AI as a Mind Partner: Cognitive Impact in Pakistan's Educational Landscape

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Abstract

This study explores how high school and university students in Pakistan perceive and use generative AI as a cognitive extension. Drawing on the Extended Mind Theory, it examines impacts on critical thinking, motivation, and ethics. Findings reveal over-reliance, mixed emotional responses, and institutional uncertainty about AI's role in learning.

1 Background

The rapid adoption of generative artificial intelligence (AI) tools in education has sparked growing academic interest in how such technologies affect learning. AI-based tools now assist students with summarizing, content generation, and problem-solving. Current research largely focuses on university students in the Global North, with limited attention to high school learners in the Global South.

This study draws conceptually from the Extended Mind Theory, understanding how cognitive processes extend beyond the brain into external objects, tools, and technologies [8]. When adolescents use generative AI to offload or scaffold thinking, these tools act as external cognitive resources, per-ordering thinking or bypassing critical cognitive steps. Usage for lower-order cognitive tasks, such as information retrieval and summarization undermines original thinking and self-regulation in students [2,3]. This also has significant motivational and emotional effects on adolescents, both positive and negative [4].

In parallel, global research revealed contrasting perceptions: some students find AI empowering and helpful for independent learning, while others express concerns around ethical use, authenticity, and academic integrity [5]. Over-reliance on AI for quick solutions over conceptual understanding shows shallow cognitive engagement [6]. Work on aligning AI use with Bloom's Taxonomy, also highlights the tension between ease of use and the depth of cognitive effort [7].

Existing studies often focus on usage patterns, surface level attitudes, but lack cognitive integration in perception studies. This study addresses these gaps by centering adolescent perspectives across high school and university contexts, in the Pakistani context.

2 Aims

Using the Extended Mind theory we explore three axes of investigation:

2.1 To examine how students' perception of AI as an extension of their cognitive processes shape their attitudes, emotions, and ethical concerns in educational settings.

2.2 To explore the impact of AI reliance on students' critical thinking and sense of cognitive ownership.

2.3 To analyze how educational policies and institutional frameworks enable or restrict the recognition of AI as an extension of students' cognition.

3 Related Works

Research on generative AI (GenAI) in education consistently shows students framing tools like ChatGPT as pragmatic assistants for brainstorming, summarizing, and drafting while calibrating trust and preferring human input when stakes are high [8,9,10]. In South Asian contexts, surveys likewise report convenient, frequent use

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coupled with worries about originality and integrity [2,5,6]. Conceptually, this ambivalence aligns with the Extended Mind perspective, students oscillate between treating AI as a tool and as a cognitive partner embedded in their study routines [1].

Cognitively, outcomes hinge on how learners engage rather than mere access. Self-regulated learning accounts emphasize planning, monitoring, and reflection as determinants of benefit, with structured prompting and goal setting linked to better metacognition and reduced dependency [12]. Systematic reviews converge on a design-contingent pattern: perceived efficiency gains are common, but effects on higher-order thinking are variable without scaffolds that force critique and explanation[13,14]. Cognitive offloading research explains the mechanism: outsourcing memory or reasoning can save effort yet depress effort thresholds, weaken retention, and blur ownership of ideas if unregulated [15,16]. Students' reported mixtures of feeling simultaneously empowered and "less original" map onto this tension between support and erosion of cognitive ownership [12,13].

Relational and affective dynamics, especially among adolescents, further shape attitudes toward AI. Youth readily anthropomorphize conversational agents, forming companion-like ties that raise engagement but can induce over-trust without clear boundaries and provenance cues [17,18]. Recent evidence shows that perceived "mind" in chatbots modulates acceptance of support and can normalize reliance in everyday study decisions [19,20]. These dynamics help explain why some learners describe AI as a "friend" or neutral sounding board, blurring tool–partner distinctions within academic contexts.

Institutional policies and classroom norms strongly influence whether students conceptualize AI as part of their cognitive process or as a prohibited shortcut. Studies document uneven or ambiguous guidance that pushes usage underground and heightens anxiety about ethics [11,21,22]. Conversely, clearer acceptable-use matrices, disclosure/citation norms, and AI literacy interventions are associated with more reflective, bounded reliance and a healthier sense of authorship [23]. Instructors' modeling and feedback practices also matter: teacher-in-the-loop analytics and feedback pipelines can channel AI toward reflective uptake rather than answer-consumption [24,25,26].

4 Methods

The sample size for this study consisted of 137 high school and university students, aged 16-22 from Lahore, Pakistan. Students were from diverse academic backgrounds, with gender representation was ensured.

Surveys and semi-structured interviews were conducted. Senior management helped distribute surveys to students in grades 11–12 and first and second-year university students. Research protocols were shared to ensure parental consent, especially for minors. The survey examined students' AI perceptions and usage across three areas: (a) frequency and purpose, (b) self-perception, and (c) institutional perception. Students could volunteer for follow-up interviews by leaving contact details at the end of the survey. We conducted 19 interviews—10 with high school students (7 females, 3 males) and 9 with university students (4 females, 5 males)—across disciplines such as sciences, humanities, and social sciences. The interviews explored the same three themes as the survey, with a deeper focus on (a) contextualizing AI use, (b) comparing self- vs. peer-perceptions, (c) understanding regulation, and (d) analyzing AI's cognitive impact.

5 Findings and Discussion

Four key themes emerged from our study: (a) Perception of AI, (b) Usage Patterns, (c) Cognitive and Emotional Impact, and (d) Institutional Relationship with AI. These findings offer a foundation for understanding AI's role in Pakistan's private education sector.

5.1 Perception of AI

Across interviews, students widely acknowledged AI's utility and convenience, especially in academic contexts. Many likened ChatGPT to a *"replacement for Google"* and even a *"lifesaver"* when under time pressure. Several rated its helpfulness as high as 4 or 5, with one participant comparing the rise of AI to the industrial revolution, underscoring how momentous they believe its impact could be. This framing resonates with global research documenting students' pragmatic use of AI for brainstorming, summarizing, and drafting, while still calibrating trust when stakes are high [9,10].

Yet, a strong undercurrent of apprehension and caution ran through the responses. Students expressed concerns about growing dependency, using terms such as *"compromised self-ability," "loss of critical thinking,"* and *"hindering learning."* One student admitted: *"Sometimes I think I should use my own brain,"* highlighting internal conflict. Such ambivalence mirrors findings from systematic reviews showing that efficiency gains often come at the expense of originality and deep engagement [2]. Cognitive offloading theory helps explain this tension: reliance on external tools can reduce effort thresholds, blur authorship, and weaken retention if left unscaffolded [15].

A subset of students went further, describing AI as a "double-edged sword." They recognized productivity gains but worried it *"makes everyone the same,"* eliminating individuality and hindering innovation. This aligns with concerns raised by Gonsalves [3], who argues that overuse of generative AI risks flattening cognitive diversity and undermining Bloom's higher-order processes. Others emphasized that AI's usefulness was constrained by user skill, noting: *"I have to feed it the solution to get a good explanation."* This perspective reflects the growing recognition that prompting skill is itself a form of digital literacy shaping outcomes [8].

Despite varied views, a common sentiment was that AI is best seen as a supportive tool, not a replacement for thinking. As one participant phrased it: *"Only savour AI, grow your own legs to stand on."* Overall, students perceived AI as simultaneously empowering and risky, powerful for productivity but potentially detrimental to long-term cognitive development. This perception maps onto the broader literature that frames generative AI as both an extension of cognition and a possible inhibitor of originality depending on context, scaffolding, and regulation [1,2]. To further emphasize this "double-edged" narrative, critiques of digital native myths similarly caution that technological convenience does not guarantee deeper learning [27].

5.2 Usage Patterns

AI tools have become a regular part of students' academic workflows, ranging from highly structured routines to spontaneous, on-the-go help. ChatGPT, in particular, emerged as a go-to assistant for brainstorming, summarizing, translating, and even generating entire drafts. For instance, one student explained how they used it to structure a moot court proposal without prior experience, saying it *"was very helpful and the proposal got accepted."* Another highlighted its utility in theory-heavy subjects for *"creating structured approaches,"* while acknowledging its inaccuracy in math-based courses. Such pragmatic integration reflects broader findings that students adopt AI primarily for efficiency and scaffolding, while remaining cautious of its limits [9].

Students also reported interactive uses, routinely uploading images of class slides, book chapters, or questions and requesting explanations or practice questions. This echoes international studies showing adolescents view conversational AI as a responsive partner for inquiry and revision [8]. At the same time, several mentioned using auxiliary tools like Quillbot and Scribbr in tandem with GPT, Quillbot to "humanize" AI text, Scribbr to bypass AI detection. This mirrors concerns raised in higher education about AI misuse and plagiarism anxiety [11].

In terms of timing and workflow, many students noted they rely on AI during "peak study times" to convert informal ideas into formal emails, summarize readings, or draft LinkedIn posts. This aligns with research linking effective AI use to self-regulated learning (SRL) practices, where structured prompting and reflection support deeper engagement [12,13]. However, students also acknowledged frequent double-checking of outputs, suggesting a partial reliance balanced by personal judgment. This reflective verification resonates with findings that scaffolded use can enhance metacognition, while unscaffolded reliance may depress higher-order thinking [14].

Beyond academics, AI was also used for personal interests such as discovering restaurants, writing poems, or generating music chords. Here too, students demonstrated ambivalence, valuing convenience but simultaneously expressing uncertainty about accuracy. This pattern reinforces the notion that context matters: without guidance, convenience-driven use risks shallow engagement, but when embedded within SRL

frameworks, AI can enhance planning and reflection [12].

Overall, the usage patterns observed in this study capture a balance of creativity, pragmatism, and caution. Students see AI as a flexible companion integrated into daily study and leisure routines, but their reliance is mediated by perceived risks of misuse and by their own ability to evaluate outputs critically. This duality reflects global patterns of adoption [2,8,9] while adding a unique insight from Pakistan: the deliberate use of plagiarism-bypass tools points to gaps in institutional policy and highlights the need for clearer acceptable-use frameworks [11, 28,29].

5.3 Cognitive and Emotional Impact

Four key themes emerged related to the cognitive impacts of AI: over-reliance, retention, executive functioning, and emotion. About 65.7% of survey respondents felt they over-rely on AI, citing reduced creativity and critical thinking, while 37% of interviewees said it hinders learning and admitted they've become "lazier" with regular use. In contrast, 37% felt their retention and planning had improved, though only 26% believed their decision-making had benefited. Several participants formed subconscious emotional bonds with AI, describing it as a "very intelligent friend" they rely on to make decisions, yet denied any emotional connection when asked directly, highlighting a complex relationship. This mirrors the findings of Jose et al. who discuss how AI can be a cognitive amplifier as well as an inhibitor [30]. While incorporating AI into education can be beneficial, to maximize its positive impact, it should be used as an enabler, not a substitute.

5.4 Institutional Relationship with AI

When inquired about the student's perception of the Institutional Relationship with AI, 32.2% of survey respondents said their institutions discourage AI use, while only 27.7% reported encouragement for responsible use. Additionally, 68% of interviewees felt AI should be strictly regulated in academic settings to prevent it from hindering learning or giving certain students an unfair advantage. There was overall wide support for clear guidelines and moderation, especially to prevent over-reliance, cheating, and loss of critical thinking. Some students proposed time-based usage time limits or subject specific restrictions. There was a split between institutional vs. personal regulation: Many believed schools/universities should take the lead in drawing clear boundaries and enforcing academic integrity. Others emphasized the need for personal responsibility, warning that without internal limits, external rules would be ineffective as students will find a way to circumvent otherwise. This reiterates the findings from another study on the impact of AI on educational performance where the conclusion mentions how institutions need to be trained to thoroughly understand how AI should be used and enforce policies to protect student data [31].

6 Limitations and Future Work

Overall, this study provides foundational insights into AI in Pakistan's educational landscape but is limited by its focus on selective private schools in Lahore, a relatively developed city. This focus may skew results toward more privileged groups with greater AI access, reducing generalizability across other regions of Pakistan, including other provinces and rural areas. To address this, we aim to expand geographic coverage by conducting studies in additional provinces and rural contexts, as well as undertaking cross-country comparisons. We also plan to include public and low-income schools to increase institutional diversity. Furthermore, self-selection may have favored students already comfortable with AI, again limiting generalizability. Our reliance on self-reported data also introduces potential bias. Future research can build on this work by expanding the interview sample size to capture a wider range of student perceptions, and by incorporating a more ethnographic approach that includes observations alongside self-reported data. In addition, we hope to conduct longitudinal studies tracking the same students over time to observe how their AI usage and perceptions evolve with technological advancements. Finally, including teachers in the sample could add valuable external perspectives on the student-AI relationship. Despite these limitations, this study offers an important starting point for integrating AI into educational settings in Pakistan.

Ethics Statement

This study adheres to the ACL Ethics Policy and was conducted with full respect for ethical research practices. All participants were informed

about the purpose of the study, their participation was voluntary, and consent was obtained. The study design was reviewed to minimize potential psychological or academic risks to students, and anonymity and confidentiality were preserved throughout data collection, analysis, and reporting. The broader impact of this work lies in its potential to inform more inclusive and contextually grounded AI education policies in the Global South, particularly in under-researched contexts such as Pakistan. While this work advocates for thoughtful integration of generative AI tools into educational settings, it also recognizes concerns around over-reliance, cognitive offloading, and ethical use. We encourage institutions and developers to co-design AI systems with students' cognitive well-being in mind. No conflicts of interest are declared by the authors.

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