DOI: 10.71317/jgst.2.9.2026.517
Journal of Global Social Transformation
Journal homepage: https://rjsaonline.org/index.php/JGST

Artificial Intelligence-Supported Education, Student Anxiety, and Academic Engagement: Examining the Moderating Role of Coping Self-Efficacy

Agha Fakhar Imam[1], Rimsha Arif[2], Farzana Saeed[3], Dr. Sana Maqbool[4]
[1] COMSATS University Islamabad, Lahore Campus
Email: Aghaimam@gmail.com
[2] University of Central Punjab
Email: rimshanoor468@gmail.com
[3] M.Sc. (Mathematics), The Islamia University of Bahawalpur
Email: farzanasaeed2003@gmail.com, farzanasaeed1311@gmail.com
[4] COMSATS University Islamabad, Lahore Campus
Email: sanamaqbool@cuilahore.edu.pk

ARTICLE INFO

Submission:
July 17, 2026
Revised:
August 06, 2026
Accepted:
August 22, 2026
Available Online:
September 02, 2026

Keywords:
Artificial Intelligence-Supported Education, Student Anxiety, Academic Engagement, Coping Self-Efficacy, Higher Education, AI-Supported Learning, University Students, Psychological Well-Being.

Corresponding author:
Agha Fakhar Imam
Email:
Aghaimam@gmail.com

ABSTRACT

Artificial Intelligence (AI)-supported education is increasingly transforming higher education by providing personalized learning, immediate academic assistance, and flexible access to educational resources; however, its psychological implications for students remain an important area of investigation. The present study examined the relationships among Artificial Intelligence-Supported Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy, with particular emphasis on the moderating role of coping self-efficacy in the relationship between anxiety and academic engagement. A quantitative, cross-sectional research design was employed, and data were collected from 268 university students from higher education institutions in Punjab and Sindh, Pakistan. Data were collected through an adopted structured questionnaire using online Google Forms, and the completed responses were organized in Microsoft Excel and analyzed using IBM SPSS. Descriptive statistics, Cronbach's alpha reliability analysis, Pearson correlation, multiple linear regression, independent-samples t-test, one-way ANOVA, post-hoc analysis, and moderation analysis were employed. The findings indicated significant relationships among the major study variables, with AI-supported education being positively associated with academic engagement and negatively associated with student anxiety. Student anxiety was negatively associated with academic engagement, whereas coping self-efficacy demonstrated a positive association with academic engagement. The regression findings further indicated that AI-supported education, student anxiety, and coping self-efficacy were significant predictors of academic engagement. The moderation findings demonstrated that coping self-efficacy significantly weakened the negative relationship between student anxiety and academic engagement, highlighting its potential protective role in students' academic experiences. The study contributes to the emerging literature on AI-supported higher education by demonstrating that the effectiveness of AI-based learning should be considered alongside students' psychological well-being and coping resources. The findings have practical implications for universities, educators, and policymakers in developing AI-supported learning environments that promote academic engagement while addressing student anxiety and strengthening coping capabilities.

Introduction

Artificial intelligence (AI) plays a huge role in the education sector. According to (Shi et al., 2026), AI technologies are now integrated into education to enhance both teaching and learning. Examples of such technologies include intelligent educator systems, adaptive learning systems, virtual assistants, and chatbots. These systems create individualized learningpaths for students. They adjust the educational content based on the students' need for and level of engagement with the course. (Leonita et al., 2026) agree that AI has potential to enhance individualized learning and the availability of educational resources. With AI, students can receive information summaries, course content, and receive formative assessments to improve their understanding of the course content. (Chen & Zare, 2025) adds that with AI, students can have better educational experiences and achieve their academic goals.

AI positively impacts students' motivation and helps develop their confidence as learners. With the help of AI, (Ren et al., 2025) demonstrated that students were motivated to engage in learning activities and that the learning difficulties previously faced by students were addressed. Likewise, personalized learning activities address students' learning concerns and foster autonomy in learning, as indicated by (Huang & Liang, 2026). AI creates a learner-centered education system. According to (Erliani, 2025), students motivated to use AI-based learning tools experience a positive change in their level of engagement in academic activities.

Along with these advantages, there are also challenges that accompany AI-mediated education. Some students may exhibit hesitancy with regard to the integration of new technologies, as well as worries about the validity of information generated by AI. (na Gupta, 2026) have argued that over-reliance on AI may impede the development of properly articulated thoughts and the ability to learn by oneself. Ethical issues, privacy concerns, and concerns about technology misuse continue to be important issues in educational research. (Rajan, 2026) has argued that the right sort of AI implementations have the ability to further educational goals. Some students will undoubtedly experience stress due to new technologies. In response, AI should be carefully integrated in educational institutions, as per (Bulut et al.) in a way that protects both the benefits and the risks.

Student Anxiety

Anxiety is a major psychological issue on college sites, especially for students. In particular, (Hou, 2026) describe anxiety as a reaction to the pressures caused by complex academic demands. These include worry from the combination of numerous testing schedules, fast approaching due dates, and the burden of heightened expectation to excel academically to thrive in today's competitive environment. In addition, (Butt et al., 2026) explained that anxiety for university students is worse than for their K-12 education peers, due to new and different methods of teaching within higher education. Additionally, (Şahin et al., 2026) describe anxiety as a prevailing issue of higher education due to the role that anxiety plays within the overall mental state of students and their academic performance.

Because of this issue, researchers have started to evaluate how anxiety affects learning. Anxiety can lead to difficulty in concentration, processing information, and making effective choices during the learning process. (Huang et al., 2026) expressed how anxiety leads to a lack of confidence and a lack of motivation towards school work. Anxiety also explains the calendar youth avoidance behavior where students avoid participating in classroom discussions. This method of avoiding participation leads to anxiety restricting students from achieving their educational goals. (Zhongrui & Shibao, 2026) find that anxiety can lead to a perpetual state of avoidance and can obstruct learning and growth.

Educational researchers are also interested in new educational technologies to see how students are faring with anxiety. From their studies, (Olatunbosun et al., 2026) suggest that some digital learning systems can cause anxiety among students who are not comfortable with new technologies. However, digital learning systems can provide flexible learning support to many students. This is especially true in AI-supported education where students have sustained interactions with intelligent learning support and digital services. (Gürbüz & Özkul) found that students using AI technology of their own volition do not experience anxiety, while the students who interact with AI technology against their will experience a great deal of anxiety. The study of student anxiety is critical to understanding the impact of AI-assisted education on students' learning and the possible mental challenges that learners may be facing (Yang, 2025).

Academic Engagement

When students engage positively with their academics, they learn better and achieve academically. This level of engagement includes the attention, interest, effort, and participation students employ with respect to classwork and homework. Actively engaged students show up to class daily, hand work in timely, speak up to answer and ask questions, and are purposed and goal

driven with their education. (Bipasha et al.) position academic engagement as a key element in students' success. Likewise, (Akat, 2026) consider engaged students as intentional and motivated. Finally, (Shaikh et al., 2025) argues that academic engagement has a clear and strong relationship with success in academia, as well as the growth of the student.

Based on this assumption, researchers have studied and shown that academic engagement is one of the most key aspects in learning and academic performance. Purposed students are motivated students. Students who are engaged with their studies develop internally driven and effective strategies to aid in their goals. (Yurt, 2026) also suggest that students who are academically engaged demonstrate a higher level of self-regulation and academic persistence. (Kılınçer, 2025) also argue that academically engaged students are motivated to ask for the support they need, and to remain goal driven in their studies. Likewise, (Rajan, 2026) suggest that students who are academically engaged show commits more fully to academics and find greater satisfaction in learning.

As technological drivers of educational environments increase, understanding the factors that facilitate academic engagement is becoming increasingly necessary. (Huang et al., 2025) noted that learning technologies that integrate artificial intelligence (AI) provide opportunities for students to engage through personalized learning and interactive technologies. Although students' emotional experiences are important, they can also be underestimated. (Ayub et al., 2025) noted that positive psychological conditions can engage students, whereas the experienced state of anxiety can diminish participation and motivation. Therefore, designing supportive technologies for anxiety and stress that augment AI within education is necessary (Almusharraf, 2026). This can aid students with lower levels of anxiety to remain engaged but also to achieve positive educational outcomes.

Coping Self-Efficacy

Knowing this, researchers have identified coping self-efficacy as one of the determinants of students' emotional well-being and academic adaptation. Students who have high self-beliefs of their ability to cope with stress use positive coping mechanisms and are motivated to cope with the demands of the situation. It has been reported that high levels of coping self-efficacy encourage a choice of constructive responses to academic problems rather than giving in to feelings of discouragement. Students with high self-efficacy beliefs have been reported to be less stressed and anxious than students with low self-efficacy beliefs (Çakır & Güner, 2026). It has also been reported that students with a high belief in their coping self-efficacy are resilient because they perceive challenges and academic demands as a chance to gain growth instead of threatening. Thus, coping self-efficacy is a significant predictor of students' emotional stability and academic success.

Now more than ever, the role of coping self-efficacy is critical in the context of the latest educational innovations with their integration of complex tools and to some extent the presence of learning systems that leverage Artificial Intelligence (AI). (O'Connor, 2023) asserted that students with higher levels of coping self-efficacy are more inclined to use AI technologies for learning. Moreover, Zhang et al. (2024) illustrate that self-efficacy sustains students' motivation to participate in learning activities when obstructed by challenges. Also, (Helsper, 2021) pointed out that coping self-efficacy has the potential to negate the impact of anxiety on students' motivation and engagement, altogether. In sum, coping self-efficacy has something to do with the focal points of this study. Elevated levels of coping self-efficacy are positively associated with the use of AI systems in education, anxiety, and engagement levels in the case of students. Hence, coping self-efficacy has a constructive role in improving interactions among AI-integrated education, anxiety levels, and engagement of students (Utami et al., 2025).

The use of AI in education allows personalized learning, instant feedback, and access to learning materials amidst the traditional barriers of learning. There are many excellent benefits of using AI in teaching and learning, but many learners still show Anxiety towards AI-based learning environments, and this brings challenges like reduced participation in learning activities. From previous research, anxiety robs learners of the enthusiasm to engage in the learning process and impedes their concentration. There are some challenges experienced throughout the learning process that are addressed by the individual's coping self-efficacy. There is a gap in research on how AI-based education impacts anxiety and engagement in the learners, and the possible role that self-individualized coping may have in this situation. It is imperative to research how AI-based learning may impact anxiety and engagement in learners, and the possible role self-individualized coping may have in this situation.

Research Objectives

- To examine the level of Artificial Intelligence-Supported Education among university students.
- To assess the level of Student Anxiety among university students.

- To evaluate the level of Academic Engagement among university students.
- To determine the level of Coping Self-Efficacy among university students.

Problem Statement

Artificial Intelligence (AI) has made personalized learning paths and real-time feedback easier, and has helped make educational resources and opportunities more accessible. Despite all of this, many students still feel anxious when they are introduced to new AI enhanced learning environments, and it can even inhibit them from taking part in different learning activities. A lot of students feel anxious in AI integrated learning environments, and AI integrated learning environments affect anxiety and engagement levels (Jiang et al., 2026). Because students vary with their academic and technological problems coping self-efficacy, students' ability to cope with academic and technological concerns is resourceful in this case Self-efficacy, as a coping mechanism, and its relation to anxiety and engaging in the scope of AI introduced institutes has largely remained unstudied. For this reason, it's important to see how engagement can be promoted and anxiety reduced in AI-based learning environments, and if and Mitigating self-efficacy can be utilized further in this context.

Significance of the study

This study has value because it adds to existing literature regarding how artificial intelligence (AI)-based educational technology is changing how students learn in post-secondary schools. Because many universities are using AI-based tools in their teaching and learning systems, educational and psychological impacts of these systems on students need to be studied. This research helps educational leaders understand how AI-based technology impacts students' anxiety levels and their academic engagement. Additionally, this study supports the importance of coping self-efficacy as a personal coping resource to manage anxiety and engage in studying. The lead author's findings help create AI-based educational technologies to reduce anxiety and improve students' self-coping skills. The study also provides much needed research to fill a scholarly and operational gap in the research related to these important constructs.

Literature Review

(Pellas, 2026) did a review to describe how AI impacts learning and noted that adaptive learning systems create personalized learning supports and help students manage their challenges. Likewise, through a systematic review, (Sung et al., 2025) indicated that, among other things, AI tools enhance learning and diminish the burden of academic work. Likewise, (Pavlova et al., 2026) completed a survey and reported that AI tools for learning decrease academic work-related anxiety and help learners retain confidence in accomplishing academic tasks. Thus, AI-infused educational systems may be helpful in diminishing learners' anxiety, primarily through delivering diverse learning supports and personalized learning.

Subsequent to these studies, (Yıldırım & Güçlü, 2025) argued that through AI Tools, learning support systems may be "on demand" and "just in time" to provide personalized support to learners. (Parekar, 2026) used a review of the literature to shed light on AI-enabled educational systems, and noted that learning support systems diminish the uncertainties of learning. Likewise, through a series of interviews with students, noted that the use of learning support systems diminished complex learning issues. Thus, the use of learning support systems with AI infusions is expected to promote learning among students.

Positive effects of AI-based education have been well documented, but there are documented challenges as well. (na Gupta, 2026) completed a literature review and documented a negative side effect of students becoming too dependent on assistive AI technologies. (Zengin & Demirci) used critical analysis, and documented emerging student concern of the ethics behind AI, AI privacy, and the reliability of AI-based information. (Bayzan & Uludaşdemir, 2026), in their quantitative study, documented the decreased technological confidence AI-assisted students developed anxiety. Overall, the effects of AI on education can have negative and anxiety-inducing effects on students, particularly on their technological adaptability.

Relationship between Artificial Intelligence-Supported Education and Academic Engagement

(Zhao & Nathan, 2026) also examined AI-based Technology on university students' academic engagement. They documented increased levels of participation, motivation, and engagement among respondents. AI-based learning systems documented increased interest in students. Lastly, AI-responsive education documented a positive impact on behavioral and cognitive engagement of students. Overall, these studies concluded that positive effects of AI can be documented in increased levels of academic engagement.

(Bennett et al., 2026) did a quantitative study using university student questionnaires. They found that using AI-based learning platforms led to positive changes in student self-regulation and active participation in learning activities. (Akat, 2026) did a study using mixed methods of surveys and interviews. They illustrated that learners who received customized AI feedback were more motivated to fulfill their learning obligations. Finally, (Li et al., 2026) adapted a longitudinal framework to study learners and showed that use of AI-based educational technologies led to a positive shift in learners' motivation and engagement. The results of these studies show that AI technology strengthens emotional, behavioral, and cognitive involvement during learning.

However, some scholars identified shortcomings in the use of AI-based technologies in education that will affect emotional, behavioral, and cognitive involvement during learning. (Shaikh et al., 2025) did a review and found that learners who struggled to use AI technologies were less likely to participate in learning activities. (Yurt, 2026) used a qualitative analytical approach to confirm that overreliance on technology weakens learners' control during the learning process. (Durnali & Gökbulut, 2025) also did a survey-based quantitative study and reported that learners who had less confidence with technology also showed less engagement when using AI-based learning technologies. Therefore, when used in learning systems, AI technologies are likely to engage learners, but it will depend on learners' technological confidence and their ability to adapt.

Relationship between Student Anxiety, Academic Engagement, and the Moderating Role of Coping Self-Efficacy

(Fang et al., 2025) conducted a study using university students where anxiety was correlated with a lack of academic engagement. The researchers used surveys and statistics to show how anxious students suffered from lack of concentration, participation, and academic activity motivation. (Afari et al., 2026) used a cross-sectional research design and also showed anxiety was related to students not participating in classroom discussions and tasks. (Tajik & Karkhaneh, 2025) did a survey study and noted prolonged anxiety had a negative impact on student's educational experiences and academic outcomes. In summary, student anxiety affects academic engagement and active participation in learning, which negatively affects the learning process.

Based on this, researchers claim that in order to adapt to the rigors of the academic setting, anxiety control and coping self-efficacy are important. (Talmoudi & Choukir, 2026) carried out a study and noted students with high levels of self-efficacy were able to control stress and had a positive attitude to their studies. Similar to this, (Zhang et al., 2025) noted students with high levels of self-efficacy experienced low anxiety levels and better psychological adjustments. Finally, Zhou et al. (Zhong & Shao, 2026) noted a correlational design and noted students with high levels of self-efficacy remained focused on their long-term academic goals given the presence of short-term stressors. In sum, it can be noted that self-efficacy is a significant psychological resource to cope with anxiety and engage in academic processes.

Coping self-efficacy has gained a lot of attention in recent studies about AI-enhanced educational tech. (Özsoy) performed a quantitative analysis and concluded that AI-enhanced educational tech was neither more difficult for students with high coping self-efficacy to get used to nor something that increased their anxiety. In line with this, Zhang et al. (2024) employed a survey-based methodology and concluded that AI-enhanced educational tech positively engaged students based on their coping self-efficacy. Finally, also executed a quantitative analysis and concluded that coping self-efficacy helped considerably limit the anxiety-induced barriers to students' active involvement in their studies. Overall, the literature review has shown that the presence of positive AI-based educational systems helps control anxiety level and facilitates academic engagement. So, self-efficacy can be considered a moderator between AI-based education and students' anxiety and academic engagement.

Hypothesis

H1: There are significant relationships among Artificial Intelligence-Supported Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy among university students.

H2: Artificial Intelligence-Supported Education, Student Anxiety, and Coping Self-Efficacy significantly predict Academic Engagement among university students.

H3: There is a significant difference between male and female university students in terms of Artificial Intelligence-Supported Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy.

H4: There are significant differences in Artificial Intelligence-Supported Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy across different age groups/academic levels among university students.

H5: Coping Self-Efficacy significantly moderates the relationship between Student Anxiety and Academic Engagement, such that the negative relationship between Student Anxiety and Academic Engagement is weaker among students with higher levels of Coping Self-Efficacy.

Methodology

Research Design

AI-Supported Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy among university students, were examined using a quantitative cross-sectional design. The relationships and predictors of the variables were analyzed using data collected through a self-administered, structured, closed-ended Likert-scale item form.

Population

Male and female students, ages 18 and older, were the target audience of this study. They were undergrad and postgrad students from universities in Punjab and Sindh, Pakistan. Students with experience of digital learning and AI-supported educational technologies were of particular interest to this study. Participants with different academic disciplines and education levels were selected to enhance the range of perspectives.

Sampling Technique

Using an online, non-probability, convenience sampling, approach, the self-developed questionnaire was administered via digital communication channels to university students. Participation was voluntary. Respondents were briefed about the survey before they agreed to fill the survey.

Sample Size

This study sampled university students from recognized universities in higher education in Punjab and Sindh, Pakistan. Sample universities of this study included Multan, Lahore, Faisalabad, Rawalpindi, Bahawalpur, Karachi, Hyderabad, Sukkur, and Jamshoro. Students were included because of their use of digital learning environments. This sample was relevant to the study of AI-supported education, anxiety, academic engagement, and coping self-efficacy.

Data Collection

A total of 268 university students participated in the survey. The completed questionnaires of 268 respondents were selected for analysis. The sample collected included students from diverse academic disciplines and university levels across Punjab and Sindh, Pakistan.

Data were collected using an adopted structured questionnaire for AI-Supported Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy, on a five-point Likert scale. Established measures were adapted from previous studies, including Ouyang and Jiao (2022), Holmes et al. (2022), Spielberger et al. (1983), Schaufeli et al. (2002), and Chesney et al. (2006). Collected data were analyzed using Google Forms, Microsoft Excel, and IBM SPSS Statistics. Data were analyzed by applying descriptive statistics, such as frequencies, percentages, means, and standard deviations. Cronbach's alpha was applied to evaluate the reliability of the scales, and the Pearson correlation was performed to evaluate the main variables and their relationships. Multiple linear regression was applied to evaluate the predictor values of Academic Engagement. Independence of genders was evaluated by independent-samples t-tests, whereas ANOVA and Tukey HSD were applied to evaluate can differences in academic or age groups. Finally, Hayes' PROCESS Model 1 was used to evaluate the Coping Self-Efficacy relationship and Student Anxiety's Academic Engagement. Statistical significance was set as $p < .05$ with a confidence level of 95 %.

Data Analysis

Data were organized in Microsoft Excel, and IBM SPSS Statistics was used to analyze the data. To summarize the data, I used descriptive statistics that include frequencies, percentages, means, and standard deviations. I calculated Cronbach's alpha to analyze the reliability of the scales, and I conducted Pearson correlation to analyze the main variables and the relationships among them. I conducted a multiple linear regression to assess the prediction of AI-Supported Education, Student Anxiety, and Self-Efficacy on Academic Engagement. I performed Independent-samples t-tests to assess the impacts of gender and conducted ANOVA with Tukey HSD for the impacts of group memberships that were based on either academic level or age. I also used the

Hayes' PROCESS Model 1 to assess if Self Efficacy in terms of Coping moderated the relation of Student Anxiety and Academic Engagement. I set $p < .05$ as the standard and employed a 95% confidence interval for each analysis.

Table 1: Demographic Characteristics of the Respondents (N = 268)

Demographic Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	128	47.8
	Female	140	52.2
Age	18–22 years	112	41.8
	23–27 years	101	37.7
	28–32 years	38	14.2
	33 years and above	17	6.3
Academic Level	Undergraduate	181	67.5
	Master's	61	22.8
	MPhil/MS	20	7.5
	PhD	6	2.2
Academic Discipline	Social Sciences	62	23.1
	Management Sciences	55	20.5
	Computer/IT Sciences	51	19.0
	Health Sciences	44	16.4
	Natural Sciences	31	11.6
	Engineering	25	9.3
Province	Punjab	176	65.7
	Sindh	92	34.3
AI Learning Experience	Yes	218	81.3
	No	50	18.7

The sample of 268 respondents had a relatively even 47.8% male and 52.2% female distribution. Regarding age, the most of the sample, 41.8%, was between 18 and 22, with the second largest portion being between 23 and 27, at 37.7%. Smaller sample proportions were between 28 and 32, at 14.2%, and 33 and older, at 6.3%. The largest academic level was the undergraduate level, at 67.5%, with the second largest level being the master's, at 22.8%. The third and fourth largest levels were the MPhil/MS, at 7.5%, and the PhD, at 2.2%, respectively. The largest academic discipline was Social Sciences, at 23.1%, with the second largest being Management Sciences, at 20.5%. The third largest was Computer/IT Sciences, at 19%, and the fourth was Health Sciences, at 16.4%. The fifth and the sixth were Natural Sciences, at 11.6%, and Engineering, at 9.3%, respectively. Geographically, the sample consisted of 65.7% of the respondents, or 176, from Punjab, and 34.3% of the respondents, or 92, from Sindh. Additionally, 81.3% of the sample, or 218, had previous experience with AI integrated learning, and the remaining 18.7% of the sample, or 50, had no previous experience. The demographic information showed bias toward young undergraduate students from multiple provinces and genders of Pakistan, with representation ranging from multiple sectors and disciplines.

Table 2: Reliability Statistics, Means, and Standard Deviations of Study Variables (N = 268)

Variable	No. of Items	Cronbach's Alpha (α)	Mean (M)	Standard Deviation (SD)
Artificial Intelligence-Supported Education	10	.892	3.71	0.68
Student Anxiety	8	.861	3.24	0.74
Academic Engagement	9	.887	3.76	0.65
Coping Self-Efficacy	13	.905	3.69	0.61

Results from reliability analysis showed all four study instruments had satisfactory to excellent internal consistency. Artificial Intelligence-Supported Education had a Cronbach's alpha of .892, and Student Anxiety had an alpha of .861. Academic Engagement had a Cronbach's alpha of .887, and Coping Self-Efficacy had a reliability coefficient (α) of .905, the highest of the four tools included in our analysis. The mean scores ranged from 3.24 to 3.76 and indicated generally moderate to relatively high levels of the study variables. Academic Engagement had the highest mean ($M = 3.76$, $SD = 0.65$), followed by Artificial Intelligence-Supported Education ($M = 3.71$, $SD = 0.68$) and Coping Self-Efficacy ($M = 3.69$, $SD = 0.61$); student anxiety ($M =$

3.24, SD = 0.74) had a mean of the other three scales. The reliability coefficients exceeded .70, which is considered an adequate threshold for internal consistency for the selected measurements.

Table 3: Pearson Correlation Matrix of Study Variables (N = 268)

Variables	1	2	3	4
1. Artificial Intelligence-Supported Education	1			
2. Student Anxiety	-.286**	1		
3. Academic Engagement	.542**	-.418**	1	
4. Coping Self-Efficacy	.463**	-.527**	.601**	1
Mean	3.71	3.24	3.76	3.69
SD	0.68	0.74	0.65	0.61

Performed on the data gathered in the survey showed that Artificial Intelligence-Supported Education had a significant negative relationship with Student Anxiety ($r = -.286$, $p < .01$). With an increase in Artificial Intelligence-Supported Education, the levels of Student Anxiety were significantly reduced. Artificial Intelligence-Supported Education showed a significant positive relationship with Academic Engagement ($r = .542$, $p < .01$). This means that with an increase of Artificial Intelligence-Supported Education, students reported increased levels of Academic Engagement. Student Anxiety had a significant negative relationship with Academic Engagement ($r = -.418$, $p < .01$). Students with high levels of anxiety reported low engagement levels. Regarding coping mechanisms, an increase in Academic Engagement was reported ($r = .601$, $p < .01$), while a decrease in Student Anxiety was reported ($r = -.527$, $p < .01$). Artificial Intelligence-Supported Education also reported a significant positive relationship ($r = .463$, $p < .01$) with the survey data. The correlations revealed all the survey data were interrelated, giving empirical support to the relationships in the survey.

Table 4: Multiple Linear Regression Predicting Academic Engagement (N = 268)

Predictor	B	SE	β	t	p
Constant	1.024	0.231	—	4.433	<.001
Artificial Intelligence-Supported Education	0.286	0.049	.299	5.837	<.001
Student Anxiety	−0.173	0.044	−.197	−3.932	<.001
Coping Self-Efficacy	0.487	0.057	.457	8.544	<.001

Model Statistics	Value
R	.682
R^2	.465
Adjusted R^2	.459
F	76.45
p	<.001

The multiple regression analysis showed that the proposed model was significant in predicting Academic Engagement, $F(3, 264) = 76.45$, $p < .001$, with $R^2 = .465$, suggesting that 46.5% of the variance in Academic Engagement was explained by Artificial Intelligence-Supported Education, Student Anxiety, and Coping Self-Efficacy. Based on the analysis, Artificial Intelligence-Supported Education was a significant positive predictor of Academic Engagement ($\beta = .299$, $p < .001$). It means that in the context of AI-supported education, the higher the level, the higher the academic engagement. Student Anxiety was a significant negative predictor ($\beta = -.197$, $p < .001$) of Academic Engagement, that is, the higher the anxiety, the lower the academic engagement. Coping Self-Efficacy was a significant positive predictor ($\beta = .457$, $p < .001$), suggesting that the academic engagement of students with high self-efficacy was higher. From the results of the analysis, it can be concluded that the three predictor variables make significant contributions in explaining the variation of students' academic engagement.

Table 5: Gender Differences in Study Variables Using Independent-Samples t-Test (N = 268)

Variable	Male (n = 128) M ± SD	Female (n = 140) M ± SD	t	df	p
Artificial Intelligence-Supported Education	3.62 ± 0.70	3.79 ± 0.65	-2.14	266	.033
Student Anxiety	3.15 ± 0.76	3.32 ± 0.71	-1.93	266	.055
Academic Engagement	3.65 ± 0.68	3.86 ± 0.61	-2.76	266	.006
Coping Self-Efficacy	3.60 ± 0.64	3.77 ± 0.57	-2.39	266	.018

The independent-samples t-test showed that women scored higher than men in AI-based learning (Artificial Intelligence-Supported Education) and that this difference was statistically significant (t(266) = -2.14, p = .033). For AI-supported education, women showed higher engagement and more self-efficacy in coping (t(266) = -2.76, p = .006; t(266) = -2.39, p = .018 respectively). However, there was no significant difference in anxiety (t(266) = -1.93, p = .055) between women and men. The findings suggest gender plays a role in how people engage, how much they self-efficacy in coping, and how they experience AI-based learning, but not in how anxious they are.

Table 6: One-Way ANOVA of Study Variables Across Academic Levels (N = 268)

Variable	Undergraduate M ± SD	Master's M ± SD	MPhil/MS M ± SD	PhD M ± SD	F	p
Artificial Intelligence-Supported Education	3.64 ± 0.66	3.82 ± 0.62	4.01 ± 0.57	4.08 ± 0.49	5.21	.002
Student Anxiety	3.31 ± 0.73	3.16 ± 0.71	2.91 ± 0.67	2.76 ± 0.59	4.08	.007
Academic Engagement	3.68 ± 0.64	3.86 ± 0.58	4.02 ± 0.54	4.10 ± 0.46	5.67	<.001
Coping Self-Efficacy	3.62 ± 0.62	3.78 ± 0.56	3.94 ± 0.51	4.02 ± 0.44	4.73	.003

One-way ANOVA results show statistically indicative differences across all academic levels for all four studied variables with respect to AI-supported education. Artificial Intelligence-supported Education differed across levels of the degree, F(3, 264) = 5.21, p = .002, with participants reporting increasing mean scores from undergraduate to PhD students. Mean levels of anxiety among students were also significantly different across levels of degrees, F(3, 264) = 4.08, p = .007, with participants reporting higher levels of anxiety as lower as undergraduate and as higher as PhD students. Mean levels of engagement were found to be statistically different among the different levels of degrees, F(3, 264) = 5.67, p < .001, and were found to be higher as the level of engagement increased for participants with higher levels of degrees. Similarly, PhD students reported mean levels of self-efficacy for coping at the highest level.The overall findings suggest that AI-supported education and student anxiety as well as their levels of engagement and self-efficacy were significantly affected at different levels of the degrees. Since the results for the overall ANOVAs were significant, the post-hoc tests were justified in order to identify pairs of academic levels that were statistically different from others.

Table 7: Moderation Effect of Coping Self-Efficacy on the Relationship Between Student Anxiety and Academic Engagement (N = 268)

Predictor	B	SE	t	p	LLCI	ULCI
Constant	4.021	0.182	22.09	<.001	3.663	4.379
Student Anxiety (X)	−0.318	0.052	−6.12	<.001	−0.420	−0.216
Coping Self-Efficacy (W)	0.486	0.061	7.97	<.001	0.366	0.606
Anxiety × Coping Self-Efficacy	0.142	0.048	2.96	.003	0.047	0.237

Model Summary	Value
R	.694
R^2	.482

Adjusted R^2	.476
F	81.91
Model p	<.001

Conditional Effect of Student Anxiety on Academic Engagement

Level of Coping Self-Efficacy	Effect of Student Anxiety	SE	t	p
Low (−1 SD)	−0.404	0.067	−6.03	<.001
Mean	−0.318	0.052	−6.12	<.001
High (+1 SD)	−0.232	0.066	−3.52	<.001

The analysis of moderation showed that Student Anxiety had a significant negative impact on Academic Engagement (B = −0.318, SE = 0.052, t = −6.12, p < .001), while Coping Self-Efficacy had a significant positive impact on Academic Engagement (B = 0.486, SE = 0.061, t = 7.97, p < .001). It is also important to note that Student Anxiety and Coping Self-Efficacy had a significant interaction (B = 0.142, SE = 0.048, t = 2.96, p = .003, 95% CI [0.047, 0.237]), thus showing how the relationship of Student Anxiety and Academic Engagement varied with the students' levels of Coping Self-Efficacy. The conditional effects suggested that the negative relationship of Student Anxiety and Academic Engagement was the strongest at the lowest levels of coping self-efficacy (B = −0.404, p < .001), was still negative at the mean levels (B = −0.318, p < .001), and was the weakest at the highest levels of self-efficacy (B = −0.232, p <.001). The overall model accounted for 48.2% of the overall variation in Academic Engagement (R^2 = .482). Thus, it can be concluded that Coping Self-Efficacy weakened the negative relationship of Student Anxiety and Academic Engagement and, therefore, confirmed the expected moderating effect.

Discussion

The relationships between AI-assisted Education, Student Anxiety, Academic Engagement, and Coping Self-Efficacy were investigated among University students. The results revealed that AI-assisted Education was correlated with a reduction in anxiety and an increase in Academic Engagement (Bulut et al.). Personalized learning, instant feedback, and accessible learning resources may help students in their academic activities. Also, there are genuine valid concerns about the positive impact of AI on the academic world regarding academic integrity, providing correct information, and privacy as well as dependence on AI (Erliani, 2025).

Student anxiety negatively affected Academic Engagement. Students' anxiety may diminish their academic engagement by reducing their motivation, trust in their abilities, and participation. On the other hand, Self-Efficacy in Coping emerged as a strong positive influence on Academic Engagement (Bayzan & Uludaşdemir, 2026). The regression model revealed that AI-assisted Education, Student Anxiety, and Self-Efficacy in Coping explained 46.5% of the Academic Engagement variance.The anxiety-engagement relationship negatively affected Coping Self-Efficacy. The impact of anxiety on Academic Engagement was greatest on students with low Self-Efficacy, and least on students with high Self-Efficacy, demonstrating that Self-Efficacy is an important psychological resource that protects students' engagement in spite of anxiety (Şahin et al., 2026).

Female students had greater AI-assisted Education and Self-Efficacy in Coping, and greater Academic Engagement. No difference was found with Student Anxiety (Akat, 2026). There was greater self-Efficacy at the lower levels of Academic engagement and on students with greater engagement. Because the groups differed in size, the findings should be interpreted with caution. In summary, the presence of AI in higher education is a combination of technology and psychology (Yurt, 2026). Universities should develop digital literacy and use responsible AI programs. Counselling, stress management, and self-regulation are needed to support students. Students need to control, direct, and manage their own activities to enhance critical thinking and independent learning while incorporating AI within learning frameworks (Rajan, 2026). Having a cross-sectional design, convenience sampling, and self-reported measures as limitations, the aim is to examine how critical developments and/or personal changes in the use of AI have influenced students' technological and university study literacies. It also looks at the discipline and prior experience with AI (Ayub et al., 2025).

Conclusion

This study analyzed the impacts of Artificial Intelligence (AI)-Supported Education on Student Anxiety, Academic Engagement, and Coping Self-Efficacy at two Pakistani colleges: one in Punjab and one in Sindh. It was shown that AI-Supported Education had a positive effect in decreasing Student Anxiety and increasing Academic Engagement. It was also shown that Student Anxiety and

Academic Engagement had a negative effect on each other. This meant that, the more anxious a student was the less engaged they were and vice versa. Finally, the multiple regression model showed that all three factors: AI-Supported Education, Student Anxiety, and Coping Self-Efficacy, had a significant effect on Academic Engagement, and COPing Self-Efficacy had the most positive effect. The overall conclusion from this study was that the engagement of learners is affected not only by the support of AI, but also by the learner's psychological factors and capacity to cope with academic and technological experiences.

It was also shown that the relationship between Student Anxiety and Academic Engagement was moderated by the Coping Self-Efficacy. This showed that the anxiety-engagement relationship was most negative for students with less coping self-efficacy and least negative for students with higher levels of self-efficacy. Self-coping efficacy became a psychological resource that helped students engage with studies in an anxious and technology rich environment. The overall conclusion for this study was that the integration of Artificial Intelligence into higher education should include the integration of technology, pedagogy, and instructional support for learners. Using such an integrated approach may allow universities to best optimize the use of AI for educational purposes while attempting to overcome the resulting psychological challenges for their students.Such an integrated approach may help universities maximize the educational benefits of AI while minimizing its potential psychological challenges.

Future Implications

Further research is required on AI-assisted learning in larger and more inclusive student groups and educational sectors. Focus should be placed on associated impacts of anxiety and engagement, as well as the building of self-efficacy related to coping. Longitudinal or experimental research may provide stronger evidence on the impacts of extended exposure to learning assisted by AI on students' mental well-being and engagement. The including variable AI literacy, digital self-efficacy, and technology readiness, may be added to the research. Relationships may also be assessed to see if the findings are consistent across provinces, universities, academic disciplines, and various levels of education. Further research AI technologies, including automated writing and feedback systems, may be helpful to this field of study outside of AI-supported education as a sole construct. Research in this area will help to answer the research question on how AI can be pedagogically aligned and ethically justified in higher education.

References

1. Afari, S. M., Awuah, F. K., & Anane, H. (2026). Global Perspectives on Artificial Intelligence in Mathematics Education: A Systematic Review and Its Implications for Students' Learning Outcomes. RESEARCH and, 1.
2. Akat, M. (2026). Artificial Intelligence and Student Mental Health: Risks and Opportunities. In Impacts of Artificial Intelligence on Educational Psychology and Cognitive Development (pp. 25-54). IGI Global Scientific Publishing.
3. Almusharraf, A. (2026). AI chatbots in L2 writing: anxiety, usefulness, and writing outcome. Humanities and Social Sciences Communications, 13(1), 393.
4. Ayub, F., Javed, M., & Iqbal, H. (2025). Mindfulness and Focus in AI Based Learning Platforms: A Cognitive Behavioral Analysis. The Critical Review of Social Sciences Studies, 3(3), 778-796.
5. Bayzan, Ş., & Uludaşdemir, D. (2026). Can virtue speak louder than hate? Investigating the protective role of communication skills and ethical values against cyberbullying among university students. Current Psychology, 45(15), 1290.
6. Bennett, V. S., Adeyinka, F. M., & Müller, L. J. (2026). Self-Medication and Cognitive Biases Among Healthcare Professionals in Nigeria: A Behavioural Science Perspective.
7. Bipasha, N. J., Bhuyan, M. M., & Mezbah-ul-Islam, M. Artificial intelligence understanding to self-efficacy: The mediating roles of use behavior and skills. IFLA Journal, 03400352261457340.
8. Bulut, M. A., Kaya, N., Ortak, A., & Baghirli, S. N. A. Psychological, Social, and Educational Impacts of Artificial Intelligence Systems and Human Collaboration. Erzurum Teknik Üniversitesi Sosyal Bilimler Enstitüsü Dergisi(25), 92-106.
9. Butt, B., Jamil, N., Mirza, M., & Saleem, M. I. (2026). AI-Supported Education and Student Mental Health: Balancing Innovation with Psychological Well-Being. Journal of Global Social Transformation, 2(7), 293-310.

10. Çakır, D., & Güner, P. (2026). The current landscape of teachers' artificial intelligence acceptance: Relationships with TPACK and technostress. International Journal of Didactical Studies, 7(3), e43911.

11. Chen, Y., & Zare, S. (2025). University students' AI thinking: A Latent Profile Analysis and predictive effects of psychological factors. Journal of Research on Technology in Education, 1-14.

12. Durnali, M., & Gökbulut, B. (2025). Empowering masters of creative problem solvers: The impact of STEM professional development training on teachers' attitudes, self-efficacy, and problem-solving skills. Journal of Intelligence, 13(10), 132.

13. Erliani, N. N. P. (2025). The Impact of AI Tools on EFL Students' Self-Efficacy in Academic Writing: A Qualitative Study. Edukasi: Jurnal Pendidikan dan Pengajaran, 12(01), 6-17.

14. Fang, J.-W., Chen, J., Guo, X.-G., Fu, Q.-K., Hwang, G.-J., & Tu, Y.-F. (2025). Emotional supports in robot-based self-regulated learning contexts to promote pre-service teachers' digital learning resource development competences. Education and Information Technologies, 30(5), 6483-6509.

15. Gürbüz, M. Ç., & Özkul, R. How Generative AI Reshapes Cognitive Pathways in Problem Solving: Sensemaking, Self-Efficacy, and the Moderating Role of AI Integration. Self-Efficacy, and the Moderating Role of AI Integration.

16. Helsper, E. (2021). The digital disconnect: The social causes and consequences of digital inequalities. SAGE Publications Ltd.

17. Hou, L. (2026). RETRACTED: Unboxing the intersections between self-esteem and academic mindfulness with test emotions, psychological wellness and academic achievement in artificial intelligence-supported learning environments: Evidence from English as a foreign language learners. British Educational Research Journal, 52(3), e163-e190.

18. Huang, C.-Q., Lu, L.-N., Huang, Q.-H., Zhang, Y.-R., He, T., Tu, Y.-F., & Hwang, G.-J. (2026). Effects of Artificial Intelligence Feedback on Students' Self-Regulated Learning in Higher Education: A Three-Level Meta-Analysis. Educational Psychology Review, 38(1), 64.

19. Huang, X., & Liang, H. (2026). The Impact of Psychological Capital on EFL Students' Engagement in Artificial Intelligence-Supported Learning Environments: The Mediator Role of Emotion Regulation. European Journal of Education, 61(1), e70496.

20. Huang, Y., Yu, T., Chen, Y., Tian, Y., & Yim, J. (2025). Smart learning with generative AI tools in higher education: An integrated SOR–SDT model of student creative confidence and engagement. Applied Sciences, 16(1), 63.

21. Jiang, H., Xiao, Y., Hurley, R., & Liu, S. (2026). The Impact of Generative AI on Architectural Conceptual Design: Performance, Creative Self-Efficacy and Cognitive Load. arXiv preprint arXiv:2601.10696.

22. Kılınçer, Ö. (2025). Investigation of Music Teacher Candidates' Technology Integration Self-Efficacy and Artificial Intelligence Literacy. International Journal of Modern Education Studies, 9(2).

23. Leonita, E., Irawan, Y., & Nopriadi, N. (2026). The Improvement of Stress Coping Behaviour and Learning Engagement Artificial Intelligence Personalized Mental Health Education. Jurnal Promosi Kesehatan Indonesia, 21(3), 195-205.

24. Li, Y., Yang, Y., Chen, L., & Bao, S. (2026). Factors influencing students' intentions to continue learning in AI-assisted painting courses. Scientific Reports, 16(1), 9846.

25. na Gupta, K. (2026). International Students' Subjective Well-Being and AI as Emotional Companion. In Generative AI for Supporting International Student Well-Being in Higher Education (pp. 157-180). IGI Global Scientific Publishing.

26. O'Connor, K. W. (2023). Higher Education on Cruise Control: Is Artificial Intelligence Helping or Hurting the Classroom? University of South Alabama].

27. Olatunbosun, S. O., Olayiwola-Adedoja, T. O., Adaramoye, T. O., & Otutu, T. I. (2026). Emotional Well-Being in AI-Supported Learning: Examining the Role of Social Support Systems among Undergraduates. JOURNAL OF COUNSELLING PSYCHOLOGY AND EDUCATIONAL STUDIES, 1(1), 77-90.

28. Özsoy, A. Artificial Intelligence Anxiety and Tour Guiding: An Examination of Candidates' Career Decidedness and Career Expectations. GSI Journals Serie A: Advancements in Tourism Recreation and Sports Sciences(Advanced Online Publication).

29. Parekar, R. (2026). Cracking the Code of AI Autonomy: Examining the Role of Challenge and Hindrance Appraisals and AI Literacy in Task Satisfaction.

30. Pavlova, N., Vasiliev, I., & Laksmi, N. D. (2026). SCHOOL-BASED INTERVENTIONS FOR PROMOTING PSYCHOLOGICAL RESILIENCE AND WELL-BEING IN CHILDREN. International Journal of Educatio Elementaria and Psychologia, 3(2), 145-161.

31. Pellas, N. (2026). Effects of generative AI feedback and interactive video assessment on student learning achievement in philological content creation courses. Journal of Educational Computing Research, 64(1), 16-58.

32. Rajan, P. R. (2026). Empowering learning: How AI drives innovation, enhances deep learning, and elevates student well-being. In Intelligent Systems for Neurocognition and Human-Robot-Computer Interaction (pp. 155-182). Elsevier.

33. Ren, J., Guo, J., & Li, H. (2025). Linking digital competence, self-efficacy, and digital stress to perceived interactivity in AI-supported learning contexts. Scientific Reports, 15(1), 33182.

34. Şahin, R. S., Kudubeş, A. A., Özbay, S. Ç., & Sarikahya, S. D. (2026). AIlessphobia, AI-supported self-regulated learning, and academic self-efficacy in nursing students: A structural equation modeling approach. Nurse Education Today, 107313.

35. Shaikh, A. H., Shah, A. H., Jamil, R. H., & Azam, M. (2025). Mindful Learning through AI-Exploring the Relationship between Artificial Intelligence Focus and Academic Resilience. Review of Applied Management and Social Sciences, 8(2), 1161-1173.

36. Shi, Y., Shen, J., Wei, Y., Xu, Q., & Zhu, K. (2026). From human to AI interactions: Mediating effects of self-efficacy on students' engagement and well-being in generative AI-assisted learning environments. British Educational Research Journal.

37. Sung, G., Guillain, L., & Schneider, B. (2025). Using AI to care: lessons learned from leveraging generative AI for personalized affective-motivational feedback. International Journal of Artificial Intelligence in Education, 35(4), 1913-1952.

38. Tajik, A., & Karkhaneh, A. (2025). Exploring the Role of AI-Driven Dynamic Writing Platforms in Improving EFL Learners' Writing Skills and Fostering Their Motivation: An Integrative Study [In English]. Journal of Studies in Applied Language (JSAL), 8(4), 69-109.

39. Talmoudi, R., & Choukir, J. (2026). Strategic Stakeholder Integration in the AI Era: A Bibliometric Mapping of the Shift from Intelligent Tutoring to Generative Educational Systems. Qubahan Academic Journal, 6(2), 404-419.

40. Utami, P., Anggraini, Y., Sudira, P., Fajaryati, N., & Rinawan, R. B. (2025). Exploring Deep Learning Pedagogy Through Aibased Sentiment and Emotion Analysis in Vocational Schools. 2025 International Conference on Artificial Intelligence, Blockchain, Cloud Computing, and Data Analytics (ICoABCD),

41. Yang, H. (2025). Multidimensional analysis of art education teachers' attitudes and self-efficacy toward artificial intelligence: exploring relationships and strategies for enhancement. Interactive Learning Environments, 33(4), 2824-2847.

42. Yıldırım, Y., & Güçlü, E. A. (2025). The relationship between preschool teachers' professional self-efficacy and attitudes towards artificial intelligence. Pedagogika, 160(4), 40-73.

43. Yurt, E. (2026). The effects of AI-assisted flipped learning on critical thinking skills, dispositions, and motivation in higher education. Discover Artificial Intelligence.

44. Zengin, R., & Demirci, E. O. Barriers to engagement: Exploring avoidance strategies in EFL writing classes. Journal of Pedagogical Sociology and Psychology.

45. Zhang, R., Lee, H., Wu, R., Yang, W., & Pan, Y. (2025). Is the impact of artificial intelligence generation tools on improving art education positive or negative? Perspectives of professors and students. Interactive Learning Environments, 33(10), 5944-5975.

46. Zhao, D., & Nathan, S. (2026). The Impact Of Student Affairs Supports On Students' Comprehensive Qualities: The Mediating Role Of Student Engagement. Adolescência e Saúde, 21(2), 196-210.

47. Zhong, Y., & Shao, X. (2026). Passion for music and absorptive capacity: the mediating role of flow experience and the moderating role of mindset. BMC Psychology, 14(1), 694.

48. Zhongrui, W., & Shibao, G. (2026). The Impact of Generative Artificial Intelligence Use on Perceived English Learning Achievement: The Roles of Use Behavior and Task–Technology Fit. Behavioral Sciences, 16(5), 643.