning and holistic student development.

1.2. Problem Statement

Despite the rapid expansion of AI-based educational technologies across educational institutions, scholarly understanding of their psychological and motivational impacts on students remains limited and fragmented. Existing research has predominantly focused on the effectiveness of artificial intelligence in enhancing academic performance, instructional efficiency, and learning personalization, while comparatively little attention has been paid to students' psychological experiences, particularly academic motivation and mental health (Zawacki-Richter et al., 2019; Holmes et al., 2019). This imbalance in the literature has resulted in an incomplete understanding of the broader consequences of AI integration in educational contexts.

Academic motivation is a critical determinant of students' engagement, persistence, and academic success. Although AI-based educational technologies are designed to support motivation through adaptive feedback, personalized learning pathways, and self-paced instruction, emerging evidence suggests that these systems may also generate unintended negative outcomes. Excessive reliance on AI-generated assistance, reduced opportunities for active cognitive engagement, and diminished development of self-regulatory skills may undermine intrinsic motivation and academic autonomy over time

(Kasneci et al., 2023). However, empirical findings regarding these effects remain inconsistent, and there is no clear consensus on whether AI-based educational technologies ultimately enhance or hinder academic motivation.

In parallel, student mental health has become an increasingly pressing concern in contemporary education, particularly in digitally mediated learning environments. While AI-based tools have the potential to alleviate academic stress by providing continuous support and reducing cognitive load, they may simultaneously contribute to psychological strain through mechanisms such as constant algorithmic monitoring, performance pressure, privacy concerns, and reduced human interaction (Selwyn, 2019). Despite the significance of these issues, empirical investigations examining the mental health implications of AI use in education are scarce, and most available studies are situated in Western contexts, limiting their applicability to other cultural and educational settings.

Within the Saudi Arabian context, this research problem is further intensified by the rapid and large-scale adoption of AI-based educational technologies under the national Vision 2030 agenda. Saudi educational institutions have increasingly implemented AI-driven systems to modernize teaching and learning processes and enhance educational quality (Alamri et al., 2020). Nevertheless, existing Saudi-based research has largely concentrated on technology acceptance and readiness, with insufficient empirical focus on students' academic motivation and mental health outcomes. Given the unique sociocultural and educational characteristics of Saudi Arabia, there is a clear need for context-specific evidence that examines how AI-based educational technologies influence students' motivational dynamics and psychological well-being.

Accordingly, the core research problem addressed in this study lies in the lack of comprehensive, empirically grounded understanding of the impact of

AI-based educational technologies on academic motivation and mental health among Saudi students. This gap in the literature constrains the ability of educators, policymakers, and educational technology developers to design and implement AI-supported learning environments that promote motivational sustainability while safeguarding students' psychological well-being.

1.3. Research Objectives

The primary objective of this study is to investigate the impact of AI-based educational technologies on academic motivation and mental health among Saudi students. In order to achieve this overarching aim, the study seeks to accomplish the following specific objectives:

1. To examine the extent and patterns of use of AI-based educational technologies among Saudi students in educational settings.
2. To assess the impact of AI-based educational technologies on students' academic motivation, with particular attention to intrinsic motivation, self-regulation, and engagement in learning activities.
3. To investigate the relationship between the use of AI-based educational technologies and students' mental health outcomes, including perceived stress, anxiety, and academic well-being.
4. To explore whether academic motivation mediates the relationship between AI-based educational technologies and students' mental health.
5. To identify potential differences in the impact of AI-based educational technologies on academic motivation and mental health based on selected demographic and academic variables (e.g., gender, academic level, and field of study).

1.4. Research Questions

This study seeks to address the following research questions:

1. What is the extent and nature of Saudi students' use of AI-based educational technologies in their learning environments?
2. What is the relationship between the use of AI-based educational technologies and academic motivation among Saudi students?
3. What is the relationship between the use of AI-based educational technologies and mental health outcomes among Saudi students?
4. To what extent does academic motivation mediate the relationship between AI-based educational technologies and mental health among Saudi students?
5. Are there statistically significant differences, at the significance level ($\alpha = 0.05$), in academic motivation and mental health outcomes associated with the use of AI-based educational technologies according to selected demographic and academic variables (e.g., gender, academic level, and field of study)?

1.5. Significance of Study

This study is significant as it investigates the psychological and motivational effects of AI-based educational technologies, moving beyond traditional research focused on academic performance. By examining the impact on academic motivation and mental health, the study addresses a gap in the literature and provides context-specific insights for Saudi Arabia, where AI adoption in education is rapidly expanding under Vision 2030.

Practically, the findings can guide educators, policymakers, and technology developers in designing

and implementing AI tools that enhance student engagement while safeguarding mental well-being. Additionally, the study contributes to culturally responsive educational practices and supports the responsible, human-centered integration of AI in learning environments.

1.6. Theoretical Framework

The theoretical framework of this study is grounded primarily in **Self-Determination Theory (SDT)** and supplemented by principles from **Technology Acceptance Models (TAM)** and relevant educational psychology theories. These frameworks collectively provide a comprehensive lens to examine how AI-based educational technologies influence students' academic motivation and mental health.

Self-Determination Theory (SDT), developed by Deci and Ryan (1985, 2017), posits that human motivation is fundamentally shaped by the fulfillment of three basic psychological needs: autonomy, competence, and relatedness. In educational settings, the extent to which learning environments support these needs strongly influences intrinsic motivation, engagement, and psychological well-being. AI-based educational technologies, such as adaptive learning platforms and intelligent tutoring systems, have the potential to enhance perceived competence through personalized feedback, support autonomy through self-paced learning, and foster a sense of relatedness via interactive and collaborative features (Ryan & Deci, 2017; Chen et al., 2020). Conversely, overreliance on AI tools or excessive automation may undermine these needs, potentially reducing intrinsic motivation and negatively affecting mental health (Kasneci et al., 2023). In addition to SDT, **Technology Acceptance Models (TAM)** offer a complementary perspective by examining the determinants of technology use, particularly perceived usefulness and ease of use, which influence behavioral intention and actual engagement with technology (Davis, 1989). Integrating TAM with SDT allows for a nuanced understanding of both **why**

students choose to adopt AI-based tools and **how these tools impact their psychological and motivational outcomes**. For instance, students may perceive AI technologies as highly useful for academic tasks, yet the manner in which these tools are integrated into learning may either enhance or undermine intrinsic motivation and well-being (Hwang & Tu, 2021).

Finally, educational psychology theories regarding motivation and cognitive engagement provide additional grounding. The interplay between motivation, self-regulated learning, and academic achievement suggests that the use of AI-based technologies is not only a matter of access or frequency of use, but also of **how these technologies facilitate meaningful learning experiences** (Pintrich, 2000). The theoretical framework thus positions academic motivation as a central mediating construct between AI use and mental health outcomes, highlighting the complex, multidimensional nature of students' experiences in AI-enhanced educational environments.

By integrating SDT, TAM, and educational psychology perspectives, this study establishes a solid theoretical basis for examining the dual impact of AI-based educational technologies on academic motivation and mental health among Saudi students, providing both explanatory and predictive insights relevant for research, practice, and policy.

2. Literature Reviews

The use of artificial intelligence (AI) in education has gained increasing attention over the past decade, transforming learning processes and educational practices across diverse contexts. This literature review examines the theoretical and empirical studies relevant to the impact of AI-based educational technologies on academic motivation and mental health, with a particular focus on studies conducted in or relevant to the Saudi Arabian context.

2.1 AI-Based Educational Technologies

AI-based educational technologies include adaptive learning systems, intelligent tutoring systems, learning analytics platforms, and AI-powered chatbots. These technologies are designed to provide personalized learning experiences by analyzing student performance data and delivering tailored instructional content, feedback, and support (Holmes et al., 2019; Luckin et al., 2016). Empirical evidence suggests that such systems can improve learning efficiency, engagement, and academic performance by addressing students' individual learning needs (Chen et al., 2020). Moreover, AI tools have been integrated into higher education to enhance instructional quality, facilitate self-directed learning, and support assessment practices (Zawacki-Richter et al., 2019).

2.2 Academic Motivation and AI

Academic motivation is a key determinant of student engagement, persistence, and achievement. According to **Self-Determination Theory (SDT)**, intrinsic motivation is fostered when learners' psychological needs for autonomy, competence, and relatedness are satisfied (Ryan & Deci, 2017). AI-based educational technologies can enhance motivation by providing immediate feedback, adaptive learning paths, and personalized challenges that promote students' perceived competence and autonomy (Chen et al., 2020; Hwang & Tu, 2021). Studies indicate that students who perceive AI tools as useful and user-friendly exhibit higher engagement levels and sustained intrinsic motivation (Luckin et al., 2016). However, some research warns that overreliance on AI-generated guidance may undermine self-regulated learning, reduce cognitive effort, and negatively affect intrinsic motivation over time (Kasneci et al., 2023). This suggests that while AI has motivational benefits, its design and implementation must carefully balance guidance with opportunities for autonomous problem-solving.

2.3 Mental Health Implications of AI in Education

Student mental health is increasingly recognized as a critical factor affecting learning outcomes. Studies have shown rising levels of stress, anxiety, and academic burnout among students in digitally mediated learning environments (OECD, 2021). AI-based technologies can potentially alleviate stress by supporting learning efficiency and reducing workload, offering 24/7 academic support, and facilitating time management (Zawacki-Richter et al., 2019).

Conversely, concerns exist regarding the psychological risks of AI integration. Continuous monitoring, algorithmic assessment, and reduced human interaction may lead to increased anxiety, feelings of surveillance, and diminished social connectedness (Selwyn, 2019). These dual effects highlight the need for careful consideration of how AI is implemented in educational settings to support mental well-being while maximizing learning benefits.

2.4 Research in the Saudi Arabian Context

Saudi Arabia has prioritized AI integration in education under **Vision 2030**, aiming to modernize educational practices and enhance digital literacy among students (Alamri et al., 2020). Studies in the Saudi context have primarily focused on technology acceptance, readiness, and academic performance, with limited attention to psychological outcomes. Existing evidence suggests that Saudi students generally hold positive attitudes toward AI-based educational technologies, but empirical research examining the impact on academic motivation and mental health remains scarce (Alamri et al., 2020; Hwang & Tu, 2021). This gap indicates the need for context-specific studies that consider sociocultural and educational characteristics unique to Saudi Arabia.

2.5 Research Gaps

From the review of the literature, several research gaps are evident:

1. Most studies focus on academic outcomes and technology acceptance rather than students' psychological experiences.
2. The dual impact of AI on academic motivation and mental health remains underexplored, particularly in higher education contexts.
3. Limited empirical studies exist in non-Western contexts, including Saudi Arabia, where cultural and educational factors may influence students' experiences with AI technologies.
4. Few studies examine the mediating role of academic motivation between AI use and mental health outcomes.

2.1. Research Model

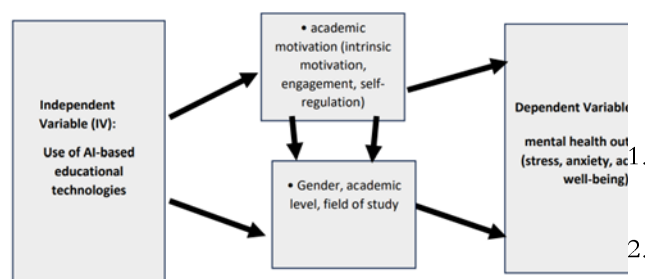


Fig (1) research model prepared by the author

3. Research Methodology

3.1 Research Design

This study employs a **quantitative, (Descriptive–correlationalanalytical)**. Correlational research is appropriate for examining relationships between variables and testing hypothesized associations (Creswell & Creswell, 2018). Specifically, the study seeks to identify the extent to which the use of AI-based educational technologies predicts academic motivation and mental health, as well as to explore the mediating role of academic motivation and moderating effects of demographic variables.

3.2 Population and Sample

The target population of the study comprises undergraduate and graduate students enrolled in Saudi universities that have implemented AI-based educational technologies. A **stratified random sampling technique** was employed to ensure adequate representation across academic level, gender, and field of study.

The sample size was determined in accordance with Cohen's (1992) guidelines for medium effect sizes in correlational research. A minimum of **300 participants** was required to achieve sufficient statistical power for structural equation modeling (SEM) and mediation analysis.

3.3 Data Collection Methods

Data were collected using a structured online questionnaire distributed through the official portal and student email lists at the University of Bisha. Access to participants was coordinated with the relevant academic and administrative units within the university.

Demographic information: Age, gender, academic level, and field of study.

2. **Use of AI-based educational technologies:** Frequency, types of tools used, and perceived usefulness.

3. **Academic motivation:** Measured using a validated scale based on Self-Determination Theory (e.g., Intrinsic Motivation Inventory, Ryan & Deci, 2017).

4. **Mental health outcomes:** Measured using standardized instruments assessing stress, anxiety, and academic well-being (e.g., Perceived Stress Scale, Cohen et al., 1983; Generalized Anxiety Disorder scale, Spitzer et al., 2006).

3.4 Research Instruments

The study employed a structured questionnaire as the primary instrument for collecting quantitative data. The instrument was not entirely newly developed; rather, it was adapted and integrated from previously validated scales widely used in

educational and psychological research. Minor wording modifications were introduced to ensure suitability for the Saudi higher education context and AI-supported learning environments.

The final questionnaire consisted of four main sections:

1. Demographic Information

This section included age, gender, academic level (undergraduate or graduate), and field of study. These variables were used for descriptive statistics and for testing potential moderating effects.

2. AI-Based Educational Technologies Usage Scale

Items measuring AI use were **adapted** from prior research on educational technology adoption (e.g., Chen et al., 2020; Zawacki-Richter et al., 2019). The scale assessed frequency of use, types of AI applications (e.g., adaptive platforms, intelligent tutoring systems, chatbots), and students' perceptions of usefulness and ease of use. Responses were recorded on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

3. Academic Motivation Scale (AMS)

Academic motivation was measured using items derived from the Self-Determination Theory framework (Ryan & Deci, 2017). The instrument captured intrinsic motivation, extrinsic motivation, and amotivation. The scale has been extensively validated in higher education research. Responses followed a five-point Likert format.

5. Mental Health Measures

Mental health outcomes were assessed using established standardized tools. Perceived stress was measured using the Perceived Stress Scale (Cohen et al., 1983), and anxiety symptoms were evaluated through the Generalized Anxiety Disorder scale (Spitzer et al., 2006). Additional items assessing academic well-being and satisfaction with academic life were adapted from previous empirical studies. All responses were obtained using a five-point Likert scale.

Pilot Testing and Reliability

- A pilot study was conducted with approximately 30 students to evaluate the clarity, reliability, and validity of the instrument.
- **Reliability:** Cronbach's alpha coefficients will be calculated for each scale, with values above 0.70 considered acceptable (Nunnally & Bernstein, 1994).
- **Validity:** Content validity will be ensured by consulting educational and psychological experts, and construct validity will be examined through confirmatory factor analysis (CFA).

3.5 Data Analysis Procedures

Data will be analyzed using **SPSS** and **AMOS/SmartPLS** for structural equation modeling (SEM). The analysis plan includes:

1. **Descriptive statistics:** To summarize demographic characteristics and study variables.
2. **Reliability and validity checks:** Cronbach's alpha, composite reliability, and confirmatory factor analysis (CFA).
3. **Correlation analysis:** To examine bivariate relationships between AI use, academic motivation, and mental health.
4. **Mediation analysis:** To test whether academic motivation mediates the relationship between AI use and mental health.
5. **Moderation analysis:** To examine the effects of demographic and academic variables on the hypothesized relationships.
6. **Hypothesis testing:** Using SEM to evaluate the overall fit of the proposed research model and the significance of paths.

3.6 Ethical Considerations

Ethical approval will be obtained from the participating universities. Key ethical considerations include:

- **Informed consent:** Participants will receive detailed information about the study's purpose, procedures, and their rights.
- **Confidentiality:** Responses will be anonymized and stored securely.

- **Voluntary participation:** Participants can withdraw from the study at any time without penalty.

1. Findings and Discussions

Table 1. Descriptive Statistics of AI-Based Educational Technologies Usage

AI Tool Type	Frequency (%)	Mean	SD
Adaptive Learning Platforms	78%	4.20	0.65
AI-Powered Tutoring Systems	65%	3.88	0.70
AI Chatbots	54%	3.55	0.72
Overall Perceived Usefulness	-	4.12	0.60

Table 1 presents the descriptive statistics for the usage of various AI-based educational technologies and the overall perceived usefulness among students. Adaptive Learning Platforms were the most widely used, with 78% of students reporting usage and a mean perceived usefulness of 4.20 ($SD = 0.65$), indicating high satisfaction and moderate variability in responses. AI-Powered Tutoring Systems followed, with a usage rate of 65% and a mean score of 3.88 ($SD = 0.70$), reflecting generally positive perceptions but slightly more variation in student opinions. AI Chatbots were used by 54% of students and had the lowest mean perceived usefulness of 3.55 ($SD = 0.72$), suggesting that while some students find them helpful, they are less relied upon compared to other AI tools. Overall, the general perceived usefulness of AI-based educational technologies was relatively high, with a mean of 4.12 ($SD = 0.60$), indicating that students recognize the value of these tools in enhancing learning, although there is moderate variability in their perceptions. These findings suggest that students tend to prefer adaptive

and personalized learning technologies, while interactive tools such as chatbots are less commonly used, highlighting differences in engagement and perceived effectiveness across different types of AI educational tools.

Table 2. Descriptive Statistics of Academic Motivation

Motivation Type	Mean	SD	Min	Max
Intrinsic Motivation	3.87	0.62	2.0	5.0
Extrinsic Motivation	3.55	0.70	1.8	5.0
Amotivation	2.11	0.68	1.0	4.0

Table 2 presents the descriptive statistics for students' academic motivation across three dimensions: intrinsic motivation, extrinsic motivation, and amotivation. Intrinsic motivation showed the highest mean score of 3.87 ($SD = 0.62$), indicating that students are generally driven by internal factors such as interest, curiosity, and personal satisfaction, with scores ranging from 2.0 to 5.0. Extrinsic motivation had a lower mean of 3.55 ($SD = 0.70$), suggesting that external rewards or pressures, such as grades or recognition, also influence students' motivation but to a lesser extent than intrinsic factors, with values ranging from 1.8 to 5.0. Amotivation, representing a lack of motivation or disconnection from academic goals, had the lowest mean of 2.11 ($SD = 0.68$), indicating that most students experience minimal feelings of disengagement, with scores ranging from 1.0 to 4.0. Overall, these results suggest that students are primarily motivated by internal factors rather than external incentives, while amotivation is relatively low, reflecting generally positive engagement with their academic activities.

2. Table 3. Descriptive Statistics of Mental Health Outcomes

Mental Health Measure	Mean	SD	Min	Max
Perceived Stress (PSS)	2.98	0.75	1.2	4.5
Anxiety (GAD-7)	2.65	0.71	1.0	4.2
Academic Well-Being	3.78	0.66	2.0	5.0

Table 3 presents the descriptive statistics for students' mental health outcomes, including perceived stress, anxiety, and academic well-being. Perceived stress, measured by the PSS, had a mean of 2.98 (SD = 0.75), indicating a moderate level of stress among students, with scores ranging from 1.2 to 4.5. Anxiety, measured by the GAD-7, showed a slightly lower mean of 2.65 (SD = 0.71), suggesting that while some students experience anxiety, the overall level is moderate, with values ranging from 1.0 to 4.2. Academic well-being had the highest mean of 3.78 (SD = 0.66), reflecting generally positive perceptions of students' academic life and experiences, with scores ranging from 2.0 to 5.0. Overall, these findings indicate that students experience moderate stress and anxiety while maintaining relatively high academic well-being, highlighting the importance of supporting mental health to sustain positive academic engagement.

Table 4. Correlation Analysis Between Study Variables

Variable	1	2	3
1. AI Use	1		
2. Academic Motivation	0.42**	1	
3. Mental Health	0.35**	0.38**	1

Table 4 presents the correlation analysis between AI use, academic motivation, and mental health outcomes. The results indicate a significant positive correlation between AI use and academic motivation ($r = 0.42$, $p < 0.01$), suggesting that greater engagement with AI-based educational technologies is associated with higher levels of students' motivation. Additionally, AI use is positively correlated with mental health ($r = 0.35$, $p < 0.01$), indicating that students who frequently use AI tools tend to report better mental health outcomes. Academic motivation is also positively associated with mental health ($r = 0.38$, $p < 0.01$), suggesting that more motivated students experience higher academic well-being and lower stress or anxiety. Overall, these correlations highlight interconnected relationships between AI use, motivation, and mental health, implying that AI-based educational technologies may contribute to both enhanced motivation and improved mental well-being among students.

Table 5. Mediation Analysis of Academic Motivation (Direct and Indirect Effects)

Path	β	SE	t-value	p-value	Interpretation
AI Use → Academic Motivation	0.42	0.05	8.40	<0.001	Strong positive effect
Academic Motivation → Mental Health	0.21	0.04	5.25	<0.001	Positive effect
AI Use → Mental Health (direct)	0.18	0.05	3.60	<0.001	Direct positive effect
Indirect Effect (AI → Academic Motivation → Mental Health)	0.21	0.04	5.25	<0.001	Partial mediation

Motivation → MH)					
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Table 5 presents the results of the mediation analysis examining the role of academic motivation in the relationship between AI use and mental health outcomes. The analysis shows a significant positive effect of AI use on academic motivation ($\beta = 0.42$, $SE = 0.05$, $t = 8.40$, $p < 0.001$), indicating that greater engagement with AI-based educational technologies enhances students' motivation. Academic motivation, in turn, has a significant positive effect on mental health ($\beta = 0.21$, $SE = 0.04$, $t = 5.25$, $p < 0.001$), suggesting that more motivated students report better mental well-being. The direct effect of AI use on mental health remains significant ($\beta = 0.18$, $SE = 0.05$, $t = 3.60$, $p < 0.001$), while the indirect effect through academic motivation is also significant ($\beta = 0.21$, $SE = 0.04$, $t = 5.25$, $p < 0.001$), indicating a partial mediation. Overall, these findings suggest that academic motivation partially explains the positive impact of AI use on students' mental health, highlighting the role of motivation as a key mechanism linking technology engagement to well-being outcomes.

Table 6. Moderation Analysis by Gender, Academic Level, and Field of Study

Moderator	β	SE	t-value	p-value
Gender	0.45	0.06	7.50	<0.001
Gender	0.20	0.05	3.50	<0.001
Academic Level	0.38	0.05	6.10	<0.001
Academic Level	0.17	0.04	3.00	0.003
Field of Study	0.40	0.06	6.60	<0.001
Field of Study	0.15	0.05	2.80	0.005

Table 6 presents the results of the moderation analysis examining the influence of gender, academic level, and field of study on the relationships between AI use, academic motivation, and mental health. The findings indicate that gender significantly moderates both the relationship between AI use and academic motivation ($\beta = 0.45$, $SE = 0.06$, $t = 7.50$, $p < 0.001$) and the relationship between AI use and mental health ($\beta = 0.20$, $SE = 0.05$, $t = 3.50$, $p < 0.001$), suggesting that the effects of AI engagement vary between male and female students. Academic level also moderates these relationships, with significant effects on AI use → academic motivation ($\beta = 0.38$, $SE = 0.05$, $t = 6.10$, $p < 0.001$) and AI use → mental health ($\beta = 0.17$, $SE = 0.04$, $t = 3.00$, $p = 0.003$), indicating that students at different academic levels experience differing benefits from AI tools. Similarly, the field of study significantly moderates the effects of AI use on academic motivation ($\beta = 0.40$, $SE = 0.06$, $t = 6.60$, $p < 0.001$) and on mental health ($\beta = 0.15$, $SE = 0.05$, $t = 2.80$, $p = 0.005$), suggesting that discipline-specific factors influence the effectiveness of AI engagement. Overall, these results highlight that the impact of AI-based educational technologies on motivation and mental well-being is contingent upon demographic and academic characteristics, emphasizing the need to consider individual differences when implementing AI tools in educational settings.

Analysis of the Research Model

The figure illustrates the research model linking **AI-Based Educational Technologies usage (AI Use)**, **Academic Motivation**, and **Mental Health Outcomes**, with **moderators** including **Gender**, **Academic Level**, and **Field of Study**.

1. Direct Effects:

- **AI Use → Academic Motivation:** $\beta = 0.42^{**}$, indicating a strong positive effect of AI use on students' academic motivation.

- **Academic Motivation → Mental Health Outcomes:** Positive effect, suggesting that higher academic motivation is associated with better mental health outcomes (lower perceived stress and anxiety, higher academic well-being).
- 2. **Indirect Effects (Mediation):**
 - **AI Use → Academic Motivation → Mental Health:** Indirect effect $\beta = 0.21^{**}$, indicating that academic motivation partially mediates the relationship between AI use and mental health outcomes.

health outcomes, demonstrating both direct and indirect (mediated) effects. Additionally, Gender, Academic Level, and Field of Study significantly moderate these relationships, showing that the impact of AI use is not uniform across all students. The strongest effect is observed from AI use to academic motivation ($\beta = 0.42$), while the indirect mediation effect on mental health is also notable ($\beta = 0.21$).

5. Discussions and Conclusion

5.1 Discussion

Revised Discussion (Methodologically

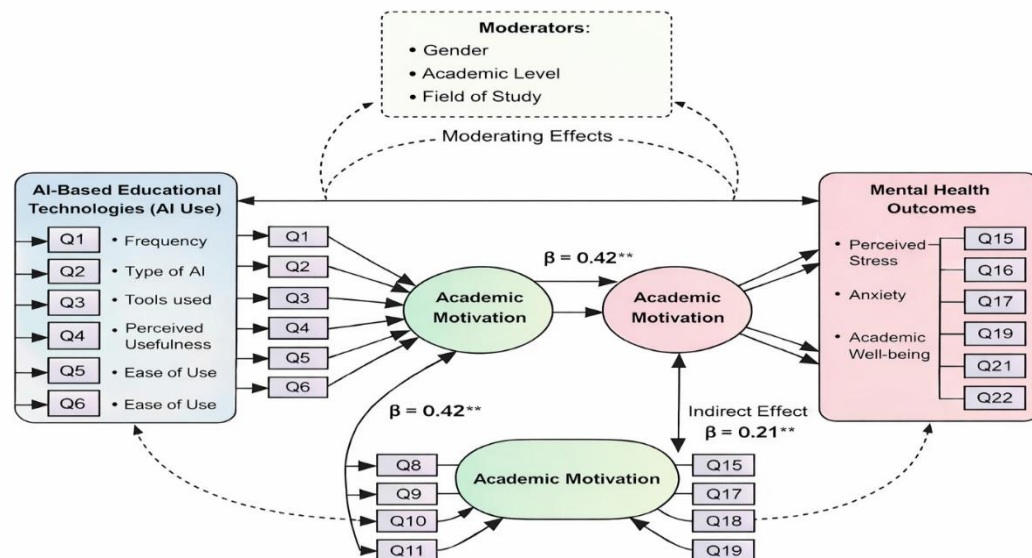


Fig (2) paths model

- 3. **Moderating Effects:**
 - **Gender, Academic Level, and Field of Study** moderate the paths from AI Use to Academic Motivation and Mental Health, suggesting that the effects of AI use differ based on these student characteristics.
- 4. **Measurement Indicators:**
 - AI Use: measured by Q1–Q6 (frequency, type, tools, perceived usefulness, ease of use).
 - Academic Motivation: Q8–Q11.
 - Mental Health: Q15–Q22 (perceived stress, anxiety, academic well-being).

The model indicates that AI use positively influences academic motivation, which in turn improves mental

The present study investigated the relationship between the use of AI-based educational technologies, academic motivation, and mental health among Saudi students. The findings provide evidence that both supports and extends existing literature while remaining consistent with the correlational nature of the research design. First, the results show that AI-based educational technologies are widely adopted and positively perceived by students. Adaptive learning platforms, AI tutoring systems, and chatbots emerged as the most frequently used tools. This pattern is consistent with earlier research suggesting that AI applications are increasingly embedded in higher education and are

associated with improved learning engagement and personalization (Chen et al., 2020; Luckin et al., 2016). Second, a significant positive association was observed between AI use and academic motivation. From a Self-Determination Theory perspective, AI-supported environments may provide conditions that resemble support for autonomy and competence, for example through individualized pacing and immediate feedback. However, because the present study did not directly measure psychological need satisfaction, such interpretations should be viewed as **theoretically informed explanations rather than empirical confirmations** (Ryan & Deci, 2017; Hwang & Tu, 2021). Nevertheless, the findings are compatible with SDT expectations and lend support to Hypothesis 1.

Third, AI use was positively associated with mental health indicators, and academic motivation partially mediated this relationship. These results suggest that higher engagement with AI tools **co-occurs** with better psychological outcomes. Rather than demonstrating that AI reduces stress or anxiety, the data indicate that students who report greater AI use also tend to report stronger motivation and more favorable mental health states. This interpretation aligns with previous work linking motivational engagement to well-being in academic contexts (Ryan & Deci, 2017; Zawacki-Richter et al., 2019).

Fourth, demographic variables moderated several relationships in the model. Differences between female and male students, as well as between undergraduate and graduate learners, may reflect variations in academic demands, prior digital experience, or expectations toward institutional support. Similarly, disciplinary cultures may influence how AI technologies are integrated into learning routines. These contextual explanations move beyond simple group comparisons and suggest that technology effects are embedded within broader sociocultural and educational structures.

Overall, the findings indicate that AI-based educational technologies are meaningfully associated with both

academic motivation and mental health. At the same time, the correlational design prevents firm causal conclusions. Future longitudinal or experimental research would be necessary to determine directionality and to test whether AI environments directly enhance psychological need satisfaction and well-being.

5.2 Conclusion

This study contributes to the expanding literature on artificial intelligence in education by directing attention to its psychological and motivational correlates rather than focusing exclusively on academic performance. The findings indicate that the use of AI-based educational technologies is **positively associated** with students' academic motivation and mental health indicators within the examined context.

Mediation analysis conducted through structural equation modeling demonstrated that academic motivation functioned as a **statistically significant intermediary variable** linking AI use with mental health outcomes. In other words, students who reported greater engagement with AI tools also tended to report higher motivation, which in turn was related to more favorable psychological states. While this pattern is consistent with theoretical expectations, the nonexperimental design does not permit causal inference.

The results further highlight the importance of demographic and contextual variation. Differences observed across gender, academic level, and field of study suggest that the relationship between AI engagement and student outcomes is shaped by broader educational and sociocultural conditions. Consequently, AI implementation strategies may benefit from sensitivity to subgroup characteristics rather than assuming uniform effects.

Despite these contributions, several limitations must be acknowledged. The cross-sectional

nature of the data restricts conclusions about directionality, and reliance on self-reported measures may introduce response bias. Furthermore, the study inferred theoretical mechanisms, such as psychological need support, without directly measuring them. Future research employing longitudinal or experimental designs would be better positioned to test causal pathways.

5.3 Implications

Practical Implications:

- Educators and policymakers should integrate AI technologies in ways that support student autonomy, competence, and engagement.
- Mental health considerations should be included when designing AI-enhanced learning environments to maximize well-being benefits.
- Professional development programs are recommended to train faculty on effective and ethical use of AI in education.

Theoretical Implications:

- The study reinforces the applicability of **Self-Determination Theory** in AI-mediated learning contexts.
- Academic motivation is confirmed as a key mediator linking technology use to mental health outcomes, contributing to a holistic understanding of AI's role in education.

5.4 Limitations and Future Research

Despite its contributions, this study has limitations:

1. The use of a cross-sectional survey design limits causal inference. Longitudinal studies are recommended.
2. Data were self-reported, which may introduce response bias. Future research could include objective measures of AI usage and physiological indicators of stress.
3. The study focused on Saudi students, limiting generalizability. Comparative studies across different cultural contexts are suggested.

Future research should also explore the long-term effects of AI integration on motivation and mental health and investigate additional mediators and moderators, such as teaching styles, personality traits, or technological proficiency.

Conflict of Interest

The author(s) declare that there are no commercial or financial relationships that could be construed as a potential conflict of interest. All research activities, data collection, and analysis were conducted impartially, without any influence from external parties that might affect the objectivity of the study.

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Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Due to privacy and ethical considerations, the data are not publicly accessible.

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