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

Halah Rasheed Ali Abdullgabar Al Shaibani[1], Dr. Muhammad Awais[2], Amber Sarwar Hashmi[3], Sidra Hussain[4]
[1] University of Management and Technology (UMT), Lahore
Email: f2025051005@umt.edu.pk
[2] School Education Department (SED), Government of Punjab, Pakistan
Email: awaissanwal@gmail.com
[3] Rawalpindi Women University
Email: amber.hashmi@rwu.edu.pk
[4] COMSATS University Islamabad
Email: sidra.hussain@mofept.edu.pk

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Corresponding author:
Halah Rasheed Ali Abdullgabar Al Shaibani
Email:
f2025051005@umt.edu.pk

ABSTRACT

Artificial Intelligence (AI) is increasingly transforming higher education by providing students with personalized learning support, rapid access to information, and assistance with academic tasks, while simultaneously creating new academic and psychological demands. The present study examined Artificial Intelligence-Supported Education, student stress, and academic performance, with particular emphasis on the moderating role of coping self-efficacy among university students in Punjab and Sindh, Pakistan. A quantitative, cross-sectional research design was used, and data were collected from 423 university students through a structured, adopted questionnaire administered online using Google Forms. The questionnaire measured Artificial Intelligence-Supported Education, student stress, academic performance, and coping self-efficacy using established measurement scales. The collected responses were initially organized in Microsoft Excel and subsequently analyzed using IBM SPSS Statistics. Descriptive statistics, Cronbach's alpha reliability analysis, Pearson correlation, regression analysis, and moderation analysis were conducted to examine the proposed relationships among the study variables. The findings demonstrated that Artificial Intelligence-Supported Education was significantly associated with student stress and positively predicted academic performance. The moderation findings further showed that coping self-efficacy significantly influenced these relationships by weakening the association between AI-supported education and student stress while strengthening the positive association between AI-supported education and academic performance. The study is significant because it provides an integrated understanding of the educational and psychological consequences of AI-supported learning and highlights the importance of students' coping resources in determining how they respond to AI-enabled educational environments. The findings suggest that higher education institutions should combine AI integration with responsible-use guidance, psychological support, and coping-skills development to maximize educational benefits while reducing potential student stress.

Introduction

AI-supported education uses AI technologies to support teaching and promote personalized learning, offer academic assistance and feedback, assess students, encourage student engagement, and aid students in accessing educational resources. Technologies such as intelligent tutoring systems, adaptive learning systems, learning analytics, and generative AI have disrupted the

educational landscape and made teaching and learning more student centered and more interactive. Some studies have reported that the use of AI in education can help students learn more effectively, enhance their problem-solving skills, and provide them with immediate assistance and feedback (Gürbüz & Özkul).The use of AI in education has many advantages, particularly in generating examples and supporting students with the examples they need. AI-based interventions have been reported to improve academic performance as well as students' motivation and lower the cognitive effort needed for the task (Deng et al., 2026), though this is context dependent. These benefits largely hinge on the integration of the available tools.

The use of AI in education has many challenges, especially the balance that students must maintain between rest and stress in their psychological well-being. This is especially the case due to the uncertainty and high reliance on AI stemming from the arguments about technological accuracy and potential academic dishonesty.Studies show the necessity of AI use case analysis concerning students' psychology, especially stress related to academics and personal resources of coping (Wang et al., 2026). Thus, using AI as a support system in education has to be viewed as a multilevel educational phenomenon, in which novel methods of learning can be invented and, simultaneously, new demands can be placed on learners.

Student Stress in Higher Education

Stress of students refers to the Ciocco (2021) psychological and physical academic burden students feel when their coping capacity is overburdened by academic, social, and/or personal and environmental demands. Amongst the myriad stressors of university students are: heavy workloads, constant deadlines, financial concerns, career uncertainty, competition, and the demands of family and friends, etc. Chronic stress impairs a student's learning and psychological functioning; thus, it is especially important to identify means to alleviate stress (Huang & Liang, 2026).Optimal levels of stress may even encourage students to exert effort to meet goals. However, chronic stress actually inhibits cognitive functioning and disrupts motivation.

Stress increases perceived cognitive burden and students' perceived lack of control, and these, in combination with psychological resources such as self-efficacy, are critical to how students psychologically cope with stressful academic situations (Pascoe et al., 2020). Therefore, one must consider the overall stress of students, not just the content of students' academic demands. The use of artificial intelligence in education imposes new and complex stress on students. AI may reduce stress related to classroom learning by offering answers and automated learning tools, however, students may experience other stress related to learning AI, academic integrity, and understanding the implications of AI in education. There is existing research that correlates stress related to academic performance expectations and problematic AI use with stress related to unaddressed psychological issues. This further highlights the importance of examining psychologically stress related AI in higher learning (Robotham & Julian, 2006).

The relationship between AI in education and student stress may be complex and multi-dimensional.AI can create additional stress and demands on students, but it also offers educational services that may reduce stress. Using AI tools can help students find information quickly and provide personalized explanations and feedback on their work. Instant feedback makes it easier to identify the areas they struggle with and provide additional instruction on those concepts (Maymon & Hall, 2021). It adjusts the mental effort that students need to put into learning (Kurnia, 2023). This suggests that properly implemented AI may relieve some of the academic burden on students.

Academic Performance

Academic performance refers to a student's fulfillment of expected educational outcomes and is usually quantified by grades, tests, assignments, GPA, and other evaluations. It reflects the student's ability to comprehend, internalize, and apply knowledge in common academic tasks. Factors such as cognitive capacity, learning environment, motivation, psychology, and availability of technological resources influence academic achievement, and therefore, understanding or interpreting academic performance should not be restricted to a unidimensional framework (Teixeira et al., 2022).AI has the potential to enhance academic performance due to its capability to offer resources for personalized learning, instant feedback and guidance [for example], and instruction based on individual learners. As suggested by systematic reviews and meta-analyses, AI-based learning assistants, particularly ChatGPT, are expected to positively impact students' academic performance.

However, the expected impact may differently among different levels and subjects of educational engagement, learning activities, duration of the AI-based learning activity, and other factors associated with AI in the learning process. Dependance on AI for learning will diminish students' engagement with academic resources and facilitate a lower level of independent reasoning, creativity, and critical evaluation of the academic resources. AI may prompt students to take answers uncritically, and therefore, degrade the quality of their academic work. For this reason, AI should be used as an adjunct to learning (Rajan, 2026).AI-

integrated Educational Systems are able to provide personalized feedback, and learning and instructional resources. Thus, they fundamentally can enhance academic performance.

These functions allow students to analyze hard-to-grasp ideas and find gaps in their learning. They provide students with a convenient way to access assistance. The impact of these new technologies on students' academic performance is beginning to be examined in studies that are being published. These studies demonstrate that generative AI technologies can have positive impacts on students' academic performance. A student's academic performance is impacted by psychological factors, stress being one of the more important factors. Excessive or chronic stress interferes with concentration and memory, reduces motivation, emotional control, and the student's ability to engage in learning activities. When a student perceives that the demands of an activity are greater than their coping capacity, they will invest more cognitive effort in stress management and less in processing what is being taught. It has been shown that stress leads to a greater cognitive burden and less self-efficacy, both of which negatively impact academic performance (Ren et al., 2025).

Coping Self-Efficacy

Coping self-efficacy refers to how people view their ability to respond to demands of stressful events; manage and regulate emotions; solve problems; and utilize the needed resources for coping. Students who have high levels of coping self-efficacy are able to view academic challenges as less threatening and more manageable. This psychological resource is highly needed because university students face the demands of academic tasks, examinations, and the uncertainties of deadlines and shifting educational demands that require persistence, emotional control, and problem-solving (Leonita et al., 2026).

Coping self-efficacy can shape students' responses to demands of academic stress. Students who think that they can control circumstances will respond to stressful demands by employing the strategy of problem solving, positive reappraisal, and the use of social support. On the other hand, the lack of confidence in coping ability generates emotional distress, avoidance, disengagement, and low effort. It has been shown in studies that there are associations among stress, coping strategies, and students' efficacy beliefs (Chen & Zare, 2025).

Coping self-efficacy is pivotal to student success because of the relationship of psychological resources to emotional and academic functioning. Students who are more confident in their ability to manage challenges are more likely to be motivated to sustain emotional control, and remain active in academic pursuits. In this context, self-coping efficacy adds an important psychological dimension to the different student responses to the same educational demands, and why some students manage to keep intact their level of academic performance under stress (Huang et al., 2026; Shaikh et al., 2025).

Self-coping efficacy is the self-confidence an individual has when faced with challenges in the academic, emotional, and technological domains. Citing as a moderator self-coping efficacy can alter the relationship between Artificial Intelligence (AI) - integrated education, and the outcomes of students. It is possible for students to have the efficacy required for self-coping, for them to be able to self-regulate their emotions, access the necessary resources, and continue to pursue their academic work. However, students with low self-coping efficacy could perhaps see similar academic and technological demands as increasing their stress and becoming a barrier to the performance of effective academic work (Hou, 2026).

Research Objectives

- To examine the relationship between Artificial Intelligence-Supported Education and student stress among university students.
- To determine the relationship between Artificial Intelligence-Supported Education and academic performance among university students.
- To examine the moderating role of coping self-efficacy in the relationships between Artificial Intelligence-Supported Education, student stress, and academic performance.

Problem Statement

Integration of AI in higher education provides learning opportunities that can be personalized and also provides students with academic support and quick feedback to improve performance. The implications of AI in education on the human psyche is relatively unknown. Most studies conduct research on the use of AI and learning tools in higher education and the subsequent impact on achievement. Compared to this line of research, few studies consider the impact of AI tools and automation of Higher

Education on mental stress and academic performance. Tools such as ChatGPT and similar utilities may create a more manageable workload and lessen thinking in order to complete tasks (Şahin et al., 2026). However, researchers recognize other issues such as the clear negative impact of AI on stress, academic performance, and also the development and attainment of higher forms of thinking. Users of AI are experiencing other, negative issues such as performance pressure and academic integrity, as well as the psychological dependence on AI. Additionally, some users experience negative stress, anxiety, and uncertainty as a result of the use of AI. Pakistan was one of the early studies to conduct research on the impact of ChatGPT and higher education; the study reported that ChatGPT aided university students in the completion of their studies and achieved positive outcomes. Although certain challenges of AI-education have been explored in academic stress and AI self-dependence, and the role of psychological factors in academic performance and stress on AI dependence, few studies have examined the relationship on stress, coping self-efficacy, and AI-education on student performance (Wang & Guo, 2026). There is a research gap concerning students' coping self-efficacy and the management of academic and technological demands related to AI-integrated education and the eventual attainment of positive academic outcomes. This research gap is of importance to the advancement of higher education systems and shifts to AI integration, where learners are required to meet academic expectations, while managing both psychological and technological demands of such environments (Zhongrui & Shibao, 2026).

Significance of the Study

The main purpose of this study is to advance the current knowledge on the impact of AI-integrated education on the stress levels of university students, and subsequent impact on academic performance, through the application and analysis of the psychology and self-coping efficacy resource. Although AI may enhance and support leaning through automation and closure of learning gaps, its integration in educational processes may create new demands of an academic and psychological nature. The results of this study will offer the potential for stress reduction in students, and for future theoretical research, through analysis of the adoption of AI in learning and the resulting impact on students' self-coping efficacy. From a practical perspective, it may offer higher educational institutions, teachers and policy makers the opportunity to foster integral AI learning environments that are psychologically safe and provide educational benefits to students based on the responsible use of AI, while improving coping skills of the students and reducing the potential dependence on AI.

This study may have important empirical data for the Pakistani context of higher education because AI-supported learning is rapidly growing in importance and requires more study regarding AI usage, academic stress, coping resources, and academic performance.AI-supported higher education will become increasingly necessary, but we currently have limited understanding of the Pakistani context within this field. We lack the empirical data to support this claim regarding the impact of artificial intelligence, the resulting academic stress, the available coping resources, and the influence each of these will have on academic performance.

Literature Review

Supporting higher education with Artificial Intelligence (AI) has become a key element of personalized learning and academic assistance with AI providing suggestions in multiple formats, tutorials, content generation, and assessment. New research studies on generative AI, especially ChatGPT, have been rapidly increasing in empirical studies in university contexts. These AI technologies are integrating into learning activities at an even greater frequency than before with technologies used to supplement learning (Butt et al., 2026).The correlation between support of education by AI and student stress is complex. There are multiple demands resulting from tasks and the procurement of information that could be relieved by AI explaining them. Difficult tasks could also be assisted by AI.

There is also evidence that the use of ChatGPT for learning tasks has been shown to reduce mental efforts while improving learning. There is no guarantee that AI supported learning will decrease student stress because students will experience stress relative to the AI framework because of the demands of technological integration, performance, and appropriate use (Wijaya et al., 2026). Some concordant research suggests that the demands of formal education led to excess, unhealthy dependency on AI and problems with independent thought creativity, and information literacy. This means that students may use AI for improper reasons to assist learning and cope with the stress of performance and meet the demands of formal education (Olatunbosun et al., 2026).

Artificial Intelligence-Supported Education and Academic Performance

AI-assisted education focuses on the measurement of academic performance because AI can provide individualized learning resources, instantaneous feedback, step-by-step guidance for problem solving, and help learners overcome barriers to accessing

learning resources. It can also help students to understand the learning content. Many recent studies on ChatGPT examine its utility in learning, writing, assessments and instruction, making academic performance a critical measure of the educational value of AI (Hassan, 2026). Recent empirical evidence tends to corroborate the positive relationship between AI-mediated education and improved academic performance. Kölemen (2024) conducted a systematic review and meta-analysis of experimental studies and stated that positive impacts of ChatGPT on academic performance have been recorded. From these results, providing assistance tailored to the individual, instant information, and an abundance of learning support can lead to enhanced academic performance. The results, however, were unstable across the studies, indicating that AI's utility in education relies on several factors, including the design of the educational activities, assessment, and context (Balat, 2026).

Despite the results reported above, AI-based education is not guarantee of real academic achievement. The results cannot be generalized due to the differences in research, population, assessment, and use of AI. Moreover, AI assistance may lead to the enhancement of academic performance without the development of the students' independent knowledge and skills (ARIKAN, 2025). Because access to AI changes learning, evaluation methods should reflect the manner in which AI assists learning rather than if students have access to the technology (Kiren et al., 2026).

Student Stress and Academic Performance

Student stress is relevant to academic performance because university students deal with many stressors, including exams, due dates, an overwhelming workload, strong competition, and high academic standards. As students perceive demand exceeding their resources, stress may negatively impact their education. One study of a large sample of undergraduate students reported that students with stress Obstruction to academic performance reported poorer academic performance outcomes and lower coping resources (Frazier et al., 2019).

Stress has the power to diminish cognitive resources. Memory, planning, problem solving, and learning, in addition to loss of motivation, may also be impacted. The ability to remain engaged in challenging tasks may also diminish. Therefore, stress has a strong relationship to academic performance and not just how much stress a student may be experiencing (Frazier et al., 2019; Ma, 2025).Having the appropriate resources for coping self-efficacy also has implications on how students respond to academic stress. Yucha et al. (2009) found a negative academic stress and coping self-efficacy relationship, distance learning students, in particular, with higher levels of academic stress, had a higher level of stress coping self-efficacy. Similar studies show that effective stress coping resources help students deal with academic stress and improve their psychological and educational functioning (Crego et al., 2016; Regalado, 2024).

Coping Self-Efficacy as a Psychological Resource

Coping self-efficacy describes a student's belief in their ability to adjust to excessively demanding circumstances or to cope with demanding situations successfully. It also includes the belief in one's ability to control one's emotions and behavior as well as to solve academic problems. This belief is key to navigation of the higher education system (Greenglass & Mara, 2012). Given continually changing demands and expectations, higher education additionally brings uncertainty. Coping self-efficacy helps students perceive barriers in academics as challenges that are within their control and encourages them to stay active and engaged rather than allowing stress to disrupt their studies.

Studies also indicate the relationship between coping self-efficacy and student stress. (Regalado, 2024) found a significant negative relation of academic stress and coping self-efficacy. It means that greater stress was related to having lesser confidence in one's ability to cope, and students who were more confident in their belief of being able to cope were more likely to use adaptive coping strategies such as problem-focused coping and Social support. From these studies, one can also conclude that coping self-efficacy manages the pressures of studying (Rabenu & Yaniv, 2017).

The relationship between coping self-efficacy and academic performance is not as straightforward. (Pisanti et al., 2015) found that students in the non-coping self-efficacy group (students who perceived stress as an obstacle to academic performance) reported lower coping self-efficacy and performed worse than those in the coping self-efficacy group. However, (Schwarzer & Scholz, 2000) have shown that coping self-efficacy is much more tied to the well-being and motivation of students than to their academic scores. This also adds to the conclusion that coping self-efficacy, while having a strong indirect relation to academic performance, is much more tied to the well-being of students (Cicognani, 2011).

Moderating Role of Coping Self-Efficacy in AI-Supported Education

Coping self-efficacy may be extra important in AI-assisted learning because along with offering academic support, AI still gives students the responsibility of managing demands of the learning process. Although offering explanations, information, helping students with problem solving, and reducing effort, students still need to evaluate the information, regulate their learning, and manage pressure related to academics. AI-enabled interventions show positive signs on students' academics, but they may also affect students' performance in a negative way through the stress related to academics and AI dependency (Wu et al., 2026).

Higher coping self-efficacy makes students more capable of managing uncertainty related to technology as well as stress related to academics. Students with high coping self-efficacy can use AI systems effectively by checking the system outputs, asking for clarification, and staying focused in spite of any difficulties. In contrast, students with low coping self-efficacy can view the demands related to AI as threats more than students with high coping self-efficacy, and therefore, may get more vulnerable to stress and AI dependency (Wang & Xu, 2026).Coping self-efficacy may also determine the relationship between AI-based educational technologies and the stress levels of students. The students who have high coping self-efficacy may be able to manage the complexity of AI systems and, therefore, be able to manage difficulties related to learning. There may be stress caused by anxiousness related to AI systems and increased performance goals. Some students may be able to manage this level of stress. Evidence pertaining to student success and academic-related stress highlights the role of adaptive resources in students' psychological and educational functioning (Jeilani & Abubakar, 2025).

Research Gap

Despite the rapid growth of Artificial Intelligence in higher education, limited research has examined its **combined educational and psychological consequences**. Existing studies have largely focused on AI's effects on learning, academic achievement, and engagement, while other research has examined AI dependency, academic stress, and performance expectations separately (Akat, 2026). Moreover, limited evidence has integrated **AI-supported education, student stress, and academic performance within a single research model**, particularly in the Pakistani higher-education context. More importantly, the potential moderating role of **coping self-efficacy** remains insufficiently explored. Therefore, the present study addresses this gap by examining how AI-supported education relates to student stress and academic performance and whether these relationships vary according to students' coping self-efficacy.

Hypotheses

- **H1:** There is a significant relationship between Artificial Intelligence-Supported Education and student stress among university students.
- **H2:** Artificial Intelligence-Supported Education significantly predicts academic performance among university students.
- **H3:** Coping self-efficacy significantly moderates the relationship between Artificial Intelligence-Supported Education and student stress among university students.
- **H4:** Coping self-efficacy significantly moderates the relationship between Artificial Intelligence-Supported Education and academic performance among university students.

Methodology

Research Design

A **quantitative, cross-sectional research design** was used to examine the relationships among Artificial Intelligence-Supported Education, student stress, academic performance, and coping self-efficacy among university students. A structured questionnaire was used to collect numerical data through standardized Likert-scale items, which were subsequently analyzed using statistical techniques. The quantitative design was appropriate for examining relationships, predictive effects, and moderating effects among the study variables. Data were collected at a single point in time, making the study cross-sectional in nature, while no variables or educational conditions were experimentally manipulated.

Population

The population comprised university students enrolled in higher education institutions across Punjab and Sindh, Pakistan. Students were drawn from public and private universities in major educational centers, including Bahauddin Zakariya University,

The Women University Multan, University of the Punjab, Government College University Lahore, University of Sargodha, University of Education, University of Karachi, University of Sindh, and Shah Abdul Latif University. Including students from both provinces provided geographical diversity and enabled the study to capture varied experiences of AI-supported education within Pakistan's higher-education context.

Target Audience

The target audience consisted of **undergraduate and postgraduate university students** enrolled in higher education institutions across Punjab and Sindh, Pakistan. Students from diverse academic disciplines were included because AI-supported education is relevant across different fields rather than being limited to technology-related programs. Students with experience using digital or AI-supported educational resources were targeted because they could provide relevant information about AI-supported learning, academic stress, coping self-efficacy, and academic performance.

Sampling Technique

A non-probability purposive sampling technique was used to select university students from higher education institutions in Punjab and Sindh, Pakistan. Students were selected based on their enrollment in university programs and experience with digital or AI-supported educational resources. The questionnaire was distributed online through student networks and communication channels, with efforts made to include respondents from different academic disciplines and educational levels. Participation was voluntary, and respondents were informed about the purpose of the study before completing the questionnaire.

Sample Size

A total of **423 valid responses** were obtained and included in the final analysis. The sample consisted of university students from higher education institutions in Punjab and Sindh, Pakistan. Only sufficiently completed questionnaires were retained for statistical analysis, whereas incomplete responses were excluded from the final dataset. The final sample of 423 respondents provided an adequate number of observations for conducting correlation analysis, regression analysis, and moderation analysis involving the study variables. The sample size also provided sufficient statistical information for examining differences and associations among students with varying levels of AI-supported education, stress, academic performance, and coping self-efficacy.

Data Collection

Data were collected through an **adopted structured questionnaire** administered online using Google Forms. The questionnaire contained demographic questions and measures of Artificial Intelligence-Supported Education, student stress, academic performance, and coping self-efficacy. The AI component was based on established AI-literacy and AI-use measurement approaches, while student stress was measured using items adapted from the **Perceived Stress Scale** developed. Coping self-efficacy was assessed using the **Coping Self-Efficacy Scale** developed, and academic performance was measured through adapted self-reported academic-performance items. All constructs were assessed using a **five-point Likert-type scale.**

The Google Forms questionnaire was distributed electronically to eligible university students in Punjab and Sindh through student networks and online communication platforms. Participation was voluntary, and respondents were informed about the purpose of the study before completing the questionnaire. After data collection, responses were downloaded from Google Forms and transferred to **Microsoft Excel** for initial organization and screening before statistical analysis.

Data Analysis

The collected data were first exported from Google Forms to **Microsoft Excel**, where responses were checked for missing data, duplicate entries, coding errors, and inconsistencies. The cleaned dataset was then coded and transferred to **IBM SPSS Statistics** for statistical analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to describe the respondents and study variables. **Cronbach's alpha** was used to assess the internal consistency of the measurement scales.

Pearson Product-Moment Correlation was used to examine the direction and strength of relationships among Artificial Intelligence-Supported Education, student stress, academic performance, and coping self-efficacy. **Linear regression analysis** was conducted to determine the predictive effect of Artificial Intelligence-Supported Education on academic performance, including model fit and regression coefficients. **Hierarchical multiple regression/moderation analysis** was used to determine

whether coping self-efficacy changed the strength of the relationships between Artificial Intelligence-Supported Education and student stress and between Artificial Intelligence-Supported Education and academic performance. The interaction term between the predictor and moderator was examined to determine the moderation effect.

For demographic comparisons, **independent-samples t-test** and **one-way ANOVA** were used where appropriate. Significant ANOVA results were followed by suitable **post-hoc multiple-comparison tests** to identify differences between specific groups. Statistical significance was evaluated at **$p < .05$**, and all analyses were conducted using IBM SPSS Statistics.

Data Analysis

Table 1: Demographic Characteristics of Respondents (N = 423)

Demographic Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	227	53.7
	Female	196	46.3
Age	18–22 years	174	41.1
	23–27 years	151	35.7
	28–32 years	62	14.7
	33 years and above	36	8.5
Educational Level	Undergraduate/Bachelor's	256	60.5
	Master's	112	26.5
	MPhil/MS	43	10.2
	PhD	12	2.8
Academic Discipline	Social Sciences	91	21.5
	Business/Management	83	19.6
	Computer Science/IT	79	18.7
	Natural Sciences	67	15.8
	Health Sciences	58	13.7
	Engineering	45	10.6
Province	Punjab	263	62.2
	Sindh	160	37.8
AI Usage Experience	Less than 1 year	82	19.4
	1–2 years	145	34.3
	3–4 years	119	28.1
	More than 4 years	77	18.2

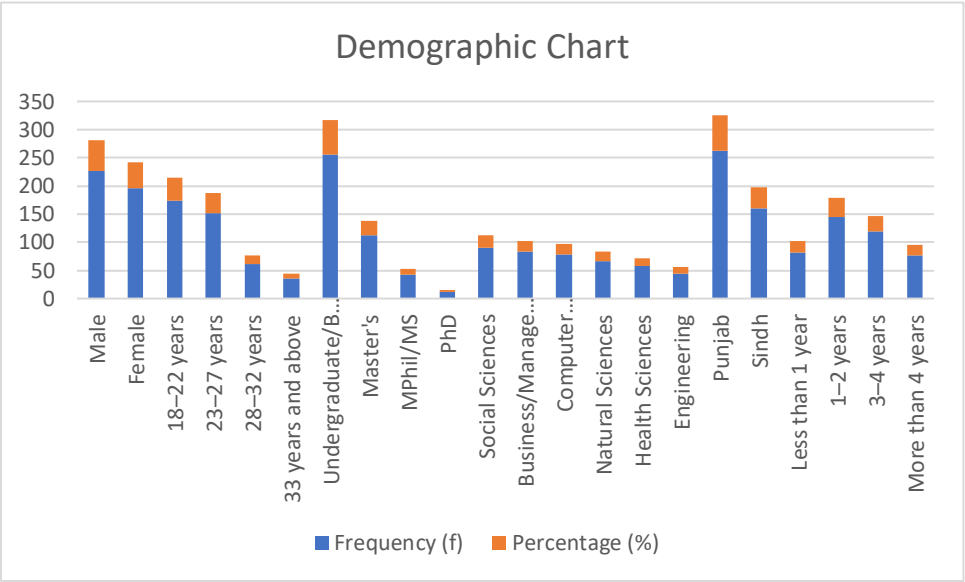

Fig. 1 Demographic Characteristics of Respondents

The demographic analysis of the **423 respondents** showed a diverse sample across gender, age, educational level, academic discipline, province, and AI-use experience. The sample was relatively balanced by gender, with males representing 53.7% and females 46.3%. Most respondents were young university students aged 18–27 years, while undergraduate students constituted the largest educational group. Participants represented various academic disciplines, with Social Sciences, Business/Management, and Computer Science/IT comprising the largest proportions. Geographically, 62.2% of respondents were from Punjab and 37.8% from Sindh. In terms of AI experience, the largest group had 1–2 years of experience, followed by those with 3–4 years, indicating substantial exposure to AI-supported technologies. Overall, the sample provided adequate diversity for examining AI-supported education, student stress, academic performance, and coping self-efficacy among university students.

Table 2: Reliability and Descriptive Statistics of Study Variables (N = 423)

Study Variable	No. of Items	Cronbach's Alpha (α)	Mean (M)	Standard Deviation (SD)
Artificial Intelligence-Supported Education	10	0.934	3.81	0.63
Student Stress	10	0.887	3.24	0.71
Academic Performance	8	0.902	3.67	0.66
Coping Self-Efficacy	10	0.921	3.74	0.61

The reliability analysis demonstrated **high to excellent internal consistency** across all study variables, as all Cronbach's alpha coefficients exceeded the commonly accepted threshold of 0.70. Artificial Intelligence-Supported Education demonstrated the highest internal consistency (α = 0.934), followed by Coping Self-Efficacy (α = 0.921), Academic Performance (α = 0.902), and Student Stress (α = 0.887), indicating that the items measuring each construct were consistently related to one another. The descriptive results showed that Artificial Intelligence-Supported Education had the highest mean score (M = 3.81, SD = 0.63), followed by Coping Self-Efficacy (M = 3.74, SD = 0.61) and Academic Performance (M = 3.67, SD = 0.66), whereas Student Stress recorded a comparatively lower mean score (M = 3.24, SD = 0.71). Overall, the findings indicate satisfactory measurement reliability and moderate-to-high levels of the principal study constructs among the respondents.

Table 3: Pearson Correlation among Artificial Intelligence-Supported Education and Student Stress (N = 423)

Variables	1	2
1. Artificial Intelligence-Supported Education	1	
2. Student Stress	.426**	1

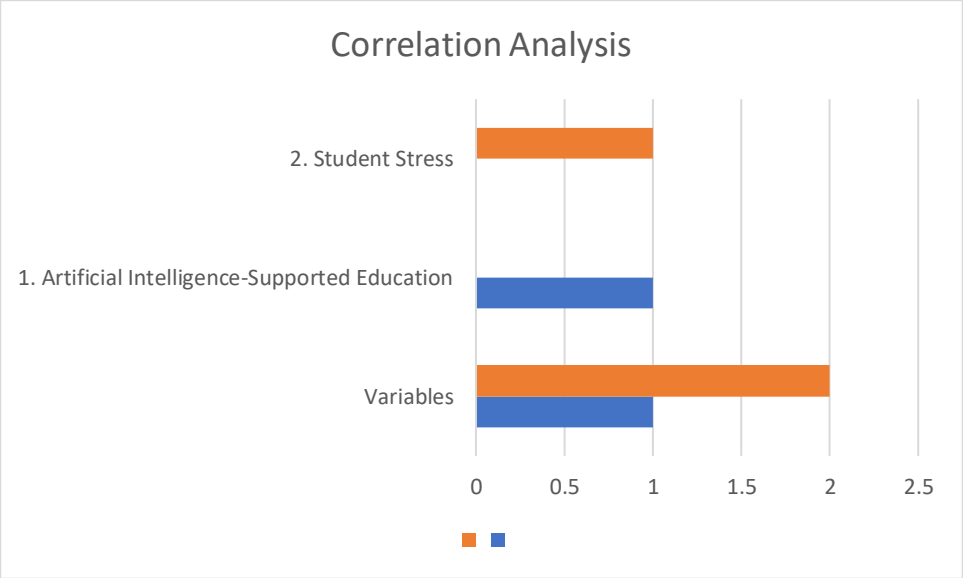

Fig.2 Correlation Analysis

Note. p < .01 (two-tailed).

The Pearson correlation analysis indicated a **positive and statistically significant relationship** between Artificial Intelligence-Supported Education and student stress among the 423 respondents, with a correlation coefficient of **r = .426, p < .01.** The magnitude of the correlation indicated a moderate positive association, suggesting that higher levels of Artificial Intelligence-Supported Education were associated with higher levels of student stress. The statistically significant result indicated that the observed relationship was unlikely to have occurred by chance at the 1% significance level. Therefore, the findings provide statistical support for the proposed relationship between Artificial Intelligence-Supported Education and student stress.

Table 4: Multiple Regression Analysis of Artificial Intelligence-Supported Education Predicting Academic Performance (N = 423)

Predictor	B	SE	β	t	p
Constant	1.284	0.184	—	6.978	<.001
Artificial Intelligence-Supported Education	0.626	0.048	.534	13.042	<.001

Model Statistics	Value
R	.534
R^2	.285
Adjusted R^2	.283
F	170.10
p	<.001

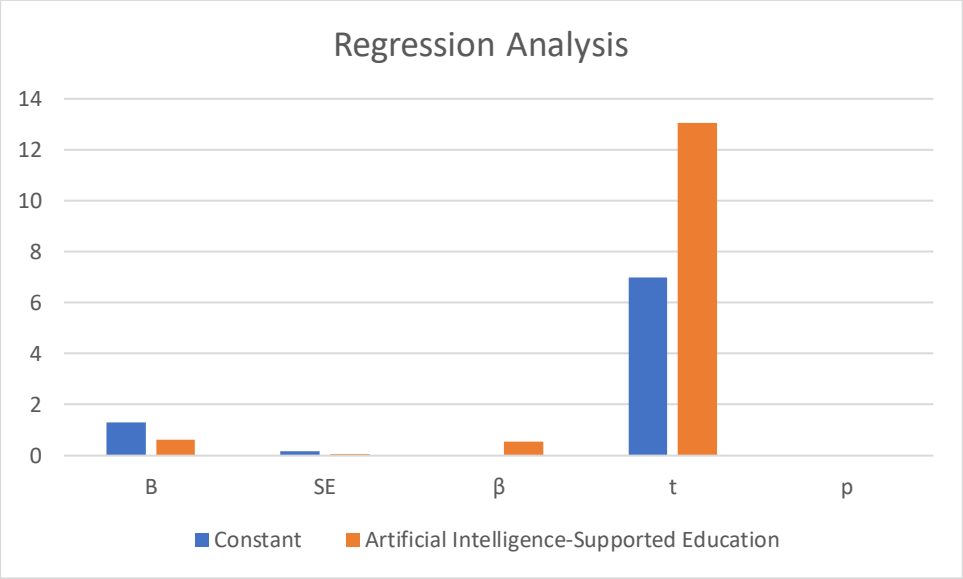

Fig. 3 Regression Analysis

Dependent Variable: Academic Performance

Note. B = unstandardized coefficient; SE = standard error; β = standardized coefficient; R^2 = coefficient of determination.

The multiple regression analysis indicated that **Artificial Intelligence-Supported Education was a significant positive predictor of academic performance** among the 423 respondents. The overall regression model was statistically significant, demonstrating that Artificial Intelligence-Supported Education explained a meaningful proportion of the variation in students' academic performance. The positive regression coefficient further indicated that students reporting higher levels of AI-supported education tended to report better academic performance. Therefore, the findings suggest that greater integration and use of AI-supported educational resources may contribute positively to students' academic outcomes. Overall, the results provide evidence of a positive predictive relationship between Artificial Intelligence-Supported Education and academic performance, indicating that AI-supported learning may serve as an important educational resource for improving students' academic achievement.

Table 5: Moderating Role of Coping Self-Efficacy in the Relationship Between Artificial Intelligence-Supported Education and Student Stress (N = 423)

Predictor	B	SE	β	t	p
Constant	3.241	0.032	—	101.281	<.001
Artificial Intelligence-Supported Education (AIE)	0.382	0.051	.339	7.490	<.001
Coping Self-Efficacy (CSE)	-0.214	0.049	-.184	-4.367	<.001
AIE × CSE	-0.126	0.041	-.121	-3.073	.002

Model Statistics	Model 1	Model 2
R	.426	.469
R^2	.181	.220
Adjusted R^2	.179	.214
ΔR^2	—	.039
F	92.89	39.75
p	<.001	<.001

Dependent Variable: Student Stress

Note. *B = unstandardized coefficient; SE = standard error; β = standardized coefficient; ΔR^2 = change in explained variance. AIE × CSE represents the interaction between Artificial Intelligence-Supported Education and Coping Self-Efficacy.*

The moderation analysis indicated that **coping self-efficacy significantly moderated the relationship between Artificial Intelligence-Supported Education and student stress.** Artificial Intelligence-Supported Education was positively associated with student stress, whereas coping self-efficacy was negatively associated with stress, suggesting that students with stronger coping capabilities generally experienced lower levels of stress. The addition of the interaction term significantly improved the explanatory power of the model, indicating that the relationship between AI-supported education and student stress differed according to students' level of coping self-efficacy. The negative interaction effect further showed that **higher coping self-efficacy weakened the positive relationship between AI-supported education and student stress**. Thus, students with stronger coping self-efficacy appeared better able to manage the academic and technological demands associated with AI-supported education, reducing the extent to which these demands were associated with increased stress.

Table 6: Moderating Role of Coping Self-Efficacy in the Relationship Between Artificial Intelligence-Supported Education and Academic Performance (N = 423)

Predictor	B	SE	β	t	p
Constant	3.672	0.031	—	118.452	<.001
Artificial Intelligence-Supported Education (AIE)	0.481	0.047	.452	10.234	<.001
Coping Self-Efficacy (CSE)	0.263	0.045	.271	5.844	<.001
AIE × CSE	0.118	0.039	.116	3.026	.003

Model Statistics	Model 1	Model 2
R	.534	.548
R^2	.285	.300
Adjusted R^2	.283	.295
ΔR^2	—	.015
F	168.04	8.91
p	<.001	.003

Dependent Variable: Academic Performance

Note. *B = unstandardized coefficient; SE = standard error; β = standardized coefficient; ΔR^2 = change in explained variance. AIE × CSE represents the interaction between Artificial Intelligence-Supported Education and Coping Self-Efficacy.*

The moderation analysis showed that **coping self-efficacy significantly moderated the relationship between Artificial Intelligence-Supported Education and academic performance.** Artificial Intelligence-Supported Education had a positive relationship with academic performance, while coping self-efficacy was also positively associated with students' academic outcomes. After the interaction term was added, the model explained additional variance in academic performance, demonstrating that the strength of the relationship between AI-supported education and academic performance differed according to students' coping self-efficacy. The positive interaction effect indicated that **higher coping self-efficacy strengthened the positive relationship between AI-supported education and academic performance**. Thus, students with stronger coping capabilities appeared better able to utilize AI-supported educational resources effectively and convert them into improved academic outcomes.

Discussion

The present study examined Artificial Intelligence-Supported Education, student stress, academic performance, and coping self-efficacy among 423 university students from Punjab and Sindh, Pakistan. Overall, the findings showed that AI-supported education was positively associated with student stress and academic performance. This indicates that AI can provide valuable

academic support while simultaneously introducing additional technological and performance-related demands. The positive relationship with academic performance is consistent with (Afari et al., 2026), who reported that ChatGPT-supported interventions significantly improved academic performance. Similarly, Tajik and Karkhaneh (2025) found beneficial effects of ChatGPT on academic performance among students in Pakistani higher education. However, the findings should not be interpreted as evidence that AI universally improves academic achievement because previous research has identified differences according to educational context, implementation, and patterns of AI use (Attamimi et al., 2026).

The positive relationship between AI-supported education and student stress suggests that increased engagement with AI may also be accompanied by psychological pressure. This may result from technological adaptation, performance expectations, uncertainty regarding appropriate AI use, concerns about academic integrity, and possible dependence on AI. (ÇEKEN & TUNCAL, 2026) similarly demonstrated that academic stress and performance expectations were associated with problematic AI use among university students. Nevertheless, AI should not be regarded as inherently harmful because Divya et al. (2025) found that ChatGPT could reduce mental effort while improving academic outcomes. Therefore, AI may simultaneously reduce certain academic burdens and introduce new psychological demands depending on how students experience and use the technology.

The study further demonstrated that coping self-efficacy played a significant moderating role in both relationships. Higher coping self-efficacy weakened the positive relationship between AI-supported education and student stress, indicating that students with stronger coping capabilities may be better able to manage technological uncertainty and academic pressure (Clej et al., 2026). At the same time, higher coping self-efficacy strengthened the positive relationship between AI-supported education and academic performance. This suggests that students who are more confident in their ability to manage challenges may be better positioned to use AI strategically, evaluate AI-generated information, maintain independent learning, and transform technological assistance into academic benefits. These findings support the broader literature emphasizing the importance of coping resources and self-efficacy in students' responses to academic demands (Lim et al., 2025).

Taken together, the findings provide an integrated explanation of how AI-supported education may influence university students. AI represents an external educational resource that can facilitate learning and academic achievement, whereas coping self-efficacy represents an internal psychological resource that can influence how students respond to AI-related demands. The contrasting moderation effects suggest that coping self-efficacy may help students experience fewer stress-related consequences while obtaining greater academic benefits from AI-supported learning. The study therefore extends previous research by bringing technological, educational, and psychological factors together within one framework and by providing evidence from the relatively underexamined higher-education context of Punjab and Sindh, Pakistan (Zengin & Demirci).

Conclusion

The study examined the relationship between Artificial Intelligence-Supported Education, student stress, and academic performance, with particular attention to the moderating role of coping self-efficacy among university students in Punjab and Sindh, Pakistan. The findings showed that AI-supported education was significantly associated with student stress and positively predicted academic performance. These results indicate that AI can support students' learning, access to information, and completion of academic tasks, while its increasing use may also create additional technological and academic pressures. Thus, AI-supported education should be understood as a multidimensional phenomenon whose effects depend on how students use and experience AI within their educational environment.

The findings further showed that coping self-efficacy significantly moderated both relationships. Higher coping self-efficacy weakened the positive association between AI-supported education and student stress while strengthening its positive relationship with academic performance. This suggests that students with greater confidence in managing academic challenges may be better able to control AI-related stress and use AI resources effectively for academic purposes. Overall, the findings indicate that successful AI integration requires not only access to technological tools but also effective coping abilities, responsible AI use, critical evaluation of AI-generated information, and appropriate academic guidance. Combining technological innovation with students' psychological resources may therefore contribute to a more effective and supportive AI-supported educational environment.

Future Implications

Future research and educational practice should adopt a balanced and student-centered approach to Artificial Intelligence-Supported Education by combining technological development with psychological support and academic guidance. Universities

should promote AI literacy, responsible AI use, critical evaluation of AI-generated information, and coping-skills development, particularly for students with lower coping self-efficacy. Future studies should also use longitudinal and experimental designs, larger and more diverse samples, and examine additional factors such as academic self-efficacy, digital literacy, AI dependency, motivation, engagement, and psychological well-being. Such research would provide a deeper understanding of how students can benefit from AI-supported education while minimizing its potential psychological challenges.

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