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AI ASSISTANCE, NOT AI DEPENDENCE, PREDICTS CRITICAL THINKING AMONG UNIVERSITY STUDENTS IN PAKISTAN

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ABSTRACT

Students use AI tools in two different ways: as a support for learning (AI Assistance) and as a replacement for their own effort (AI Dependence). This short article asks which of the two goes with stronger critical thinking. Data came from 150 university students in Pakistan (99 undergraduate, 51 postgraduate) who completed an online survey. AI Assistance had a moderate positive correlation with Critical Thinking ($r = .522$, $p < .01$) and AI Dependence a weak one ($r = .173$, $p < .05$). When both were entered together in a regression ($R^2 = .272$), only AI Assistance was a significant predictor ($\beta = .517$, $p < .001$); AI Dependence was not ($\beta = .015$, $p = .843$). The difference lies in how AI is used, not simply how much. Because the design is cross-sectional, the results show association and statistical prediction, not cause.

Keywords: *AI Assistance; AI Dependence; Critical Thinking; University Students; Pakistan*

1 INTRODUCTION

AI tools such as ChatGPT, Grammarly and Quillbot are now part of daily study for many university students. Researchers describe a two-sided picture. Used well, AI can give quick feedback, explanations and new perspectives (Kasneci et al., 2023; Romero-Rodríguez et al., 2023). Used heavily in place of one's own effort, it may lead to *cognitive offloading*, where mental work is passed to the technology (Ahmad & Muhammad, 2025; Lodge et al., 2026). Critical thinking, meaning the ability to analyse, evaluate and interpret information independently (Facione, 1990), is the skill most often discussed in this debate.

Many studies group all AI use together. This article keeps the two patterns apart. AI Assistance is constructive use of AI to improve understanding and learning. AI Dependence is heavy reliance on AI with little personal effort.

Earlier studies

Earlier work approaches this question from several angles. General reviews describe the opportunities and challenges of AI and large language models in education (Kasneci et al., 2023; Ouyang & Jiao, 2023). Some studies look directly at thinking: Romero-Rodríguez et al. (2023) examined students' views of ChatGPT as a tool for complex thinking, Bi and Tan (2024) asked whether ChatGPT scaffolds or substitutes undergraduate reasoning, and Fasahat et al. (2025) examined the role of AI in fostering critical thinking among university students. Other studies focus on over-reliance: Zhai et al. (2024) reviewed technology overreliance and

cognitive passivity, Yang et al. (2025) studied AI dependence and the innovation capability of college students in China, and Fernando et al. (2026) described profiles of AI dependency among university students. A further group looks at context, including AI adoption among Pakistani students (Hassan & Farooq, 2025) and across academic levels (Holloway & Benson, 2024).

Taken together, these works describe the picture as mixed, with benefits in some settings and concerns about over-reliance in others. Few of them separate constructive use from heavy reliance within the same sample, and little of this evidence comes from Pakistan. This gap is what the present study addresses. Table 1 summarises the studies by topic.

Table 1. *Earlier studies and how they relate to this article (summarised from titles and topics)*

Study	Focus	Link to this article
Kasneci et al. (2023)	Opportunities and challenges of large language models for education	Shows why AI use has both benefits and risks
Ouyang & Jiao (2023)	AI in education, three paradigms	Background on AI in education
Romero-Rodríguez et al. (2023)	ChatGPT at university as a tool for complex thinking	Supports the idea that AI can help thinking
Bi & Tan (2024)	ChatGPT as scaffold or substitute for undergraduate reasoning	Same assistance-versus-substitution question
Fasahat et al. (2025)	AI and critical thinking among university students	Closest topic to the main relationship
Zhai et al. (2024)	Technology overreliance and cognitive passivity	Source of the over-reliance concern
Yang et al. (2025)	AI dependence and innovation capability (China)	Links dependence with cognitive outcomes
Fernando et al. (2026)	Profiles of AI dependency among university students	Describes levels of student dependence
Hassan & Farooq (2025)	AI adoption and perceived impact among Pakistani students	Local context for this study
Holloway & Benson (2024)	AI adoption and critical literacy across academic tiers	Context for undergraduate and postgraduate comparison

The study therefore asked: *which pattern of AI use goes with higher critical thinking among Pakistani university students?*

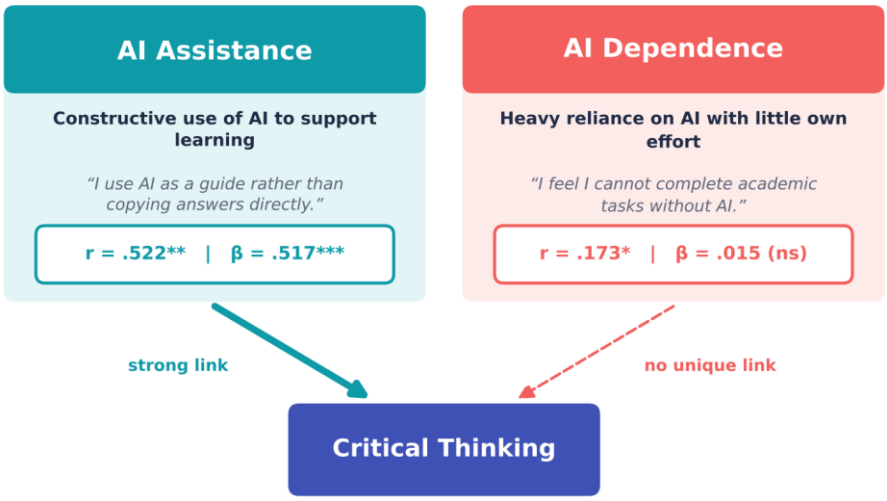


Figure 1. *The two patterns of AI use compared with Critical Thinking (r = correlation; β = standardized regression weight; ns = not significant).*

2 Method

A quantitative, cross-sectional, correlational design was used. The sample was 150 university students in Pakistan (80 male, 70 female; 99 undergraduate, 51 postgraduate), reached through convenience sampling and an online Google Forms survey. Three scales used a 5-point agreement rating: AI Assistance (5 items, α = .884), AI Dependence (5 items, α = .865) and Critical Thinking (6 items, α = .908). An example item for each scale is below. Participation was voluntary with informed consent, and data were analysed in SPSS using Pearson correlation and multiple regression ($p < .05$).

Table 2. *Scales used in the study*

Scale	Items	Example item	α
AI Assistance	5	"I use AI as a guide rather than copying answers directly."	.884
AI Dependence	5	"I feel I cannot complete academic tasks without AI."	.865
Critical Thinking	6	"I use logical reasoning when solving problems."	.908

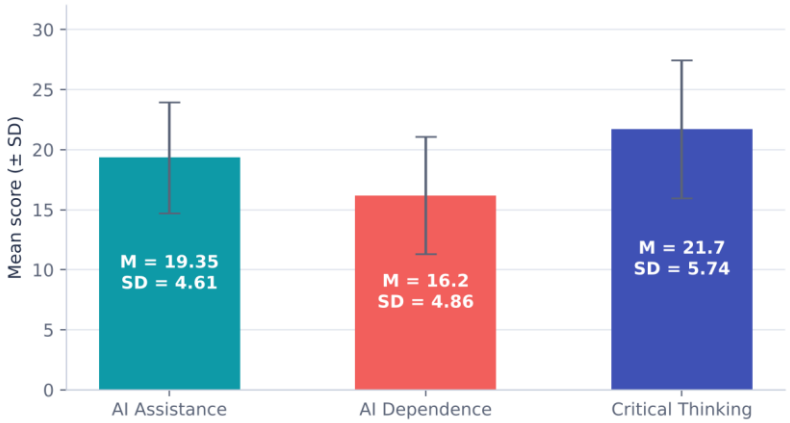


Figure 2. *Mean scores (± SD). Students scored higher on AI Assistance (M = 19.35) than on AI Dependence (M = 16.20).*

3 Results

Correlations

AI Assistance had a moderate positive relationship with Critical Thinking (r = .522, p < .01), and AI Dependence a weak positive one (r = .173, p < .05). The two AI patterns were also related to each other (r = .306, p < .01): students who use AI for help also tend to rely on it more.



Figure 3. *Correlation matrix of the study variables (N = 150).*

Regression

Because the two AI patterns overlap, a multiple regression tested their separate contributions. The model was significant and explained 27.2% of the variance in Critical Thinking (R^2 = .272, adjusted R^2 = .262, $F(2, 147)$ = 27.49, p < .001). AI Assistance was a strong predictor (β = .517, p < .001). AI Dependence was not (β = .015, p = .843). VIF was 1.104, so multicollinearity was not a concern.

Table 3. *Multiple regression predicting Critical Thinking (N = 150)*

Predictor	B	SE	β	t	p
AI Assistance	0.643	0.092	.517	6.99	< .001
AI Dependence	0.017	0.087	.015	0.20	.843

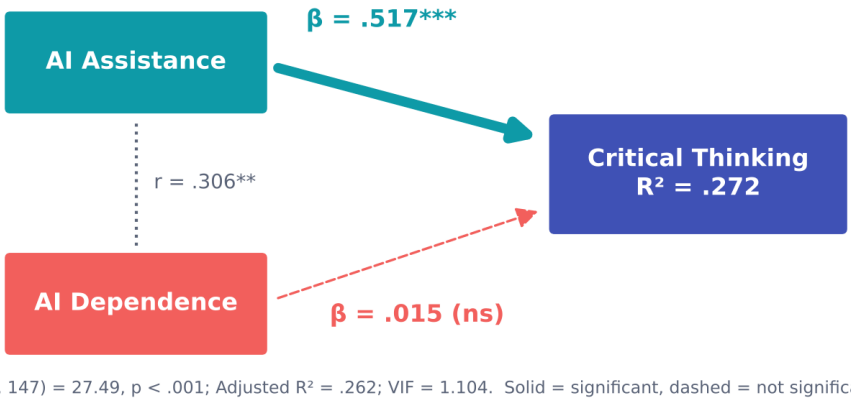


Figure 4. *Regression model: AI Assistance is the only significant predictor of Critical Thinking.*

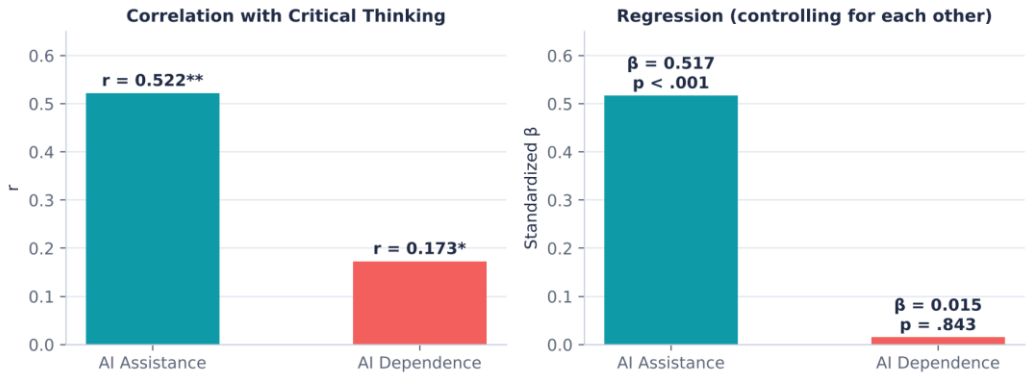


Figure 5. ***AI Dependence correlates weakly with Critical Thinking, but adds nothing once AI Assistance is in the model.***

Using the reported correlations and weights, the variance can be split. About 24.2% of Critical Thinking variance is uniquely linked to AI Assistance, about 3.0% is shared between the two AI patterns, and AI Dependence adds less than 0.1% on its own (Figure 6; calculated from the reported values).

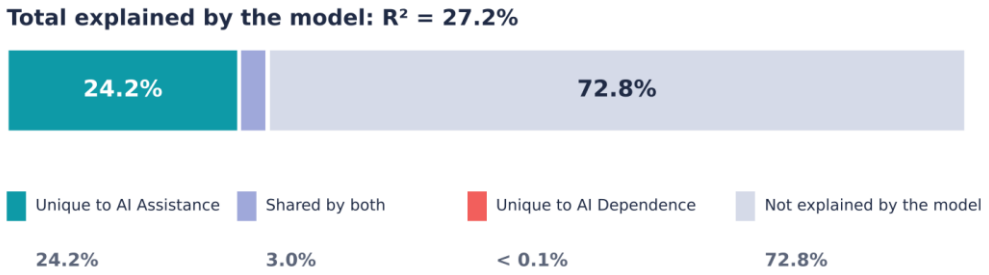


Figure 6. ***Share of Critical Thinking variance linked to each AI pattern (calculated from the reported r and β values).***

4 Discussion

The main message is that the way AI is used matters more than how much it is used. Students who use AI to understand concepts, get explanations and explore ideas also report stronger critical thinking. The weak link for AI Dependence mostly disappears once AI Assistance is taken into account, which suggests that it came from the overlap between the two patterns and not from dependence itself. This fits Cognitive Load Theory, in which AI can take over routine mental work and leave room for deeper reasoning (Sweller, 1988), and it agrees with earlier reports that AI helps when students engage actively with its output (Romero-Rodríguez et al., 2023). The question of whether AI scaffolds or substitutes reasoning (Bi & Tan, 2024) is answered here only in part: assistance went with stronger thinking, but the design cannot show that it scaffolds it. The finding that students at both study levels looked alike also fits the wider adoption of AI tools across academic tiers (Holloway & Benson, 2024; Hassan & Farooq, 2025).

These results do not show that dependence is harmless. The study measured self-reported use at one point in time, so heavy reliance could still affect independent reasoning or innovation capability over a longer period (Zhai et al., 2024; Yang et al., 2025; Fernando et al., 2026). They also do not show that AI Assistance *causes* better thinking; students who already think critically may simply use AI more constructively.

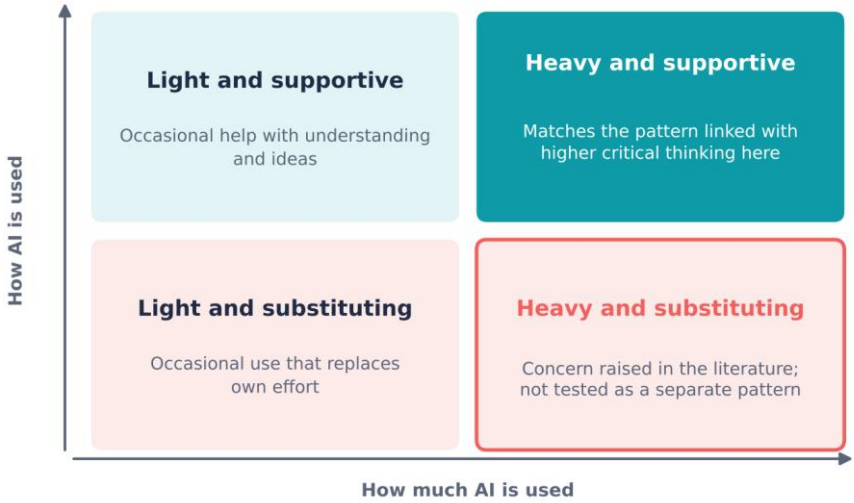


Figure 7. ***A simple way to think about AI use: the supportive/substituting split (conceptual illustration, not a tested model).***

Practical points

- Encourage students to use AI to understand, question and explore, not to copy answers.
- Design tasks where the student must add their own reasoning to AI output.
- Teach students to check AI answers instead of accepting them as they are.

Limitations

The study is cross-sectional, relies on self-report, and uses a convenience sample of 150 students, so it cannot show cause and effect and may not generalise to all Pakistani university students. Other factors such as motivation, digital literacy and learning style were not measured.

5 Conclusion

In this sample, AI Assistance, and not AI Dependence, was the significant predictor of critical thinking. The educational value of AI appears to lie in supportive, active use. Longitudinal studies with larger and more varied samples are needed to confirm this.

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