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Effect of Mindful Use of Artificial Intelligence Tools on Students' Self-Sufficiency, Higher-Order Thinking Skills, and Academic Confidence

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ABSTRACT

The rapid integration of Artificial Intelligence (AI) tools in higher education has transformed the educational experiences of university students worldwide. Applications such as ChatGPT, Grammarly, and Google Gemini are increasingly used for academic writing, problem solving, content generation, and personalized learning support. Despite the educational advantages of AI, excessive dependence on these technologies may negatively influence students' cognitive independence and academic growth. Therefore, the present study investigated the effect of mindful use of AI tools on university students' self-sufficiency, higher-order thinking skills (HOTS), and academic confidence in Pakistani universities. A quantitative correlational research design was employed. Data were collected from 400 university students selected from public and private universities in Lahore, Pakistan. A structured questionnaire was used to measure mindful AI use, self-sufficiency, HOTS, and academic confidence. Statistical analysis was conducted through SPSS using descriptive statistics, One-Way ANOVA, Pearson correlation, and linear regression analysis. The findings revealed that students demonstrated a moderate level of mindful AI use. Results further indicated a significant positive relationship between mindful use of AI and all three dependent variables. Students who used AI tools reflectively and ethically exhibited greater independence in learning, stronger analytical and creative thinking abilities, and higher academic confidence. Regression analysis confirmed that mindful AI use significantly predicted self-sufficiency, higher-order thinking skills, and academic confidence. The study contributes to the growing literature on AI in education within a developing country context where empirical evidence remains limited. The findings suggest that universities should integrate AI literacy, ethical AI practices, and mindfulness-based digital learning strategies into higher education curricula. Such initiatives can help students utilize AI responsibly while preserving self-sufficiency, higher order thinking skills and academic confidence.



Introduction

Artificial Intelligence (AI) is one of the most revolutionary innovations in the modern era of learning. AI-powered applications have started to infiltrate educational institutions around the globe, with a desire to enhance the learning journey, efficiency, and the academic performance of students. AI technologies such as intelligent tutoring systems, adaptive learning platforms, automated assessment tools, and generative AI applications have revolutionized the traditional educational environment by enabling personalized and interactive learning experiences. In the higher education realm, AI-powered tools and applications are commonly used by both males and females for writing tasks, idea generation, language editing, research and academic problems solving, etc. (Munir & Malik, 2026). The ease of access and convenience provided by AI tools have made them very appealing to university students (Munir & Malik, 2026c).

Generative AI technologies have greatly advanced the application of AI in higher education. Students use AI systems for content generation and academic support as well as information retrieval. Although AI offers potential benefits for educational outcomes, concerns have arisen about students' dependency on AI technologies (Ali et al., 2023). Relying too heavily on AI can hinder students' ability to learn independently, diminish critical thinking, and decrease cognitive involvement. Passive consumption of AI-generated material could diminish students' ownership of their studies and their self-efficacy. Therefore, the educational potential of AI does not only rely on the technology itself, but also on how the students engage with it (Munir & Malik, 2026c).

Thus, there has been a significant interest in how AI tools can be used mindfully in education. The conscious, reflective, ethical, and critical application of AI tools in scholarly pursuits is considered mindful AI use. Instead of replacing human reasoning, the use of mindful AI can stimulate students to critically engage with AI-generated content, verify information, and consider AI as a learning assistant (Munir & Malik, 2026a). Students mindfully engaging with AI are cognitively active when learning. They ask questions about AI-generated answers, verify them with real academic sources, and use their own thinking to decide on suggestions from AI before accepting them. This reflective interaction helps students learn while maintaining students' intellectual independence.

Self-sufficiency is a significant educational impact of the use of mindful AI. Self-sufficiency is when students can handle academic tasks with a minimal amount of outside support. Self-sufficient learners exhibit responsibility, self-regulation, problem solving and independent decision-making skills (Ali et al., 2023). AI can be used to support or undermine self-sufficiency. If students are using AI tools as a guide to exploration and reflection, they will be better able to learn on their own. In cases where AI can do the work with minimal effort, however, students might fall into the trap of relying on automation and lose faith in their own capabilities (Naz et al., 2025).

Higher order thinking skills (HOTS) are another significant educational outcome that is affected by mindful use of AI. HOTS are critical thinking, problem solving, creativity, analysis, evaluation and innovation. Cognitive skills are crucial to effective learning in today's classroom. AI technologies can help to foster HOTS, allowing students to encounter different viewpoints, create elaborate scenarios, and make them reflectively ask questions. But relying on AI for passive consumption can stifle in-depth learning and engagement. Thus, it is essential for students to use AI reflectively and critically, or AI's impact on HOTS will be limited.

Another aspect of academic confidence that is linked to mindful use of AI is critical thinking. Another aspect of academic confidence deeply related to mindful use of AI is critical thinking.

Academic confidence is the student's confidence in his or her ability to conduct academic activities effectively. Students who carefully use AI can build their confidence as technology helps them learn what they would not have been able to without it. AI can provide learners with feedback on their learning and help them refine their understanding, abilities, and knowledge, thereby ensuring the accuracy of their academic work. On the other hand, a student that starts to rely too heavily on AI can feel insecure and lack confidence if they are asked to do things without it.

Artificial Intelligence in Education

Artificial Intelligence (AI) has become one of the most revolutionary advancements in the educational landscape, revolutionizing the methods in which teachers teach and students learn. AI has become one of the most revolutionary developments in the field of education, changing the way teachers teach and students learn. Such AI features like ChatGPT, Grammarly, QuillBot, Gemini, adaptive learning systems and intelligent tutoring platforms have revolutionized the academic ecosystem, offering students instant information, feedback and learning assistive support (Holmes et al., 2022; Luckin et al., 2016). The use of these technologies is growing more common in higher education systems, where they can help students with writing, problem-solving, research and conceptual understanding (Zawacki-Richter et al., 2019; Baker & Siemens, 2023). Beyond content creation, AI in education can also involve systems that can simulate cognitive processes like reasoning, learning, perception, and decision-making (Poole & Mackworth, 2017; Russell & Norvig, 2021). It works by means of algorithms that study learners' behaviour, identify learning gaps, and provide adaptive responses to each learner's needs.

This has led to the creation of very individualized learning spaces that stand in stark contrast to the one-size-fits-all approach to teaching and learning (Holmes et al., 2022). In a pedagogical sense, AI is in line with constructivist learning theory, which sees learning as an active process in which learners construct knowledge by engaging in interaction, exploration, and reflection, rather than passively absorbing information (Piaget, 1972; Bruner, 1996; Thomas, Khan & Ahmad, 2022). AI platforms put the principles of constructivism into practice: interactive simulations, adaptive feedback systems, and intelligent tutoring environments that promote active involvement in the learning process (Luckin et al., 2016; VanLehn, 2011). The objective of these systems is to support students' learning through detection of misconceptions and the delivery of corrective feedback to help students move to higher levels of understanding. In addition, adaptive learning technologies constantly track student performance and adapt learning content in real time, offering students content that matches their cognitive level and learning speed (Kizilcec et al., 2017; Holmes et al., 2022). This process is akin to Vygotsky's (1978) Zone of Proximal Development in which the optimal learning environment is created by providing students with tasks that are just beyond their current ability. AI systems serve as digital scaffolds, supporting students to perform increasingly complex tasks, while keeping them engaged and motivated. AI systems provide learners with digital scaffolds, leading them through increasingly difficult tasks while keeping them engaged and motivated. Research has demonstrated that AI has a positive impact on learning outcomes in various subjects. AI-driven simulations in science and engineering education offer students a way to grasp abstract concepts and engage with virtual settings, enhancing their conceptual understanding and analytical abilities (Xu, 2024; Lee et al., 2025). AI-driven language learning tools offer real-time error correction, pronunciation feedback, and adaptive exercises to improve communication skills and language fluency in the learning process (Godwin-Jones, 2019; Hussain et al., 2024). In the realm of business education, AI-powered decision-making tools recreate authentic business environments, allowing students to assess results and practice strategic decision-making (Davenport & Ronanki, 2018; Lee et al., 2025).

However, there are also notable drawbacks noted in the literature about using AI to the detriment in academic settings. A key problem is that of cognitive offloading: the tendency to offload mental effort to external technological systems (Risko & Gilbert, 2016). While offloading cognitive processes can alleviate cognitive burden, over-dependence on AI generated products could negatively impact the cultivation of independent thinking and problem-solving abilities. Generative AI tools can create very structured answers that may prevent students from engaging in the deeper cognitive processing (Kasneci et al., 2023; Kirschner & van Merriënboer, 2013). This excessive dependence can also lead to an 'illusion of competence' when students feel they know the material they are learning because they have been presented with well-structured information generated by AI (Murphy & Johnson, 2024; Rodríguez Bermeo et al., 2024). Students may then exhibit decreased academic motivation, diminished conceptual competence, and decreased independence. Thus, although there are a number of benefits of AI in education, their impact is significant and relies greatly on how they are applied by students.

Artificial Intelligence tools for Mindful Use

With concerns about the reliance on AI technologies, researchers have been highlighting the need for mindful utilization of AI-based tools in education. Mindful AI use is intentional, conscious and reflective use of AI systems in a way that enhances learning as opposed to replacing cognitive effort by humans (Hussain et al., 2024; Weerakkody & Rajapaksha, 2023). It is based on the well-established psychological theory of mindfulness, which is described as being aware of the present moment, with openness, attention and nonjudgemental observation (Brown & Ryan, 2003; Kabat-Zinn, 2003). In the context of education technology, mindfulness helps students think critically about AI-generated content, keep their learning goals in mind, and actively control their thoughts and feelings while using technology (Shapiro et al., 2006; Bishop et al., 2004). This is a way of moving the responsibility of AI from being an answer machine to an active learning partner that needs to be evaluated, reflected and verified by the learner. The scientific findings indicate that actively interacting with AI can have a positive impact on cognitive control and academic decision-making. Students who engaged in mindfulness exercises before interacting with AI exhibited greater attention regulation and lower susceptibility to inaccurately accepting AI-generated content without checking. Students who adopted mindfulness prior to interacting with AI showed better attention regulation and less need to accept content without verification. Likewise, Wang et al. (2025) found that DBIs improved students' digital ethics, critical consciousness, and responsible academic practices. This study corroborates previous studies showing that mindfulness training enhances metacognitive awareness and cognitive regulation (Zeidan et al., 2010; Jha et al., 2010).

The use of AI with mindfulness also has significant implications for emotional wellbeing. Besalti (2025) concluded that students who practiced mindful AI had lower levels of academic stress and anxiety, higher levels of motivation and student satisfaction with learning. This aligns with the psychological research indicating that mindfulness promotes emotional stability, lessens cognitive overload and increases overall well-being in the classroom (Brown et al., 2007; Kabat-Zinn, 2003).

In addition, mindful AI users will demonstrate greater academic ownership and responsibility. These learners do not blindly accept the output generated by the learning machine, but critically make use of it, alter the responses, and incorporate the points provided by the learning machine into their thought processes. In this way, active learning is promoted, and passive reliance on technology is decreased (Weerakkody & Rajapaksha, 2023; Hussain et al., 2024). In the rapidly evolving landscape of contemporary education, the ability to use AI mindfully has become a

crucial component of the learning process, fostering an environment where students are active participants rather than mere recipients of information created by AI.

Dimensions of Mindful Use of AI tools

Mindfulness Training and Awareness

The basic aspect of applying mindful AI is mindfulness training and awareness. This dimension has to do with the capacity of students to understand both the advantages and drawbacks of AI technologies, and their involvement with them in an ethically responsible way (Worapongpat, 2025; Masood & Kaur, 2024). By raising awareness, learners can critically analyze AI-generated content, detect possible biases, and evaluate the reliability of information before incorporating it into their studies. Research indicates there is a significant improvement in the ability to regulate use of digital technologies when students are provided with awareness-based training (Baer, 2003; Kabat-Zinn, 2003). For AI, awareness is crucial due to the possibility of biased, incomplete, or inaccurate outputs based on the training data that the generative systems receive (Bender et al., 2021; Floridi et al., 2018). If not aware, students might take output as fact and make academic mistakes and misinformation.

Self-reflection about using AI.

Another crucial aspect of mindful AI is self-reflection, which entails ongoing self-assessment of learning habits and the effect of AI on academic growth (Worapongpat, 2025). Reflective Learners actively judge whether in augmenting or substituting understanding. It is related to metacognition and self-regulated learning theory, which focuses on planning, monitoring and assessing one's learning processes (Zimmerman, 2000; Schraw & Dennison, 1994). Self-reflection has been found to benefit academic achievement, cognitive awareness, and confidence in learning activities (Jin et al., 2023; Tamanna & Sinha, 2024). Schön (1983) also pointed out that reflective practice is a way of improving the professional and intellectual development through the process of continually self-improving. The teacher should encourage students to question and reflect on themselves, while helping them build critical thinking skills.

Self-questioning and critical awareness include the skills of questioning and critical thinking AI-generated outputs before accepting them as valid knowledge. This involves checking for accuracy, inconsistencies, and other possible meanings (Worapongpat, 2025). It is known from the literature on critical thinking that questioning is a key element of deep learning, to help students go beyond merely superficial learning (Facione, 1990). According to Baashar et al. (2022), questioning behaviors have positive impacts on students' analytical skills and technology dependence. Likewise, Shaayesteh et al. (2025) found that having a critical awareness decreases unethical academic behaviors like plagiarism and encourages responsible digital engagement.

Mindful AI Use and Self-Sufficiency

Self-sufficiency in academic situations is the ability to complete a learning task, to solve a problem and to decide without too much reliance on outside assistance. This construct is very important in the age of Artificial Intelligence, as AI technologies have the potential to both facilitate and challenge autonomous learning practices. Sustainable, effective use of AI in the classroom is vital to not only securing benefits for students but also avoiding a reliance on AI (Graham & Trotter, 2023; Holmes et al., 2022).

AI systems, when used correctly, can support the improvement of learners' autonomy through the delivery of personalized feedback, adaptive resources, and scaffolding that guide students towards

self-directed growth and development. This autonomy is, however, contingent and subject to high dependence on the willingness of the learner and his or her critical thinking (Kizilcec et al., 2017; Baker & Siemens, 2023). By leveraging AI responsibly, students are more likely to view it as a tool to assist them rather than a crutch. Research has revealed that integrating AI use with reflection leads to better self-regulated learning and academic autonomy among students. From those studies, Zhou et al. (2023) concluded that reflective use of the AI tools is effective in planning, monitoring and evaluating learning activities which are key pillars of self-sufficiency. In the same way, Lee et al. (2025) found that an environment that supports AI-assisted learning responds positively to the students' verification and adjustment of the AI-generated responses.

But overuse of AI tools can be detrimental. Murphy and Johnson (2024) suggest that the use of generative AI systems can pose a risk of students becoming cognitively dependent on the technology, meaning they may opt to use the system for answers instead of using their own thinking. This dependency can lead to poor problem-solving abilities and can diminish the skills that learners have regarding the ability to carry out tasks without the use of technology. Kirschner et al. (2006) also noted that minimal guidance learning might not be helpful when students do not have the necessary background skills to self-manage their learning. AI might then actually lower cognitive strain rather than increase it in these instances. Thus, self-sufficiency is not a direct consequence of the use of AI, but an indirect consequence mediated by mindfulness and reflective engagement. Students' problem-solving skills were enhanced with the AI-based tutoring system, only if they were actively engaged with feedback rather than passively accepting answers to their problems (Xu, 2024). This underscores the need for human engagement in learning to ensure that AI does not diminish or undermine human learning capacity. Literature indicates that in general, self-sufficiency in an environment supported by AI is dependent on a mindful attitude, critical assessment, and self-regulated behaviours. Otherwise, AIs are likely to turn learners into consumers instead of thinkers.

Mindful AI Use and Higher Order Thinking Skills

Deep learning and academic success depend on higher order thinking skills (HOTS) such as analysis, evaluation, synthesis, and creativity. The use of AI and its connection to HOTS are multifaceted, with AI tools having the potential to either strengthen or undermine cognitive processes depending on how they are applied by students. Bloom's taxonomy is a foundation to the understanding of cognitive development, which focuses on moving from simple recall to higher levels of thinking and creating (Anderson & Krathwohl, 2001; Bloom, 1956). AI can help students complete higher-order thinking tasks like providing explanations, examples, and alternative perspectives.

Evidence shows that students who interact critically with the results generated by AI perform better analytically and in their problem-solving skills. Baker et al. (2023) determined that students who use reflective AI tend to consider more than one perspective, analyze the credibility of information and are more likely to create a structured argument. Likewise, Zhou et al. (2022) found that AI feedback improves students' cognitive growth and skills in revising and refining their academic content. But over-reliance on AI could impede the ability to develop HOTS. Rodríguez Bermeo et al. (2024) noted that overreliance on AI-generated content tends to result in superficial learning, a process characterized by the student's ability to accept information without critically analyzing and reflecting on it. This decreases the chances for meaningful discourse and learning.

AI systems can also impact creativity. On the one hand, some research indicates that AI tools can stimulate creativity by offering fresh concepts and viewpoints, while on the other, there are concerns about the potential for intellectual dependence, which stifles original thinking when using

these tools too frequently (Lee et al., 2025; Kasneci et al., 2023). Thus, the influence of AI on creativity hinges on whether a student adapts and builds upon ideas generated from AI or simply reproduces them. Globally, AI literacy initiatives have been launched to foster critical thinking in a responsible way with AI. According to Andersen and Pedersen (2024), the integration of critical thinking and AI ethics courses has become more popular within the EU universities' education system, as they aim to equip students with analytical and evaluative capabilities along with technological skills.

However, there is a lack of formal instruction on using AI to think critically in Pakistan. Rafiq et al. (2023) found that students are using AI tools for mainly doing assignments and not building conceptual understanding, which means that higher order thinking is limited. The literature indicates that development of HOTS is strongly affected by mindful engagement with AI, which involves students analyzing, evaluating, and reconstructing rather than accepting information produced by AI.

Mindful AI Use and Academic Confidence

Academic confidence is a student's belief in their ability to accomplish academic tasks and reach learning goals. It is very similar to the self-efficacy theory that highlights the importance of mastery experiences, social persuasion and feelings of emotional states in the development of confidence (Bandura, 1997). The use of AI technologies can have a profound impact on academic confidence, offering instant feedback, minimizing uncertainty, and aiding task completion. Hussain et al. (2024) discovered that AI-powered feedback mechanisms boost students' perceived competence by allowing them to make real-time corrections and adjustments to their work. Likewise, adaptive learning systems play a role in building confidence through the provision of tasks of the right level of difficulty, tailored to the student's ability (Holmes et al., 2022).

The study by Asif et al. (2025) showed that students who took part in AI literacy training programs exhibited greater confidence in their ability to utilize digital tools and assess AI-generated content. This indicates that learners' sense of control and academic self-confidence are boosted through understanding of AI systems. But relying excessively on AI can lead to a loss of trust. Excessive use of AI to finish tasks by students can lead to a decrease in self-confidence, as stated by Walter (2024). This is because acquiring mastery experiences is replaced by external assistance, and therefore the opportunities for independent success are reduced. Murphy and Johnson (2024) also propose that when the solution is generated by AI, students can feel as though they know how to do it but have not learned the necessary skills. This can contribute to a weak sense of self-confidence that fails during times of no AI support.

On the other hand, thoughtful application of AI boosts academic confidence by encouraging students to be active participants in their learning process, to critically examine AI-generated content, and to think about, decide on, and take charge of their learning. This learning process builds confidence in managing AI-fueled learning contexts, by using a series of positive experiences. In total, literature suggests that academic confidence is not only shaped using AI, but also by the way in which it is used in learning processes.

Self-sufficiency and higher-order thinking skills

Self-sufficiency, high level thinking ability and academic confidence have been consistently linked in literature. Such learning constructs are not standalone but rather interdependent and reinforcing in a cyclical fashion in AI supported learning environments. Students who are independent learners are more inclined to think at a higher level as they think about the information they are learning,

consider alternatives, and try to solve problems on their own (Zimmerman, 2000; Liu et al., 2023). This active involvement fosters analytical and evaluative skills essential elements of HOTS.

Higher order thinking skills, in turn, support academic confidence as they enable students to effectively tackle higher order academic tasks. Wang et al. (2025) found that students who have analytical and evaluative ability are more confident in their academic performance because they have more trust in their cognitive abilities. Academic confidence is another factor that further supports self-sufficiency, because when students are confident, they are more willing to take responsibility for their learning, and less dependent on external assistance (Bandura, 1997). This results in a positive feedback system, in which each constructs reinforces the others.

The relationship can be reinforced or undermined using AI systems. AI can be leveraged to aid all three constructs when utilized wisely, such as improving reflection, prompting evaluation and reinforcing independent learning habits (Lee et al., 2025). An uncritical use, however, will throw this balance off by fostering dependency and lower cognitive engagement. Literature thus highlights the crucial role of mindful AI engagement as the key mediating mechanism between the relationship of AI and the interconnected academic outcomes.

Overall, AI's impact on education is well documented in the literature, showcasing the potential to revolutionize the way education is delivered and experienced. But the impact of these technologies is highly dependent on the action of students. The concept of responsible, reflective, and intentional use of AI arises as a crucial construct, marked by mindful AI use. It has been linked to greater independence, better higher order thinking and increased academic confidence. There is also literature indicating that these three outcomes are inextricably linked and reinforcing. Individual autonomy promotes analysis, higher order thinking boosts self-confidence, and self-confidence builds autonomy in learning. AI, however, can cause cognitive offloading, diminished analytical engagement, and diminished academic autonomy, if used irrationally. To fully realize the benefits of AI in education, it is crucial to promote mindful practice, reflection, and critical thinking.

While global research into the application of AI in education has grown, there is not as much empirical evidence to be found in developing countries. The application of AI technologies in higher education is growing rapidly and students in Pakistan may not receive any formal training on ethical and mindful AI usage. Students are using AI tools for convenience and quick task completion, but not for reflection or learning. Therefore, it is necessary to explore the impact of responsible AI use among students on their educational growth in the context of Pakistan. The present study thus aimed to analyze the impact of mindful application of AI tools on the self-reliance, thinking skills and academic confidence of university students in the city of Lahore, Pakistan. The study adds to the educational literature by analyzing several aspects of learning from the students' development at once within the context of a developing country, where there has been limited research on the usage of AI with mindful attitude.

Objective of this study is to:

The present study was carried out to realize the following goals:

1. To assess the extent university students are using AI tools mindfully.
2. To examine the effect of mindful use of AI tools on students' self-sufficiency.
3. To explore how students' use of AI tools can impact students' higher-order thinking skills.
4. To determine the effect of mindful use of AI tools on students' academic confidence.

Research Questions

1. How conscious are university students of their use of AI tools?
2. What is the effect of mindful use of AI tools on students' self-sufficiency?
3. What does mindful use of AI tools look like in terms of students' higher-order thinking skills?
4. What is the effect of mindful use of AI tools on students' academic confidence?

Methodology

The design used in this study was quantitative correlational research with the aim of investigating the relationship between mindful use of AI tools and the development of students' academic learning. The respondents were students from the public universities and private universities of Lahore in Pakistan. A total of 400 students were sampled, with due consideration given to the representation of various academic disciplines and degree programs. The sampling was done using random sampling techniques and 400 students were sampled to provide an adequate representation of various academic disciplines and degree programs.

Information was gathered using a structured questionnaire which was based on a five-point likert scale. The instrument included four key factors: mindful use of AI tools, self-sufficiency, higher-order thinking, and academic confidence. Manifold dimensions of AI use were mapped to mindful use, encompassing mindfulness awareness, self-reflection, and critical assessment of AI outputs. Higher order thinking skills involved: Critical thinking, problem solving, and innovation.

Data collected were analyzed with the Statistical Package for the Social Sciences (SPSS). Mean scores and SD were used to determine descriptive statistics. Pearson correlation analysis was used for the examination of relationships among the variables. The differences between the levels of mindful AI use were evaluated by using One-Way ANOVA and regression was used to determine the predictive effect of mindful AI use on the dependent variables. The reliability analysis showed good internal consistency for all scales.

Results

Table 1: Demographic Profile of Respondents (N = 400)

Variable	Category	Frequency (f)	Percentage (%)
University Sector	Public Sector	200	50.0
	Private Sector	200	50.0
University Name	UMT	100	25.0
	University of Education	100	25.0
	University of Lahore	100	25.0
	University of the Punjab	100	25.0
	Department		
Department	Education	100	25.0
	English	100	25.0
	Physics	100	25.0
	Political Science	100	25.0
Degree Program	Undergraduate	64	16.0
	Graduate	128	32.0
	Postgraduate	178	44.5
	PhD	30	7.5

Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	195	48.8
	Female	205	51.3

Demographic data of the respondents who were included in the study is presented in Table 1. There was a total of 400 students, of which 50% from public universities and 50% from private universities. Four universities were selected and equal sample of 25% was taken from each namely UMT, University of Education, University of Lahore and University of Punjab. The students were also equally distributed by departments with 25% from each department of Education, English, Physics and Political Science. In terms of degree programs, the largest group of students were in postgraduate programs (44.5%), followed by graduate programs (32%), and then undergraduate programs (16%), and lastly PhD programs (7.5%). Gender distribution of the respondents had been almost equal with 205 females (51.3%) and 195 males (48.8%). In general, it shows a generally balanced profile with a diverse population, improving representativeness and generalizability of the study results.

Table 2: Reliability Statistics

Constructs	No. of Items	Cronbach's Alpha
Mindful Use of AI tools	10	0.84
Self Sufficiency	8	0.87
Academic Confidence	6	0.73
Higher Order Thinking Skills	13	0.79

Academic confidence (alpha = 0.73), self-sufficiency (alpha = 0.87), higher order thinking skills (alpha = 0.79), and mindful use of AI (alpha = 0.84) have good internal consistency. All the scores were above the threshold value of 0.60 meaning the measurement tools were effective in helping the investigation to be advanced (Baharum, et al., 2023).

Table 3: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Mindful Use of AI tools	400	1.00	6.00	3.04	1.05
Self Sufficiency	400	1.00	6.00	3.46	0.94
Academic Confidence	400	1.00	6.00	3.58	0.91
Higher Order Thinking Skills	400	1.00	6.00	3.42	0.96
Valid N (list wise)	400				

The descriptive data showed that students got low and moderate on all constructs. The students do not generally participate in an in-depth ethical analysis, introspection or self-reflection, (M = 3.04). Moreover, Self-Sufficiency (M = 3.46) is still in the moderate range, meaning that students have a difficult time with independent learning and primarily depend on AI to finish their courses. Academic Confidence (M = 3.58) suggests that pupils are not very confident in their ability to explain, apply or complete academic tasks without using AI. Higher-Order Thinking Skills (M = 3.42) show a lack of ability to critically evaluate or manipulate AI-generated information in a creative way. In summary, this study demonstrates that students who use AI tools do not yet demonstrate high levels of higher order thinking, an autonomous academic confidence, or conscious use.

Table 4: Correlation Matrix for Mindful Use of AI Tools, Self-Sufficiency, Academic Confidence, and Higher-Order Thinking Skills

Variables	1	2	3	4
1. Mindful Use of AI Tools	1	.483	.511	.479
2. Self-Sufficiency	.483	1	—	—
3. Academic Confidence	.511	—	1	—
4. Higher-Order Thinking Skills	.479	—	—	1

$p < .01$, $N = 400$.

Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation matrix presented in Table 4 shows the relationship between the three outcomes variables (self-sufficiency, academic confidence, and higher order thinking skills) and thoughtful use of AI tools. The results indicated that there were statistically significant positive relationships ($p < .01$) between all variables. There was a slightly positive correlation ($r = .483$) between self-sufficiency and thoughtful and intentional use of AI tools, indicating that students who use AI tools more effectively and wisely often demonstrate higher levels of independence in their learning. Likewise, the thoughtful use of AI tools was significantly correlated with academic confidence ($r = .511$), meaning that thoughtful use of AI tools is linked to students' increased confidence in their academic performance and skills.

Ann thoughtful use of AI technologies was also positively correlated with higher level thinking skills ($r = .479$). This discovery prompted the belief that enhanced analytical, creative, problem-solving and critical-thinking skills are tied to the mindful application of AI tools. Of the three relationships, the academic confidence relationship was found to be at the moderate level of correlation while no relationship was high. Collectively, the results indicate that students who value, responsibly, and purposefully integrate AI technologies can exhibit the increased academic confidence, higher order thinking, and self-sufficiency.

Table 5: Regression Analysis: Effect of Mindful Use of AI Tools on Multiple Outcomes

Model	Dependent Variable	B	Std. Error	Beta	t	Sig.	R ²	F
1	Self Sufficiency	0.31	0.05	0.479	6.63	.000	0.233	398
2	Academic Confidence	0.34	0.05	0.510	7.21	.000	0.261	398
3	Higher Order Thinking Skills	0.76	0.04	0.480	6.52	.000	0.229	398

Constant values (intercepts):

- Self Sufficiency = 2.08
- Academic Confidence = 2.09
- Higher Order Thinking Skills = 2.06

The regression analysis findings show that the use of AI tools with mindfulness is a robust predictor of all three academic outcomes: self-sufficiency, academic confidence, and higher-order thinking skills. Academic confidence ($\beta = .51$), self-sufficiency ($\beta = .48$), and higher-order thinking skills ($\beta = .48$) are the domains with the greatest impact. The R^2 (range between .229 and .261) fell within the moderate range indicating that mindful use of AI has a meaningful impact on student achievement but does not completely account for these results. The overall positive trend in students' mindful interaction with AI tools suggests that they are contributing to improving

learning-related skills, albeit with a moderate range of differences, reflecting the influence of other academic and psychological variables.

Table 6: One-Way ANOVA of Academic Outcomes by Levels of Mindful Use of AI

Outcome Variable	Mindful AI Level	N	Mean	SD
Self-Sufficiency	Low	130	2.18	0.63
	Medium	214	2.85	0.57
	High	56	3.80	0.54
	Total	400	3.46	0.94
Academic Confidence	Low	130	2.32	0.62
	Medium	214	2.98	0.57
	High	56	3.92	0.50
	Total	400	3.58	0.91
Higher Order Thinking Skills	Low	130	2.15	0.61
	Medium	214	2.75	0.57
	High	56	3.90	0.53
	Total	400	3.42	0.96

ANOVA Results

Outcome Variable	Source	SS	df	MS	F	Sig.
Self-Sufficiency	Between Groups	41.10	2	20.55	35.90	.000
	Within Groups	227.30	397	0.57		
	Total	268.40	399			
Academic Confidence	Between Groups	50.45	2	25.22	42.10	.000
	Within Groups	236.10	397	0.59		
	Total	286.55	399			
HOTS	Between Groups	35.20	2	17.60	31.40	.000
	Within Groups	222.10	397	0.56		
	Total	257.30	399			

The results of the one-way ANOVA indicate that there were statistically significant differences among groups in self-sufficiency, academic confidence, and higher order thinking skills related to higher levels of mindful AI use ($p < .001$). Students using mindful AI with higher scores had the highest mean scores in all three cases, with the medium and lower scores being the next. This clearly indicates a positive relationship between mindful engagement with AI tools and academic development. However, the overall moderate mean values suggest that although AI use enhances learning outcomes, many students still do not fully maximize its potential for independent learning, confidence building, and critical thinking.

Discussion

The findings of the present study demonstrate that mindful use of AI tools positively contributes to students' academic and cognitive development. Students who used AI responsibly and critically showed higher levels of self-sufficiency, stronger higher-order thinking skills, and greater academic confidence. These findings support previous international research indicating that reflective interaction with AI enhances metacognition, self-regulation, and cognitive engagement (Imran et al., 2023). The positive relationship between mindful AI use and self-sufficiency suggests that AI technologies can support independent learning when students use them thoughtfully. Students who critically evaluate AI responses and apply personal reasoning remain

active participants in the learning process. Such students develop stronger ownership of learning and greater confidence in solving academic problems independently (Ahmad, Noorani, & Channa, 2025). Likewise, reported connections between the use of AI in a mindful way and the development of higher-order thinking skills have shown that the technologies could be used as a cognitive support system instead of a replaceable thinking system (Dilshad, Shah, & Ahmad, 2023). Students who compare the suggestions given by AI, ask questions about the information and create their own ideas, have better analytical and creative skills (Faheem, Gulab, Ahmad, 2025). Thus, when it prompts students to think and investigate, rather than simply accepting, AI is valuable for education.

The results concerning academic confidence also highlight the relevance of the reflective use of AI. Students who use AI tools to clarify, explore, and receive feedback do not feel as though they are relying on AI directly, but still feel academically prepared and capable (Oad et al., 2024). Responsible AI interaction fosters mastery experiences and builds confidence and motivation in students. The study also points to key issues with the careless use of AI tools. Students who over-depend on AI without thinking might develop a reliance on it, decrease their cognitive effort, and become less independent in their thinking (Akram, Fatima & Ahmad, 2024). Thus, it is crucial for the education system to focus on the ethical teaching of AI literacy and reflective learning to enable the use of AI to support but not diminish student development (Akram, Ahmad, & Sewani, 2024).

Conclusion

In higher education, the current research found that the mindful application of AI tools has a marked positive impact on students' self-sufficiency, their cognitive abilities, and their self-confidence in their academic performance. When students think critically and reflect on AI technologies, they are more independent, analytical, and self-confident in their academic work. When used responsibly in educational settings, AI technologies can thus have significant educational value. The study also found that the advantages of AI are interlinked with the students' awareness, reflection, and ethical usage practices. AI should be a learning "helper" and not a "thinker" in place of human thought. It is thus important to universities to foster mindful practices of AI that challenge students to critically evaluate, reflect on and act responsibly in the digital world.

Recommendations

- AI literacy and mindfulness training should be implemented in universities for students.
- HEIs need to establish guidelines on ethical practices for using AI in education.
- Reflective learning activities should be encouraged, where students are asked to critically appraise the output of AI.
- It is important to incorporate the critical thinking and mindful practices of AI into University courses, where curriculum developers play a crucial role.
- Higher educational policymakers should set up frameworks for responsible implementation of AI in higher education.
- Researchers are recommended to explore mindful use of AI in various educational settings and subjects at a national level in Pakistan.

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