

Impact on Cognition and Creative Capacity among AI Users in Pakistan: A Cross-Sectional Study

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ABSTRACT

OBJECTIVE: To assess the perceived impact of artificial intelligence on students' cognitive and creative capacities.

METHODOLOGY: This cross-sectional study used a online questionnaire distributed via simple random sampling to students and professionals in Pakistan. Participants aged under 45 years who used AI for educational tasks were included. Based on 86% of the population using AI and Cochran's formula, 185 responses were required. Data was analyzed using Excel Microsoft.

RESULTS: Out of 185 participants, 69.7% were aged 18–24 years, 78.4% were students; 54.6% held a bachelor's degree, and 63.8% were from medical field. Frequent AI use was reported by 64.3%, with ChatGPT being the most used tool (89.7%). 86.5% used AI for academic work and 63.8% for general knowledge. Cognitively, 54.6% sometimes relied on AI instead of recalling from memory, 50.8% preferred AI over original ideas, and 47.1% noted reduced creativity. Additionally, 39.5% reported improved critical thinking, but a majority (87.6%) believed over-reliance on AI may harm intelligence. A significant association existed between AI use frequency and decision-making confidence ($p = 0.0034$); none with creativity and duration of AI use ($p = 0.333$).

CONCLUSION: This study highlights effects of AI on cognition and creativity among Pakistani students and professionals. High Adoption correlated with reduced decision-making confidence. While creativity impacts were more task-related than time-based, concerns about AI encouraging convergent thinking persist. However, many students showed digital literacy.

KEYWORDS: Generative AI, ChatGPT, Medical Students, Critical Thinking, Creativity, Cognitive Capacity.

INTRODUCTION

Artificial intelligence (AI) refers to the development of computer systems capable of performing tasks that typically require human intelligence, including reasoning, learning, decision-making, and language understanding¹. It has application in various sectors which include agriculture (e.g., smart farming), manufacturing, healthcare (e.g., diagnostic support), autonomous transportation, banking, marketing, and education². The role in education include personalized learning apps, intelligent tutoring platforms, AI writing tools, and automated grading systems³.

Within academic environments, recent data indicate that approximately 86% of students utilize AI tools to support their academic activities, with 24% engaging with these systems daily and 54% at least weekly⁴. The study of southeast Asian university shows that the frequency of AI use is high with the mean of 4.35. Its usage has a significant negative relationship with critical thinking ($r = -0.48$) which show that its higher use is associated with lower level of independent thinking⁵. To further support this regionally, the

evidence from Pakistani universities shows that AI account for 46.1% in research, 42.7% in critical thinking, and 47.3% in academic originality ($p < 0.001$)⁶.

Human cognition involves mental processes that include attention, memory, problem-solving, and decision making. These functions are essential for learning, academic achievement, and adaptive behavior⁷. While AI has been shown to improve certain 21st century cognitive skills, it also have challenges such as bias, ethical concerns, and over-reliance⁸. Empirical evidence demonstrates that ChatGPT can mimic human-like problem-solving patterns but its excessive use can overload thinking processes rather than boosting brain's power⁹.

Closely linked to cognition is creative capacity which is defined as the ability to generate valuable ideas or solutions through divergent thinking¹⁰. The impact of AI on creativity remains debated. Some studies suggest that AI use results in similar writing and repetitive content particularly in idea generation and expression¹¹. Conversely, other studies argue that AI not only generates more creative ideas than humans but also improves the expression of creativity¹². Moreover, a randomized controlled trials in Nigeria shows that AI-powered tutoring can improve language learning and digital skills¹³.

Despite these advancements, there is growing concept of "cognitive debt" which is described as

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reduction in active cognition due to over-reliance on AI systems. Empirical evidence indicates that LLM users has lower cognitive engagement during essay writing tasks and struggled to recall accurately¹⁴. This increasing use of AI-generated content within biomedical research literature also indicate that AI use in research would decrease the innovation¹⁵. Another study shows that those students who use generative AI tools scored on average 6.71 points lower on exams than non-users especially among high-performing students¹⁶.

Despite growing global evidence on AI's cognitive and creative impacts, most studies focus on objective performance outcomes rather than individuals' subjective perceptions of cognitive change. Furthermore, evidence from low-resource, high-academic-pressure settings such as Pakistan remains limited. This study allows to understand the perspective of AI users on their cognition and creativity. Therefore, the study has the following objectives: To assess AI tool usage among students (frequency, duration, and platforms). To evaluate perceived effects of AI use on cognitive functions (memory, attention, decision-making). To examine the relationship between AI usage frequency and confidence in independent decision-making. To analyze the association between duration of AI use and perceived changes in creative capacity

METHODOLOGY

The study is an analytical cross-sectional survey. The study evaluates the perceived impact of AI usage on cognition and creative capacity among Pakistani users. Data were collected from higher education students and professionals of Pakistan. These included medical institutions (LUMHS, Jamshoro; PUMHS, Nawabshah; and Isra University, Hyderabad) and non-medical universities (MUET, Jamshoro; NUST, Islamabad; FAST, Karachi; IoBM, Karachi; and IBA, Karachi).

Data collection was conducted over a two-month period, from 20 June 2025 to 25 July 2025. A convenience sampling technique was used to recruit participants. The participant filled the through an online Google Forms questionnaire distributed on digital platforms (WhatsApp and Linked In). Ethical approval was granted by Research Ethics Committee of LUMHS, Jamshoro (NO: LUMHS/REC/830), on 17 June, 2025.

The inclusion criteria were age between 18 to 45 years, irrespective of gender and residence (rural or urban). Participants were required to have been using AI tools for educational or professional purposes for at least six months. In addition, only those participants were included who were enrolled in an educational program (such as school, college, or university) or were working in a professional field requiring cognitive involvement. Participants who had no exposure to AI tools, or those diagnosed with neurological or psychiatric illnesses were not included. Those on

medications affecting cognitive functioning, or with learning disabilities were also excluded from the study. The final sample consisted of 185 participants. The sample size was calculated using Cochran's formula with a 95% confidence level ($Z = 1.96$), $p(0.86)$, $q = 1 - p (0.14)$, and a margin of error ($e = 0.05$), which gave a calculated sample size of approximately 185 participants. The prevalence ($p = 0.86$) was based on a published survey which state that 86% of students use AI in their studies⁴. It also meets the 10:1 participant-to-item rule for the 17-item questionnaire. Therefore, the sample size is considered adequate for this cross-sectional study.

A structured 17-item online questionnaire was made in English using Google Forms. The questionnaire was divided into three sections. Section 1 included demographic information and institutional background of participants. Section 2 included frequency, duration, and types of AI tools commonly used, along with their functional purposes (creativity, writing, learning, and problem-solving).

Section 3 assessed the perceived impact of AI on cognitive capabilities and creative capacity using structured closed-ended questions across six domains: memory recall, attention span, decision-making confidence, critical thinking, problem-solving, and originality. Frequency and reliance items used a 5-point ordinal scale ranging from always to never. Impact and capability items measured changes in originality, decision confidence, and critical thinking using structured ordinal scales (e.g., significantly enhance to significantly limit; very confident to not confident at all; and improved to declined). Dichotomous and trichotomous items analyzed convergence and intelligence impacts using nominal response options ("yes," "no," "maybe," and "not sure").

Raw data from Google Forms were exported into Microsoft Excel for cleaning and statistical processing. A total of 196 samples were initially collected but after removing incomplete responses, a final sample of 185 responses was retained. Data analysis was conducted using two main approaches. Descriptive Statistics: In this individual item responses were converted into tables showing frequencies and percentages. Participant distributions by gender, AI platforms, and perceived impact on creativity were shown on pie and bar charts. Inferential Statistics: In this chi-square (χ^2) tests of independence (with a significance threshold of $p < 0.05$) were performed to evaluate the relationship between AI usage frequency and decision-making confidence without AI assistance; and AI usage duration and the perceived impact on creativity. Digital informed consent was mandatory for all participants. The online survey instrument was programmed with a strict setting. Access to the questionnaire was restricted unless the participant actively read the consent statement and selected 'Yes' to confirm voluntary participation. To protect participant privacy, all collected data was kept confidential.

RESULTS

Table I shows the social and demographic profile of the participants. The mean age of the participants was approximately 22.4 ± 4.8 year which suggests a major young population. 69.7% of the total participants were aged between 18 and 24 years of age and female has a higher proportion of the sample (71.4%) compared to males (28.6%) [Figure 1]. Half of the participants has a bachelor's degree (54.6%) and maximum (63.8%) were from medicine and health sciences followed by engineering and technology (20.0%). This shows that population is young, female, and mainly from medical and technical fields.

As shown in **Table II**, 64.3% of participants reported frequent use of AI tools, while 27.6% used them occasionally. ChatGPT was reported as the most widely used tool being utilized by 89.7% of respondents, followed by Meta AI (54.1%), Grammarly (32.4%), Gemini (30.3%, Quillbot (29.7%)), and DeepSeek (29.2) [Figure 2]. 86.5% participants reported that they use AI for academic work, 63.8% for general knowledge 49.7% for professional applications 54.6% for translation, and 37.8% creative writing. In terms of duration, 56.2% of the participants reported that they had been using AI tools for over a year. This suggests that AI has been integrated in both academic and professional practices.

As shown in **Table III**, 54.6% participants reported that when seeking information, they promptly use AI tools instead of recalling from memory. Only a minority (18.9%) of participants rarely or never depend on AI for initial information retrieval. Moreover, that half of the respondents (50.8%, $n = 94$) precisely admitted relying on AI instead of developing ideas independently, while (21.1%, $n = 39$) did rarely depend on AI and only (9.2%, $n = 17$) claimed they never relied on AI. Participants were also asked whether more exposure to AI lead to fewer unique ideas and more convergent thinking, on which (46.5%, $n = 86$) agreed, and (14.1%, $n = 26$) disagreed.

Majority (87.6%, $n = 162$) believe that over use of AI has negative effect on intelligence and only (12.4%, $n = 23$) disagreed. The population is divided into approx. half since (45.9%, $n = 85$) reported an increment in creativity, and (47.1%, $n = 87$) reported a reduction in originality [Figure 3]. There was a wide perspective over AI content as 37.8% verifies answers via other sources, 33.5% revised answers using their reasoning, and only 27.6% accepted actual AI feedback. A chi-square test (**Table IV**) revealed a statistically significant association between AI usage frequency (independent variable) and confidence in decision-making without AI (dependent variable). The test shows a significant association ($\chi^2 = 29.4$, $df = 12$, $p = 0.0034$). The **Table V** shows the relationship between duration of AI use (independent variable) and its impact on creativity (dependent variable). This test has no association statistically ($\chi^2(12, N = 185) = 13.51$, $p = 0.333$).

Table I: Social and Demographic profile of Participants (n = 185)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (years)	Under 18	23	12.4%
	18–24	129	69.7%
	25–34	26	14.1%
	35–44	7	3.8%
Gender	Female	132	71.4%
	Male	53	28.6%
Education	Matric/O Level	14	7.6%
	Intermediate/A Level	28	15.1%
	Bachelor's Degree	101	54.6%
	Master's Degree	18	9.7%
	MPhil/PhD	5	2.7%
	Other	19	10.3%
Occupation	Student	145	78.4%
	Academic/ Researcher	14	7.6%
	IT/Tech Professional	5	2.7%
	Government Employee	8	4.3%
	Business/ Entrepreneur	2	1.1%
	Unemployed	3	1.6%
	Other	8	4.3%
Field of Study / Profession	Medicine/Health Sciences	118	63.8%
	Engineering/ Technology	37	20.0%
	Business/ Finance	11	5.9%
	Computer Sciences	4	2.2%
	BS Mathematics	3	1.6%
	Arts and Humanities	2	1.1%
	General Sciences	2	1.1%
	Premedical	2	1.1%
	Social Sciences	1	0.5%
	English	1	0.5%
	Textile Designing	1	0.5%
	Audit and Finance	1	0.5%
	Natural Sciences	1	0.5%
	Environmental Sustainability & Mgmt	1	0.5%
	Rural	80	43.2%
	Urban	105	56.8%

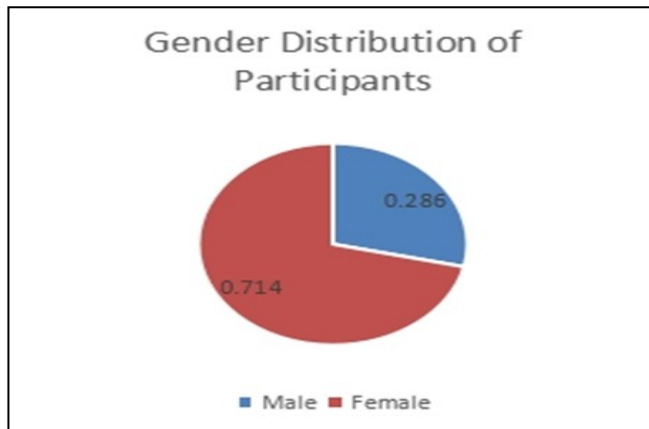


Figure 1: Gender Distribution

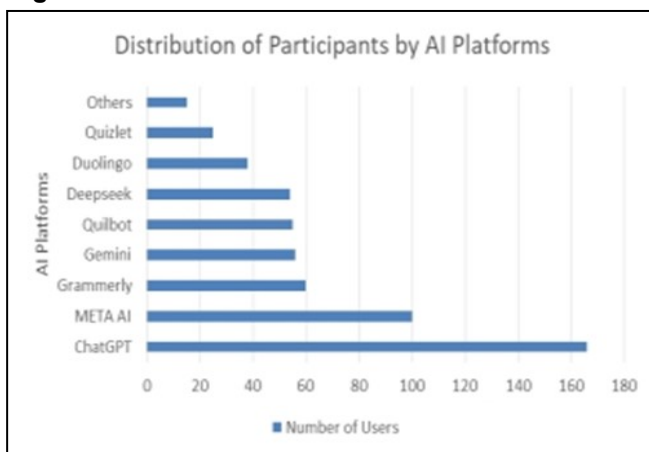


Figure 2: distribution of participants by AI platforms

Table II: Ways of AI Tool Usage among Participants (n = 185)

Category	Subcategory	Participants (n)
Frequency of AI Use	Never	3
	Rarely	12
	Occasionally	51
	Frequently	119
AI Tools Most Used	ChatGPT	166
	META AI	100
	Grammarly	60
	Duo lingo	38
	Quizlet	25
	Quillbot	55
	Gemini	56
	Deep seek	54
	Others like Copilot, Claude.ai, Perplexity AI.	15
Primary Purpose of AI Usage	General Knowledge	118
	Academic Work	160

	Professional Work	92
	Creative Writing/ Design	70
	Coding/Technical Tasks	43
	Entertainment	46
	General Inquiry	77
	Translation	101
	Others	88
Duration of AI Tool Usage	1–3 months	18
	3–6 months	20
	6 months to 1 year	43
	More than a year	104

Table III: Impact of AI on Creativity and Cognitive Abilities

Question	Response Category	Participants (n)
Do you use AI first or try to create your own ideas when faced with a creative challenge,?	Always Consult AI First	29
	Usually Consult AI	43
	Try on My Own First	97
	Rarely Use AI for Creativity	15
	Never Use AI for Creativity	1
Do you rely on AI content OR create ideas independently?	Never	17
	Rarely	39
	Sometimes	94
	Often	27
	Always	8
Would increased use of AI lead to convergence?	Yes	86
	No	26
	Maybe	67
	Not Sure	6
Do AI use has limited your originality?	Significantly Enhance Creativity	28
	Slightly Enhance Creativity	57
	No Impact	13
	Slightly Limit Creativity	63
	Significantly Limit Creativity	24
When an AI tool gives a response, do you:	Accept it and Move On	51
	Try to verify it with Other Sources	70

	Think Critically and Revise the Answer	62
	Ask Others to Help You Assess it	2
How confident are you in making decisions without AI assistance?	Very Confident	39
	Somewhat Confident	67
	Neutral	49
	Not Very Confident	20
	Not Confident at All	10
Has your ability to think critically and analyze information changed since using AI tools?	Improved	73
	No Change	69
	Declined	43
Do over use of AI have negative impact intelligence?	Yes	162
	No	23

Table IV: Chi-Square analysis between AI usage frequency (independent variable) and decision making without AI assistance (dependent variable)

AI Usage Frequency	Not confident at all	Not very confident	Neutral	Somewhat confident	Very confident
Never	1	1	0	1	1
Occasionally	0	1	15	17	18
Rarely	0	0	4	3	5
Frequently	9	19	30	46	15

Table V: Chi-Square analysis between duration of AI usage (independent variable) and its perceived impact on creativity (dependent variable)

Duration of AI Usage	No Impact	Significantly Enhance	Significantly Limit	Slightly Enhance	Slightly Limit
1 to 3 months	1	3	1	10	3
3 to 6 months	3	4	2	4	7
6 months to 1 year	3	3	4	15	18
More than a year	6	18	15	28	37

DISCUSSION

AI rapidly transforms cognitive landscapes, particularly among students, by reshaping how information is accessed, processed, and applied in academic settings. This cross-sectional study shows the perceived impact of AI users on cognitive and creative capacities among young academically active Pakistani population. The results suggest complex relationship between AI tools and their users with both benefits and drawbacks. Unlike previous studies which mainly focus on Western populations, this research underscores the viewpoint from the academic setting

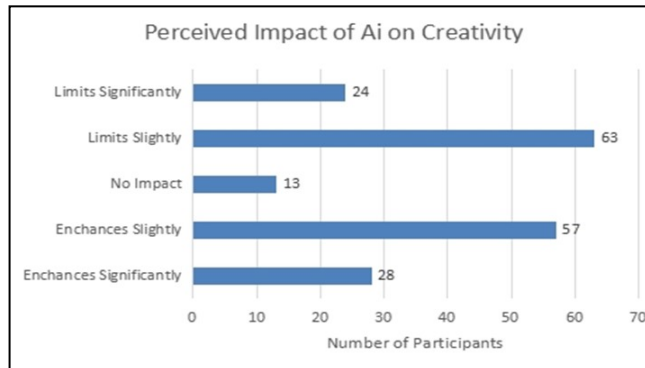


Figure 3: Perceived impact of AI on creativity

of low-resource and high-pressure educational environments. Many participants have reported frequent engagement with AI tools specifically for academic purposes. ChatGPT was reported as the most commonly used AI tool. This result corroborates the finding of previous research who also identified ChatGPT as the primary tool favored by students¹⁷.

The frequent use of AI mirrors the global trends in biomedical literature, where authors have long integrated common AI tools into their research workflows¹⁵. This high rate of AI tools use suggests that AI has become a part of students' education in Pakistan. Keeping in mind that over half of the participants had used AI for more than a year, this shows the habitual use.

Many participants reported that AI tools support idea formation. However, on the other side of the coin, maximum also believes that their originality and creativity have significantly reduced. These findings support results presented in the Pakistan-based study that overuse of AI could promote convergent thinking, instead of divergent thought processes⁶. This cognitive decline also supports evidence that while AI tools temporarily increase motivation but their use in complex academic tasks causes a negative impact on performance ultimately¹⁶. Nonetheless, the fact that over half of the respondents still preferred to develop ideas independently points the importance of balance AI use with independent cognition.

A major portion of our sample (50.8%, n = 94) acknowledged relying on AI rather than formulating ideas on their own. This empirical finding is highly consistent with previous literature demonstrating that heavy AI utilization is linked to lower levels of analytical thinking and can severely impede critical skill acquisition⁵. Previous literature highlights that generative AI can professionalize stories beyond what writers could accomplish alone, yielding more useful and well-written narratives¹⁸. However, our results show that over half of our sample (50.8%, n = 94) admitted relying on AI rather than developing their own ideas; it is likely that the 'gains' of AI usage are disproportionately favoring short-term output quality

over the long-term development of critical writing skills.

Our findings show a significant relationship between frequency of AI usage and participants' confidence in decision-making without AI ($\chi^2 = 29.4$, $df = 12$, $p = 0.0034$). This may reflect a shift in cognitive autonomy, where decision-making confidence becomes intertwined with external tools. This finding is consistent with recent MIT Media Lab findings, which showed that prolonged use of AI may diminish active learning and foster increased reliance on AI for surface-level tasks¹⁴. Furthermore, the study confirms that when students utilize generative AI for academic assignments like case study writing, the cognitive benefits have a direct negative overall effect on actual exam performance¹⁶.

Another chi-square test between duration of AI usage and its impact on creativity showed an insignificant relationship. The finding suggests that the impact of AI on creativity is not dependent on duration of usage, but it might be dependent on some of its qualitative aspects for instance, the type of tasks or nature of AI engagement.

In conclusion, our findings have a twofold impact on students' academic progress. On the one hand, it improves students' creativity and idea generation. On the other hand, its overreliance can weaken students' critical thinking skills by limiting opportunities for independent thinking. These results highlight the need for a balanced and guided use of AI in higher education, when it is used as a supporting tool rather than a replacement for core learning processes. Consequently, universities should establish clear policies and guidelines for the responsible and ethical use of AI. Students should be encouraged to use AI as a support tool rather than a replacement for independent thinking.

Limitations and Future Directions

The data mainly involves medical students which centers the findings from a certain group only. Moreover, all data was self-reported which can introduce potential bias in recall or perception. Future studies should involve various academic fields and to reduce potential bias, longitudinal or experimental designs to assess links between AI and its users. Moreover, the study lacks objective academic performance metrics, relying instead on subjective perceptions of cognitive impact.

Ethical Permission: Liaquat University of Medical & Health Sciences, Jamshoro, The study has been approved by ERC.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Unsa Saleem: Data collection

Muslim Ali Lakhia: Concept, Final approval

Misbah Memon: Data analysis

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