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The Mediating Role of AI Tool Use in Academic Stress and Productivity among Pakistani Female University Students

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Abstract

Artificial intelligence (AI) tools are becoming more common in the academic lives of university students and their association with academic stress and productivity are not well documented in developing countries. This study aimed to explore the usage of AI tools and its relationship with the reduction of academic stress and improvement of academic productivity among female undergraduate students in Pakistan. A cross sectional survey design with a quantitative approach was used. A 34-item questionnaire was used to collect data from 291 students of four academic departments of two public women's universities. The three main scales had high internal consistency with Cronbach's alpha ranging from .921 to .924. Data were analyzed by descriptive statistics and Pearson product–moment correlation with SPSS. The overall response for students' use of AI tools was at a high level, with the means of the items ranging from 3.82 to 4.12. The most highly rated tools were Microsoft Copilot and Google Gemini, and students frequently alternated between the platforms as needed for their academic tasks. The perceived stress-reduction scores ranged from 3.82 to 4.12, with the highest scores being for workload manageability and reduced deadline pressure. Productivity scores were between 3.80 and 4.18, and the highest perceived benefits were: completion of tasks faster and work was more efficient. Perceived stress reduction ($r = .370 – .654$, $p < .01$) and productivity improvement ($r = .294 – .559$, $p < .01$) were positively and significantly related to AI-tool use. The overall stress reduction was also positively correlated with overall productivity ($r = .516$, $p < .01$). The results indicate that meaningful use of AI could be beneficial for academic task management and to students' perceived coping with academic demands. The data are cross sectional and self-reported, however, and do not allow for causal interpretation.

Key Words: Artificial Intelligence, Academic Stress, Academic Productivity, Female Undergraduates, Higher Education, Pakistan.

Vol. 4 No. 3 (2026)

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Introduction

Artificial Intelligence (AI) has quickly made its way into higher education, impacting the ways students look for information, work on assignments, refine their academic writing, get feedback, and organize learning tasks. While intelligent tutoring, automated assessment, learning analytics, prediction, and adaptive instruction were the primary educational uses of AI in the past, recent generative AI systems enable students to use technology directly via natural-language prompts (Zawacki-Richter et al., 2019; Crompton & Burke, 2023). AI tools like ChatGPT, Google Gemini, Microsoft Copilot, Grammarly, Perplexity AI, DeepL, and academic support and presentation platforms can explain concepts, summarize content, help draft and edit, translate text, and offer instant academic support (Kasneci et al., 2023; Lo, 2023). As a result, AI is no longer a technology of institutions and has become more and more a tool for learning by the university students.

As the use of generative AI continues to increase, there are opportunities to enhance students' academic experiences. Students can use AI tools to break down complex tasks into smaller steps, explain complex ideas, structure information, brainstorm ideas, and get help when they are not able to get help from their teachers or classmates. These functions can enhance flexibility, personalization, and efficiency in learning (Crompton & Burke, 2023; Kasneci et al., 2023). The learning potential of AI is not guaranteed, however. AI-generated content might contain inaccuracies, biases, too broad or fabricated references. Reliance on automated responses can also undermine independent thinking, academic ownership and acquisition of disciplinary knowledge (Dwivedi et al., 2023; Tlili et al., 2023). This means critical evaluation and verification of information, digital literacy, and clear institutional guidance are all key to effective use.

Academic stress is one of the outcomes of the use of AI that is not sufficiently explored. The pressure that is often felt by university students is related to exams, deadlines for assignments, workload, performance expectations and uncertainty about complex academic tasks. Academic stress can have a negative impact on motivation, concentration, psychological well-being, engagement and educational performance (Pascoe et al., 2020). Some of the task-related stress factors can be mitigated by the use of AI tools, which can offer students instant explanations, organize their tasks, clarify assignment instructions, assist with deadlines, and boost their academic confidence and control. However, there are potential sources of stress with the use of AI when students find themselves in situations of misinformation, unfamiliar systems, ethical issues, excessive use of tools, or unclear university policies.

The contrasting possibilities can be explained by using the Cognitive Load Theory. The capacity of working memory is limited, and students' learning can be interfered by having to process irrelevant information during doing a complex task (Sweller, 1988). AI tools can be used appropriately to support the reduction of extraneous cognitive load by

Vol. 4 No. 3 (2026)

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making instructions easier to follow, providing structure, giving examples and giving quick feedback. This could enable students to concentrate more on comprehending and performing academic tasks. On the other hand, if the tools are not well-designed, the output may be incorrect, and the verification process may be complicated, it can increase the cognitive load. AI's impact on academic stress will thus vary based on the quality of the AI technology, the type of academic work, and student's critical engagement with AI.

AI can also be a factor in academic productivity. Academic productivity is not just about quantity of work done, but also about how quickly the work is done, how well time is managed, how well tasks are organized, accuracy, quality, how well the tasks are prioritized, ability to focus, progress towards learning goals and how well tasks are completed. Generative AI can aid in these outcomes in various ways, such as streamlining repetitive tasks, drafting and revising documents, summarizing content, creating examples, and managing academic workloads (Lo, 2023; Kasneci et al., 2023). These tools can also be used to assist with learning outside of the classroom, which can help avoid the frustration of a small learning problem that can cause a big learning problem. But increased production does not necessarily mean increased learning. Students can finish assignments quickly without comprehending the content and unverified AI-generated content can lead to further mistakes. Productivity enhancement thus relies on students' ability to continue with the analysis, source checking, revision, and final academic judgment.

The second theory is Self-Regulated Learning Theory, which elucidates the potential role of AI in enhancing academic productivity. The other theory is Self-Regulated Learning Theory, which explains how AI can contribute to academic productivity. According to Zimmerman (2002), self-regulated learners set goals, choose strategies, plan time, keep track of their work and review their results. AI can help with these processes by helping to plan, create practice tasks, pinpoint areas for improvement, and offer instant feedback. If students continue to be active decision makers, then AI can be used as a temporary scaffolding tool instead of a replacement for students' own learning. In contrast, when students simply accept answers produced by AI, they might not be able to reflect on them, which could hinder their long-term learning.

The TAM is another framework that can be used to explain student uptake of AI. Davis (1989) suggested that perceived usefulness and perceived ease of use are the main factors that influence the use of technology. Students will be more inclined to use AI tools if they think that these tools can enhance their academic achievement and are not too demanding to use. Usefulness can be demonstrated in this context by quicker task completion, clearer explanations, better writing, better organisation and less uncertainty. Students can use a variety of platforms to write, translate, research, retrieve information and present their work, so looking at multiple AI tools will give a more accurate representation of student behaviour than just ChatGPT.

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

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There may also be a link between perceived stress reduction in school and productivity. Students who are not as stressed by deadlines, workloads and the uncertainty of assignments may be able to focus and finish tasks efficiently. Likewise, students who are able to plan their work, manage their time and deliver assignments on time and in good order will feel less anxious and have a greater sense of control over their learning. According to the Cognitive Load Theory, eliminating extraneous cognitive load can free up resources for learning and according to the Self-Regulated Learning Theory, planning and monitoring can enhance performance and decrease uncertainty. However, these relationships can be bi-directional, so that cross-sectional evidence can only be used to show association, not causality.

Although there has been a surge in research on AI in higher education, there are still a number of gaps. The literature has tended to focus on the technical application, intentions to accept, academic integrity, and capabilities of specific platforms (Zawacki-Richter et al., 2019; Crompton & Burke, 2023). Few studies have focused on the joint effect of using AI on students' perceived reduction in academic stress and increased productivity. One tool is often the subject of research, while students are becoming more adept in using more than one system as needed for the task. Furthermore, evidence is not uniform and results from technologically advanced universities may not be representative of those in developing countries where access, digital literacy, language, infrastructure and institutional policies may vary.

The problems are especially pertinent in Pakistan where empirical studies on the use of AI by female undergraduate students are still limited. In addition to academic pressures, female students might have to balance family responsibilities, social pressures, language issues, and institutional support. The present study thus aims to focus on female undergraduate students of two public women universities of Punjab, Pakistan. It explores a wide variety of AI tools and the definition of AI-tool use is based on how often and how broadly students are using tools in their academic pursuits. Academic stress reduction as perceived includes anxiety, pressure of deadlines, manageability of workload, mental fatigue, confusion about assignments, academic self-confidence, control, and feeling overwhelmed. Academic productivity enhancement perceived is the speed of task completion, quantity and quality of work, accuracy, organization, prioritization, focus, time management and academic performance.

Therefore, this study aims to determine if there is a positive correlation between the use of AI tools and the reduction in academic stress and the enhancement of academic productivity and the reduction in academic stress and the enhancement of academic productivity among female undergraduate students. The study provides context-specific evidence, combining psychological and academic outcomes in a single framework and analyzing the use of multiple platforms of AI instead of just one generative AI tool. The hypotheses are: Hypothesis 1: The use of AI tools is positively correlated with a reduction in

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

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the perceived academic stress, Hypothesis 2: The use of AI tools is positively correlated with an improvement in academic productivity, and Hypothesis 3: A reduction in perceived academic stress is positively correlated with an improvement in academic productivity.

Objectives of the Study

1. To determine the extent and patterns of AI-tool use for academic purposes among female undergraduate students.
2. To examine the association between AI-tool use and perceived academic stress reduction among female undergraduate students.
3. To assess the association between AI-tool use and perceived academic productivity enhancement among female undergraduate students.
4. To investigate the relationship between perceived academic stress reduction and perceived academic productivity enhancement among students who use AI tools.
5.

Research Hypotheses

H1: AI-tool use is positively and significantly associated with perceived academic stress reduction among female undergraduate students.

H2: AI-tool use is positively and significantly associated with perceived academic productivity enhancement among female undergraduate students.

H3: Perceived academic stress reduction is positively and significantly associated with perceived academic productivity enhancement among female undergraduate students who use AI tools.

Conceptual Framework

The conceptual framework suggests that there is a positive relationship between the use of AI tools and the reduction in perceived academic stress and the enhancement in perceived academic productivity among female undergraduate students. It also makes the assumption that there is a positive correlation between stress reduction and productivity improvement; that is, students who experience less stress on their workloads, confusion, and academic anxiety may be able to complete tasks more efficiently, manage time, and enhance academic performance. The framework is based on the Technology Acceptance Model, Cognitive Load Theory and Self-Regulated Learning Theory, and is not causal due to the cross sectional correlational design of the study.

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

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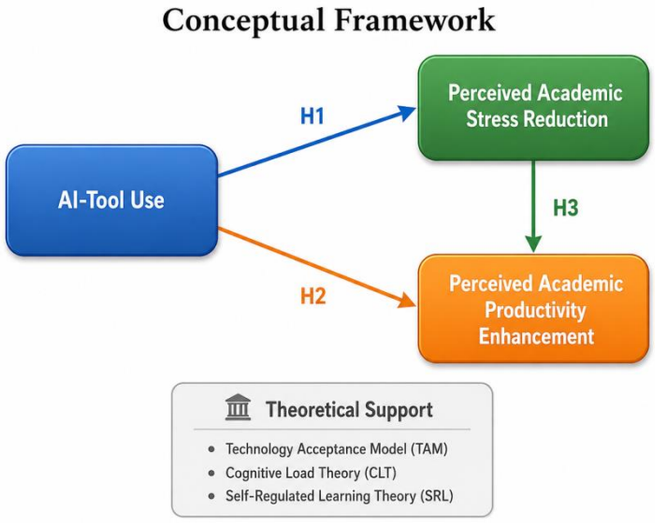

Fig.1. Conceptual Framework of the Study

Methodology

Research Design

This study used a quantitative, descriptive, cross-sectional survey design to explore the relationships between the use of an AI tool, reduction in academic stress, and improvement in academic productivity. The data was gathered from the participants at a single time and thus statistical relationships were measured but not causal relationships.

Population and Sample

The accessible population comprised of 1358 female undergraduate students of The Women University Multan and Government Sadie College Women University Bahawalpur, Punjab, Pakistan. The participants were selected from the departments of Education, English, Psychology and Computer Science. Stratified random sampling was employed and eight strata were formed from the two Universities and four departments. Simple random sampling was then done within each stratum. The final sample consisted of 291 students of which 144 were from The Women University Multan and 147 were from Government Sadiq College Women University Bahawalpur.

Research Instrument

A structured bilingual questionnaire was used to gather data with 34 items. The demographic questions were included in section A which included four questions: gender, department, semester, and university affiliation. The remaining 30 items were split three ways between AI-Tool Use, Perceived Academic Stress Reduction, and Perceived Academic Productivity Enhancement. The AI-tool-use scale measured students' usage of ChatGPT, Google Gemini, Microsoft Copilot, Grammarly, Perplexity AI, DeepL, AI presentation tools,

Vol. 4 No. 3 (2026)

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Online ISSN 3006-466X

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research platforms, other chatbots, and switching between tools. The stress-reduction scale included anxiety, deadline pressure, manageability of workload, mental exhaustion, confusion of assignments, academic confidence, control, and feeling overwhelmed. The productivity scale measured task completion time, quantity and quality of work, accuracy, organization, prioritization, focus, time management and perceived academic performance. The items on all constructs were rated on a 5-point Likert scale ranging from 1, "Strongly Disagree" to 5, "Strongly Agree." The average score for the 10 items in each scale was used to represent the corresponding construct (higher scores reflecting more widespread AI-tool use, more perceived stress reduction, or more perceived productivity enhancement).

Validity and Reliability

Items on the questionnaire were derived from the theoretical and empirical literature and three subject experts were consulted to ensure content validity. Face validity was done by pilot testing and linguistic validity was achieved by forward and backward translation from English to Urdu and vice versa. The pilot study was carried out with 30 students from a university which was not a part of the main sample. The pilot study results were used to make improvements to the clarity, wording and understanding of the items and the questionnaire took about 10-15 minutes to complete. Cronbach's alpha was used to assess internal consistency. Alpha values in the pilot study were 0.86 for AI-Tool Use, 0.84 for Academic Stress Reduction and 0.85 for Academic Productivity Enhancement. The internal consistency of the items in the final sample was excellent with alpha values of 0.924, 0.924, and 0.921, respectively.

Data Collection and Ethical Considerations

The last questionnaire was conducted online using Google Forms. The survey link was sent via university email, institutional LMS and WhatsApp (where direct email was not possible). The introductory page included information on the purpose of the study, the voluntary nature of participation, anonymity, the approximate time for completion and the researcher's contact information. Completed questionnaire was considered to be informed consent. There was no personally identifying information gathered and participants were able to opt out without penalty. Stratum allocation was monitored weekly, and a single reminder was sent to departments that were not meeting the required stratum. The number of unanswered items in the responses was limited to five or fewer and responses with more than five were not included. A total of 291 questionnaires were completed and were found to be valid and were exported to Microsoft Excel for screening and then imported into IBM SPSS Statistics Version 26. There were no missing values in data set.

Data Analysis

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

Print ISSN 3006-4651

IBM SPSS Statistics Version 26 was used to analyses data. The demographic characteristics of the participants were described using frequencies and percentages and the 30 Likert scale items were calculated using means and standard deviations. Cronbach's alpha was used to evaluate scale reliability. Pearson product–moment correlation was used to test the relationships between AI-tool use and perceived academic stress reduction, AI-tool use and perceived academic productivity enhancement, perceived academic stress reduction and productivity enhancement. All tests were two-tailed and the level of statistical significance was set at $p < .01$. The correlation coefficients were given the following meanings: weak (0.10-0.29), moderate (0.30-0.49), strong (0.50-0.69), and very strong (0.70 or greater). A regression analysis was not performed.

Results

Descriptive Analysis

AI-Tool Use among Female Undergraduate Students

The first one explored students' use of AI tools for academic purposes. 291 respondents had complete data. The mean scores of the ten items related to the use of AI ranged from 3.82 to 4.12 on a five-point scale, suggesting a generally high level of use of multiple AI tools. The mean score for Microsoft Copilot was 4.12 (SD = 0.728), followed by Google Gemini with a mean score of 4.10 (SD = 0.799) and switching between different AI tools based on the academic task with a mean score of 4.01 (SD = 0.772). ChatGPT was also widely used (M = 3.99, SD = 0.865). The mean (M = 3.82, SD = 0.855) for Claude and other alternative chatbots was the lowest, but still above the scale midpoint. The standard deviations of all the parameters were less than 1.00, indicating a fairly uniform response from the sample. Overall, the results indicate that there was no platform-specific dominance of the use of AI. The respondents often employed AI tools that were integrated into their office, general-purpose chatbots, tools for research, translation, and task-specific applications, and they regularly switched between various tools based on their academic needs.

Table 1

Descriptive Statistics for AI-Tool Use (N = 291)

AI-tool-use item	Mean	SD
Microsoft Copilot for academic tasks	4.12	0.728
Google Gemini for research and information gathering	4.10	0.799
Switching between AI tools according to the task	4.01	0.772
ChatGPT as the primary academic AI tool	3.99	0.865

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

Print ISSN 3006-4651

Perplexity AI for searching and verifying information	3.98	0.807
AI-based translation tools such as DeepL	3.97	0.765
AI research tools such as Consensus and Semantic Scholar	3.90	0.799
Grammarly's AI features for academic writing	3.86	0.922
AI-powered presentation tools	3.86	0.815
Claude or other AI chatbots besides ChatGPT	3.82	0.855

Perceived Academic Stress Reduction

The second goal measured students' experiences of AI tools decreasing academic stress. The mean scores for the ten items were between 3.82 and 4.12, which are generally favourable perceptions on all dimensions. Manageability of heavy academic workload (M = 4.12, SD = 0.728) and managing academic deadlines with less pressure (M = 4.10, SD = 0.799) were the top two items. The overall stress-reduction item also was rated high (M = 4.01, SD = 0.772). The lowest rated item was related to avoiding feeling overwhelmed during busy academic times (M = 3.82, SD = 0.855), but this was still above the scale midpoint. The response variability of reduced mental exhaustion was the highest (SD = 0.922), indicating that the psychological experiences of the students with the use of AI were less consistent than their experiences with workload and deadline support. However, the standard deviations of all measures were less than 1.00, meaning that the responses were fairly consistent across measures. In general, the descriptive results show that students' main perception of AI is that it helps them to manage workloads, lessen the pressure of deadlines, clarify academic tasks, and boost their confidence and control. But its benefits were less pronounced for deeper psychological effects like mental fatigue and being overwhelmed.

Table 2

Descriptive Statistics for Perceived Academic Stress Reduction (N = 291)

Perceived stress-Reduction Item	**Mean**	**SD**
AI makes heavy academic workload more manageable	4.12	0.728
AI helps manage academic deadlines with less pressure	4.10	0.799
AI reduces overall academic stress	4.01	0.772
AI reduces anxiety about academic tasks	3.99	0.865
AI reduces confusion when starting assignments	3.98	0.807

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

Print ISSN 3006-4651

AI increases confidence in handling academic challenges	3.97	0.765
AI reduces stress caused by complex academic tasks	3.90	0.799
AI reduces mental exhaustion	3.86	0.922
AI increases control over academic work	3.86	0.815
AI helps avoid feeling overwhelmed during busy periods	3.82	0.855

Perceived Academic Productivity Enhancement

The third goal explored students' views on the use of AI tools to improve academic productivity. The mean scores for the ten productivity items were between 3.80 and 4.18, suggesting positive perceptions overall for all productivity items. The most highly-rated benefit was that academic tasks were completed faster (M = 4.18, SD = 0.690), while more work was accomplished in less time came in second (M = 4.15, SD = 0.688). The findings indicate that the productivity gains of using AI were most strongly perceived as being in terms of speed and efficiency. The least rated item was the ability to concentrate better when studying (M = 3.80, SD = 0.923). This item also showed the largest standard deviation, suggesting that students' experience of using AI to focus on the task varied more than their experience of speed and efficiency of the task. However, it had a mean score higher than the scale mid-point. In general, students found AI tools to be most beneficial in completing assignments efficiently, enhancing the quantity of work done, enhancing assignment quality, and aiding in academic achievement. The perceived effect was relatively less and less consistent for sustained attention during study sessions.

Table 3

Descriptive Statistics for Perceived Academic Productivity Enhancement (N = 291)

Productivity-Enhancement Item	Mean	SD
AI helps complete academic tasks more quickly	4.18	0.690
AI enables more work to be accomplished in less time	4.15	0.688
AI improves the quality of academic assignments	4.01	0.738
AI contributes to better academic performance	3.98	0.828
AI enhances overall academic productivity	3.96	0.831
AI improves the organization of academic tasks	3.91	0.809
AI helps produce more accurate academic work	3.89	0.817

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

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AI helps prioritize important academic activities	3.88	0.814
AI improves time-management skills	3.88	0.850
AI improves focus during study sessions	3.80	0.923

Inferential Analysis and Hypothesis Testing

Pearson product–moment correlation analysis was used to test the three hypotheses using data from 291 respondents. All tests were two-tailed and evaluated at the $p < .01$ significance level.

Hypothesis 1

H1: *AI-tool use is positively and significantly associated with perceived academic stress reduction among female undergraduate students.*

The hypothesis H1 is supported as the correlation between AI-tool use and the reduction of perceived academic stress among female undergraduate students is positive and significant. The findings were in favour of H1. The correlation between the items for using the AI tools and perceived stress-reduction outcomes were moderate to strong positive correlations ranging from r = .370 to r = .654. This suggests that the more people reported using AI tools, the more they felt it helped them decrease academic anxiety, workload pressure, assignment confusion, and overall stress. The strongest correlation (r = .638, p < .01) was found for the relationship between AI research tools and overall stress reduction, followed by Claude or other chatbots (r = .603, p < .01) and AI presentation tools (r = .583, p < .01). Hence, the support of H1 was given.

Hypothesis 2

H2: *AI-tool use is positively and significantly associated with perceived academic productivity enhancement among female undergraduate students*.

The results also confirmed H2. The relationships between the use of AI tools and productivity measures were weak to strong positive, with most of the correlations in the moderate range (r = .294 to .559). The correlation between switching between AI tools and better organization of academic tasks was the highest at the item level (r = .559, p < .01). As far as productivity overall is concerned, the highest correlations were found with Claude or other chatbots (r = .547, p < .01), AI research tools (r = .538, p < .01), and switching between AI tools (r = .516, p < .01). The findings indicate that students who indicated using AI tools more broadly and flexibly also indicated being more efficient, organized, productive in their work, and more productive overall in their academic work. So, H2 was given support.

Hypothesis 3

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

Print ISSN 3006-4651

H3: *Perceived academic stress reduction is positively and significantly associated with* perceived academic productivity enhancement among female undergraduate students.

H3 was correlated with statistically significant positive values of r from .294 to .559. The overall perceived stress reduction and the overall academic productivity enhancement was positive and strong ($r = .516$, $p < .01$). The best correlation at the item level was between overall reduction in stress and organization of academic tasks ($r = .559$, $p < .01$). Reduced stress due to complex academic tasks was also positively correlated with overall productivity ($r = .538$, $p < .01$), and avoiding feelings of being overwhelmed was positively correlated with overall productivity ($r = .547$, $p < .01$). The results suggest that the more students felt that AI tools were beneficial for reducing stress, the more they reported using them to improve their productivity in school. Thus, it was supported that H3 should be supported.

Overall, all three hypotheses were confirmed. The results show statistically significant positive relationships between the use of AI tools, perceived reduction of academic stress, and perceived increase in academic productivity. The study employed a cross-sectional correlational design, however, which does not allow for the conclusions that the use of AI-tools led to the reported decrease in stress and increase in productivity.

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

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Table 4

Pearson Correlation Results for Hypothesis Testing

Hypotheses	Variables examined	N	Correlation Results	Strongest reported association	Significance	Magnitude	Decision
H1	AI-tool use and perceived academic stress reduction	291	r = .370–.654	AI research tools and overall stress reduction: r = .638	p < .01, two-tailed	Moderate to strong	Supported
H2	AI-tool use and perceived academic productivity enhancement	291	r = .294–.559	Tool switching and organization: r = .559; Claude/other chatbots and overall productivity: r = .547	p < .01, two-tailed	Weak to strong, predominantly moderate	Supported
H3	Perceived academic stress reduction and perceived productivity enhancement	291	r = .294–.559	Overall stress reduction and organization: r = .559; overall stress reduction & overall productivity: r = .516	p < .01, two-tailed	Moderate to strong	Supported

Note. Pearson product–moment correlation was used. Correlation strength was interpreted as weak (r = .10–.29), moderate (r = .30–.49), strong (r = .50–.69), and very strong ($r \geq .70$).

Discussion

The present study explored the correlation among the use of AI tools, perceived reduction in academic stress and perceived improvement in academic productivity among female undergraduate students in two public women universities in Pakistan. The results indicated that many of the AI tools were used, the majority of participants had positive attitudes towards the academic value of the tools, and there were statistically significant results for all three hypotheses. The findings contribute to the existing higher education AI literature, as they are based on a female, non-Western student body, which is underrepresented in the literature.

The extent of AI-tool usage found in this study aligns with the increasing adoption of AI in higher education (UNESCO, 2023). Multi-tool switching and ChatGPT were the next most highly rated features, with Microsoft Copilot and Google Gemini being the top two. The pattern indicates that students weren't solely relying on a single chatbot but choosing the appropriate tool based on the type of academic task (Lim et al., 2023). The discovery is consistent with the systematic review of 138 higher-education studies conducted by Crompton and Burke (2023), which revealed AI assistants, intelligent tutoring systems, assessment tools, and student-learning management as key educational applications of AI. This is also in line with the findings of a survey by Chan and Hu (2023) of 399 university students, who generally expressed positive attitudes towards generative AI

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

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and acknowledged its value in personalized learning, writing, brainstorming, research and information analysis.

The prominence of Copilot and Gemini, however, is different too much of the early generative-AI literature, which focused primarily on ChatGPT. This gap could be due to the fact that Copilot and Gemini can be integrated with some of the most popular academic tools, such as document preparation, summarization, information retrieval, and presentation development. The high scores for switching between AI platforms also indicate that the participants had task-specific AI-use practices. Students did not seem to use AI tools interchangeably but choose the tools that they thought would be most useful for specific academic needs (Sallam, 2023). This interpretation aligns with the results of Chan and Hu (2023), who identified students' preferences for various types of AI functions for immediate learning support, technical writing assistance, information retrieval, research, and the creation of multimedia content.

The findings were consistent with H1, as the use of AI tools was found to positively and significantly correlate with reduced academic stress. The correlations were between r = .370 and r = .654, which are considered moderate to strong positive correlations. Students felt that AI could be helpful when dealing with high workloads, when there was a pressure of deadlines, when they didn't understand assignments, and when it made them feel more confident and in control of their work. The results are consistent with previous studies that have found that students appreciate the benefits of generative AI, such as its ability to offer timely, individualized, and always-available academic assistance. For instance, students found AI helpful when they struggled with their assignments, required immediate explanations, or were unable to get help from another person (Chan & Hu, 2023). Similarly, Kasneci et al. (2023) described the capability of LLM to offer personalized explanations, summaries, outlines, step-by-step guidance and research support. This help can help to alleviate uncertainty and help make challenging schoolwork seem more attainable.

The stress reduction effect must be taken with a grain of salt, however. The literature available has concentrated on learning support, personalised feedback, writing support, and engagement, but not on the measurement of academic stress. The current results thus offer some preliminary evidence that the practical academic support provided by AI can also be linked to the students' emotional experiences of workload and pressure. But the somewhat greater diversity of responses regarding decreased mental fatigue suggests that AI did not impact all aspects of stress in the same way. While AI can assist students in organizing and completing tasks, it doesn't necessarily reduce fatigue, stress, or emotional burden. Further experimental and longitudinal studies are needed to determine if there are long-term decreases in academic stress when using AI.

The results also confirmed H2, showing that there were significant positive correlations between AI-tool usage and perceived improvement in academic productivity.

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

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Print ISSN 3006-4651

Correlations ranged from r = .294 to r = .559. The greatest perceived benefits were getting tasks done faster and doing more work in less time, while the least mean and the most varied responses were for improvement in study focus. The results are similar to those of Chan and Hu's (2023) and Rudolph et al. (2023) studies, where students reported finding AI helpful in speeding up information retrieval, brainstorming, summarizing reading material, enhancing their writing, and completing repetitive tasks. They are also bolstered by the results of Mahapatra's (2024) intervention study on the use of ChatGPT for formative feedback that revealed a significant positive impact on the academic writing skills of undergraduate ESL students and strong positive feedback from students on the use of ChatGPT.

There is also converging evidence from a wider range of productivity research. Brynjolfsson, Li, and Raymond (2023) discovered that having a generative-AI assistant boosted the average productivity of over 5,000 customer-support employees, with greater effects for less-experienced workers. While this research was carried out in a workplace setting, not a university, it backs up the general idea that AI can help to make tasks more efficient by giving fast advice and making valuable knowledge available. The correlations that were found in the present study are therefore not too high and are moderate. While AI can enhance productivity in terms of speed, organization, and output, other factors like motivation, prior knowledge, digital competence, teaching quality, learning strategies, and institutional support also play a role in students' productivity (Ng et al., 2024).

This is especially significant for the relatively weak and variable result for improved study focus. It implies that the advantages of AI may be more pronounced for external academic tasks like completing assignments, finding information, and adhering to deadlines, than for internal cognitive activities like maintaining focus. The results of Mahapatra (2024) suggest that with proper training and guidance, ChatGPT can enhance writing, while also highlighting the need for proper student training. Likewise, Kasneci et al. (2023) emphasized the need for AI literacy, critical thinking, fact-checking abilities, and ongoing human oversight for the effective application of these LLM tools in education. Thus, relying solely on access to AI should not be considered as enhancing attention or deep learning.

The results confirmed H3, which predicted that perceived academic stress reduction would be positively related to perceived productivity enhancement. The overall stress reduction and overall productivity were significantly correlated with r = .516, with item-level correlations ranging from r = .294 to r = .559. This indicates that students who felt that AI would alleviate the stress on their academic work also felt that they were more productive. One possible reason is that by decreasing task ambiguity, helping to plan, and making tasks seem less overwhelming, AI might allow students to spend more time and mental energy on their academic tasks. On the other hand, quicker completion of tasks and improved time management can help to minimize stress and overwhelm. However, the

Vol. 4 No. 3 (2026)

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correlation between stress reduction and productivity cannot be taken as a causal link. Since the data were gathered at a single point in time, and all variables were self-reported, it is not possible to determine if reduced stress resulted in increased productivity, if increased productivity resulted in reduced stress, or if both were due to some other factor. The positive association could also be partly due to students' general positive attitudes towards AI. To establish direction and mechanisms of this relationship would require longitudinal, experimental, or structural-equation studies (Dwivedi et al., 2023; UNESCO, 2023).

Last, the positive findings need to be interpreted in light of the risks found in previous studies. Chan and Hu (2023) identified the concerns of students regarding accuracy, privacy, ethical issues, overreliance, and effects on personal development. The concerns of cheating, truthfulness, privacy, misleading information, and manipulation in educational applications of ChatGPT were also identified by Tlili et al. (2023). Kasneci et al. (2023) highlighted the need for pedagogical guidance, critical evaluation, and fact-checking of the information generated by AI, which can be biased or inaccurate. Thus, the present findings are in favor of guided integration of AI and not for free or uncritical use. Universities should have clear policies, train students in AI-literacy, equip them with source verification skills, establish ethical standards for the use of AI, and offer them the chance to utilize AI as a tool for learning, not a replacement for critical thinking (OECD, 2024).

Conclusion

The present study investigated the relationship between the use of AI tools and academic productivity enhancement and academic stress reduction among 291 female undergraduate students of two public women universities in Pakistan. The results indicated that AI tools have been incorporated into students' everyday academic activities. The most popular use was with Microsoft Copilot and Google Gemini, with switching between different AI platforms for tasks coming in second, and ChatGPT coming in third. This trend suggests that students used AI tools based on their academic needs, not using one tool for all tasks.

The three hypotheses were confirmed. The use of AI tools was positively and significantly correlated with the reduction in academic stress, specifically in the areas of workload management, deadline pressure, assignment confusion, academic confidence, and students' sense of control. The use of AI tools was also correlated with positive outcomes of perceived productivity improvements, such as completing assignments faster, being more efficient, improving assignment quality, improving organisation, time management, and perceived academic performance. These results also indicate that the benefits of stress reduction and productivity were linked, as students who felt AI was assisting them to cope with academic stress were more likely to report higher productivity.

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

Print ISSN 3006-4651

But the advantages of AI were not always as pronounced for each outcome. The benefits reported by students were more noticeable for external cognitive tasks (e.g., assignment completion and deadlines) than for internal cognitive tasks (e.g., sustained concentration, mental fatigue). AI is thus a tool that can be used to support students' learning and mental health, but should not be seen as a panacea for their psychological stress, attention issues, or other learning difficulties.

The study is overall an evidence of a population which is underrepresented in the study of female university students in Pakistan. It suggests that meaningful AI usage could aid in task management for academic work and in students' self-assessment of their academic coping. However, the study was a cross sectional, self-report study, and thus, associations are drawn, not causes. It is therefore important to have clear institutional policies, equitable access, digital and AI literacy training, guidance on the ethical use of AI, and to continue to emphasize independent thinking and critical evaluation in the context of responsible AI integration.

Practical Implications and Recommendations

The results are relevant to students, teachers and higher education institutions. Given the positive correlation between the use of AI tools and the reduction in perceived stress and productivity, universities need to emphasize the responsible and guided use of AI tools, rather than a blanket ban on AI tools or their uncritical use.

Implications for Students

AI should be viewed as a tool to aid students' learning and should not replace their own thinking. Different tools may be helpful as they were positively related to both stress reduction and productivity outcomes, so purposeful use of different tools may be beneficial. Students should use tools based on the task, for example, research platforms to find scholarly sources, writing tools to support them in writing, and generative assistants to brainstorm and structure ideas. But, any AI-generated content should be verified from credible and primary and scholarly sources before being used in academic work. Pupils should also be taught to be critically AI literate, such as by being able to write prompts to get the best out of AI, identify incorrect or fabricated information, safeguard their own information, indicate when AI has been used, and differentiate between appropriate usage and academic dishonesty. As students may not get the same perceived benefits from AI as they do from other study strategies (such as realistic scheduling, focused study periods, independent reading, and teacher consultation), they should use AI in conjunction with other study strategies.

Implications for Educators

Vol. 4 No. 3 (2026)

Journal of Social Signs Review

Online ISSN 3006-466X

Print ISSN 3006-4651

Teachers should use AI in a structured and critical way in teaching. Students should not just copy and paste AI-generated answers, but compare AI answers with academic sources, point out inaccuracies or bias, explain why they are inaccurate, and explain their own reasoning. These can help maintain the critical thinking skills of the students, and also provide them with the advantage of AI efficiency. Teachers should also make it clear what types of AI usage are allowed for particular courses and assessment. Explicit instructions in the classroom can help to eliminate confusion and help students recognize when they are receiving academic support versus engaging in academic dishonesty. Professional development is thus needed to enhance teachers' AI literacy, assessment design, source-verification skills, and teaching skills for responsible use of AI.

Implications for Higher-Education Institutions

AI policies should be well-defined, transparent, and tailored to specific disciplines at universities. These policies should include what is acceptable, what is not, when and how to disclose, data privacy obligations and what will happen if it is misused. Consistently communicating the guidelines to students and staff will help to avoid policy confusion as an added stress on the academic journey. There should also be formal training by the institutions in the form of libraries, academic-support centres and student orientation programmes. The training should include generative AI, academic research tools, citation verification, ethical use, privacy, prompt design, etc. Specialized research tools should be discussed in particular as they have been shown to have positive relationships with stress reduction and productivity and may therefore have value, but may not be used by students if they are not aware of them.

Last but not least, equal access needs to be solved. Internet access, appropriate devices, departmental subscriptions, and access to approved AI platforms should be provided throughout departments and campuses. If not, the potential of AI could be limited to students who already have more digital resources and skills. In general, AI should be used as a tool for supervised learning, enhancing academic productivity and task management, while maintaining human judgment, independent study, academic honesty, and student health and safety.

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