

Use of Artificial Intelligence in Education with its Impact on Critical Thinking among university students: A Qualitative Approach

Pooja Mehta¹, Ruttuja Karkhanis More², Rageshwari Munderia³

¹NMIMS Deemed To-Be University, pooja.mehta015@nmims.in

²NMIMS Deemed To-Be University, ruttuja.karkhanismore@nmims.edu

³NMIMS Deemed To-Be University, rageshwarimunderia21@gmail.com

Abstract

AI is being integrated into the educational system and is rapidly transforming it. While it claims to promote learning, its ease of use may also lead to cognitive offloading and reduced independent thought (Carr, 2011). Despite its rapid adoption, very little is known about how students are using AI for academic purposes and its influence on their critical thinking. This research aims to examine how university students use Artificial Intelligence (AI) tools in their academic work and to explore their perceptions of AI's influence on critical thinking skills. This research uses a qualitative design. Data was gathered using focus group discussions (FGDs) and semi-structured interviews with 10 undergraduate psychology students (n=10, age = 18 to 20) enrolled at private universities in the area of Vile Parla, Mumbai, India. Specifically, the students who used AI tools daily for academic purposes. Data was then analysed using thematic analysis. The findings reported that the students used and appreciated AI technology because of its speed and efficiency, but they were concerned about its reliability and trustworthiness as well as its potential impact on their own critical thinking. This study provides evidence on AI use and critical thinking from and under represented Indian population, addressing a gap in the literature dominated by Western-centred quantitative studies. Future research needs to acknowledge the longitudinal aspect of the findings presented here; specifically, to identify whether the cognitive and identity changes that students reported are lasting or transitory, and to include research on the same themes from different disciplinary, institutional, and national contexts. Research using mixed-methods designs that include qualitative accounts from students along with pre- and post-measurements of critical thinking performance would also be highly valuable for the education community.

Keywords: Artificial Intelligence (AI), Critical thinking, Collaborative learning

1. Introduction

The integration of artificial intelligence (AI) tools into higher education has accelerated much faster than institutions have been able to understand their optimum usage and the risks it poses. AI tools like ChatGPT, Perplexity, Grok, etc., are freely available, require no institutional subscription, respond within seconds, and represent it with authority to virtually any academic prompt. For students facing tight deadlines and demanding assessments, this convenience is extremely useful. It is also, this study argues, pedagogically consequential in ways that are not yet adequately understood.

Higher education institutions are embracing AI rapidly, and supporters claim it has the potential to enhance the results of particular populations (Bahroun et al., 2023). It was reported by UNESCO (2021) that 9% of respondents from the student population believed they experienced difficulties with learning autonomously once AI technology became a part of their learning environment. This indicates that applications designed to increase access to education may also lead to the deterioration of some cognitive abilities that education is aimed at developing.

The present study frames the idea that AI leads to a decline in critical thinking. Carr's (2011) cognitive offloading thesis holds that when AI tools routinely absorb the work of synthesis, evaluation and argumentation, the learner's capacity for those processes diminishes over time. Whether AI operates for interactive, conversational AI, which is qualitatively different from the passive retrieval tools Carr (2011) originally analysed, remains an empirical question and one that the existing literature, dominated by quantitative outcome studies (Wang et al., 2024a; Zawacki-Richter et al., 2019), has not yet answered through student-centred qualitative inquiry.

The focus of this study is to fill this research gap. Specifically, it examines whether undergraduate students enrolled at private universities located in Mumbai, India, use AI tools to help with their academic work, as well as how students believe those tools are impacting their critical thinking. The context for Indian students' interaction with AI is that there is no formal structure within their universities to guide their experience; no compulsory courses to provide digital literacy training; and assessments that value original argumentation as an indicator of superior performance, which makes cognitive offloading a possible and important outcome. Gaining an understanding of the context for students' interactions with AI requires first gathering evidence (i.e., student interviews) from which educators can develop appropriate pedagogical interventions.

Research Questions

- How do students in private universities utilize AI tools to support their academic work?
 - How do students in private universities perceive the influence of AI tools on their critical thinking skills?
- AI in Education

According to Zawacki-Richter et al. (2019), AI was operated invisibly until recently. A systematic review of over 2500 publications about AI in Education conducted by (Zawacki-Richter et al., 2019) found that the most common types of applications of AI during the last decade were adaptive learning platforms, intelligent tutoring systems and automated assessments. All three of these applications have modified content difficulty as well as flagged at-risk students, but did not provide opportunities for dialogue with the learners. There was a notable absence of educators from the research that evaluated the efficacy of these applications. Generative AI has fundamentally changed this reality, however. The introduction of generative AI tools like ChatGPT provides humans with a new ability to generate original text, maintain long-term scholarly discussions, and imitate the conventions of argumentation in ways that establish collaborative intelligence. As noted by Luckin et al. (2016), each of the new AI tools creates a co-participant relationship between the learner and the AI tool, rather than a user/tool relationship. Research supports this assertion; AI tools have been found to assist in the co-regulation of learning (Järvelä et al., 2023) and to provide feedback interactions that are approaching the quality of peer review.

Nonetheless, Holmes & Tuomi (2022) provide a critical caveat to this assertion that should not be overlooked. Because generative AI generates a response through matching patterns on probabilities rather than by introspective understanding, students who regard generative AI as an authoritative co-collaborator run the risk of outsourcing the evaluative judgments on which learning is predicated. The transition from an AI tool used in the background to an AI tool used conversationally represents the most significant benefit and risk associated with the development of generative AI.

AI and Critical Thinking

Critical thinking is defined as “the deliberate, controlled process of evaluating, interpreting and making sense of information” (Facione 1990). In addition, metacognitive self-regulation (Paul & Elder, 2006) has been included as significant to critical thinking. This means that critical thinking differs from simply “processing information” because it involves continually monitoring, evaluating, and revising one’s own reasoning to ensure the quality of the resulting product. Ultimately, both definitions of critical thinking, based on cognitive effort and reflection, demonstrate that cognitive offloading theory describes how valuable critical thinking can become during the use of external systems that employ generative activities.

The relationship between AI and critical thinking is an area of study that has resulted in conflicting findings. On the more positive side, Li et al. (2024) found that students enrolled in integrated STEM courses exhibited improvements in the quality of their argumentative writing when working collaboratively with AI. The improvement in argumentative writing quality was especially pronounced when AI was used as a partner in a debate rather than solely as an answer provider. In medical education, Antoniou et al. (2024) reported similar case-study findings, noting that students had greater engagement with cases when participating in AI-mediated discussions than when using traditional discussion formats. Walter (2024) asserted that the construction of high-quality prompts to be used when engaging with AI (prompt literacy) requires metacognitive awareness to be developed because students must define for themselves the information they need from AI, as well as the reasons for requiring that information.

Díaz and Nussbaum (2024) provide a very detailed synthesis: The way in which AI affects education is not intrinsic to the technology itself but rather based on the context (pedagogy) in which it is used. The impact of a specific tool may result in either a more in-depth development of thinking or a more trivial development of thinking based on how it is introduced, designed, and evaluated. Conversely, Essien et al. (2024) found that among students at a business school, habitual use of AI text generators resulted in a decrease in their ability to create independent arguments on assignments when AI is not present, with many students stating that they had lost the ability to initiate writing assignments without an AI assistant.

Student AI Use:

Despite the academic debate regarding AI and critical thinking being very fruitful, the more fundamental inquiry of how students actually interact with AI, in terms of intent, knowledge and perceived impact on their own thought processes, has received relatively little rigorous research. Evidence is starting to show that students' use of AI is widespread and diverse (e.g., creating drafts of assignments, summarising reading materials, creating outlines, checking grammar, and managing their calendars/appointments; Johnson et al., 2024; Yamamoto et al., 2025). In many instances, students view AI as a general-purpose cognitive assistant as opposed to a restricted academic tool, a change with ramifications regarding reliance or dependence across many different academic tasks. Chiu & Li (2023) suggest that accessibility to AI is a key factor in driving its adoption; however, Johnson et al (2024) point out that accessibility to AI without the instructor implementing a pedagogically driven structure around the use of AI leads to the development of non-critical users of AI.

The use of AI in institutes has gained traction, with those in support of this method claiming that AI can improve learning experiences for some groups (Bahroun et al., 2023). But a report by UNESCO (2021) found that 9% of students surveyed say that they have trouble studying by themselves after AI was introduced.

Research Gap

The notable absence of academic literature deals specifically with non-Western settings that are poorly governed and low in resources. Students at private colleges in Mumbai are often English-speaking, skilled at using computers and create assessments that demonstrate their ability to engage in independent reasoning. As this group is particularly vulnerable to cognitive offloading caused by the use of AI, they lack the governance, digital literacy, and pedagogical policies that are being formed to support students' use of AI in more affluent countries. Therefore, expanding students' access to AI, without simultaneous investment in high-quality pedagogy and educational policy related to its use, may create new avenues for accessing information, while at the same time impeding students' ability to think independently. Despite previous research analysing and measuring cognitive offloading, little is known about how the experience of cognitive offloading by students can create a change in cognitive functioning. This research will investigate what students in this understudied education sector think about their use of AI and the impact on their critical thinking.

Methodology

This study has adopted an exploratory qualitative design. Qualitative methodology was chosen because the central research questions concern students' subjective experiences of how they perceive, narrate and make sense of their use of AI tools. The study is theoretically anchored by Carr's (2011) cognitive offloading framework. The present study was based on primary data collection, for which the data were collected through focus group discussions and interviews.

Participants

10 undergraduate students were recruited from private universities in Mumbai using a purposive sampling method. Purposive criteria required that participants be enrolled in a social science program, be between 18 and 20 years of age, and have used at least one easily available and accessible AI tool, such as ChatGPT or Grok, for academic purposes. Students from the social science program, particularly psychology, were recruited. Two FGDs were conducted, each lasting 50 to 60 minutes. The first group included 2 males and 3 females, and the second group included 5 females. Subsequently, individual interviews took place, each lasting thirty to forty minutes. The same 10 participants who took part in the FGDs were subsequently asked to participate in individual interviews.

The choice of social science students, especially psychology students, was deemed appropriate in this research as the course emphasis of students of these disciplines entails considerable focus on the processes of reflection as well as

critical and metacognitive thinking, which may better prepare this group of people to notice the smallest alterations in their reasoning brought on by a utilitarian application of AI. Participants were recruited by referrals and emails, and participation was entirely voluntary, and no financial or academic incentives were offered.

Data Collection

This study used both focus group discussions (FGDs) and individual interviews to comprehensively explore students' perspectives on AI tools as collaborators in their academic usage. The FGDs facilitated the investigation of peer dynamics, shared norms and the participants' collective attitudes, whilst individual interviews allowed for deeper exploration of personal experiences that may not surface in group contexts due to social desirability. The FGDs followed a semi-structured guide covering (a) patterns of AI use, including frequency, purpose and tool preference; (b) perceptions of AI's influence on academic work quality; (c) experiences of trust, verification and doubt in relation to the content generated by AI; and (d) its perceived effects on independent thinking and critical thinking skills. A similar guide was followed for individual interviews, as well as a deeper exploration of the themes that emerged from the FGDs. This allowed for direct comparison of the themes across both methods and for participants to deepen accounts they had offered in the FGDs.

The interview guide was validated by an expert in the field, and the interviews were conducted face-to-face in a classroom setting with the researcher facilitating the FGDs and then the interviews. Both of these methods were conducted in a mixture of English and Hindi as per the participants' comfort. The researcher was trained in both languages. Examples of inquiries asked included: 'Can you remember a recent assignment you completed which made use of an AI?'; 'On what basis would you assess what information is provided by an AI?'; and 'Has your thinking pattern changed since you started using AI regularly?'.

Data Analysis

The data were examined using Reflexive Thematic Analysis (Braun and Clarke, 2006) within a framework of six successive steps: becoming familiar with the data, conducting primary coding, generating themes, reviewing the themes, defining the themes, and writing the paper.

The analysis was done inductively, which helped obtain meaning patterns in the research rather than using theoretical categories before beginning the analysis. Once the themes emerged, the cognitive offloading framework by Carr (2011) was used as a way to interpret participants' understanding of cognitive transformation caused by generative artificial intelligence. Analytic quality was ensured by means of an iterative and reflexive analysis. We discussed coding choices, themes, and interpretations in the course of the meetings with the second and third authors.

Ethical Considerations

The study adhered to the ethical principles set forth by the American Psychological Association (APA) Ethical Principles of Psychologists and Code of Conduct. Ethical guidelines were strictly followed in the process of conducting the research involving human subjects.

The participation in the study was voluntary, and the participants were provided with the purpose of the study, research procedures, duration, and applications of the data before its gathering through the issuance of a Participant Information Sheet. The participants were informed of their rights to participate voluntarily and to refuse to answer certain questions if they want to. The anonymity and confidentiality of the subjects were ensured by giving them identification numbers and removing all personal identification data from interviews and reports. Audio-recording was conducted after the informed consent of the participants was received, and it was used to ensure the accuracy of transcription and analysis.

Due to the presence of several participants in the focus group, complete confidentiality of the group could not be assured. Thus, respondents were made aware of the limitation and were asked not to disclose the contents of the discussion. Ground rules aimed at ensuring respectful and non-judgmental interaction as well as privacy were agreed upon before each of the group sessions took place.

Although the study presented minimal risks, participants were told they could take a break, skip questions, or stop participating if they experienced any discomfort. Finally, debriefing was conducted after each interview and focus group discussion in which participants were given the opportunity to ask questions related to the research. It is worth noting

that during the whole research process, the researcher kept professional boundaries and demonstrated a respectful and empathetic attitude towards the participants.

Results

The thorough examination of the discussions of the focus group and the semi-structured interview has yielded six major themes concerning participants' understanding of generational AI in academic settings. They are: (1) Credibility issues in AI results; (2) Involvement in AI; (3) Cognitive offloading and the perception of thinking processes; (4) Deepening dependence on AI; (5) AI vs. teacher; and (6) Factors influencing dependence on AI. Table 1 below contains the themes and subthemes as well as quotations from participants. The numbers of participants also include the form of interaction with the participants during data collection (FGD = Focus Group Discussion; INT = Individual Interview).

Participants said that they were cautious in regard to AI rather than fully trusting it. Even though AI is generally recognized as a positive source for academic purposes, many of the participants admitted that they assessed the information provided by AI carefully, especially when factual accuracy was of key importance. This is in line with the theme Credibility issues in AI results which included elements of conditional trust, verification, and skepticism.

The theme AI involvement shows what kinds of activities participants have accomplished with AI during their academic practices. Participants explained how AI could help them to structure their assignments, find ideas, clarify some concepts, or do the work that they needed to accomplish. Several participants also spoke about learning how to ask questions correctly, meaning that they became aware of the influence of their questions on the quality of information provided by AI.

Another aspect of the study is that the participants indicated that, after using AI regularly, they started to perceive changes in their cognitive processes. In the size of the Cognitive offloading and perceived changes in the process of thinking, it turned out that the participants viewed reliance on AI as something that has helped them perform the activities that they cognitive tasks on their own. While several participants saw that they engaged less in critical process while coping with academic tasks, they noted that they had greater clarity of thoughts as they used AI to explain complicated issues.

In the theme of Participants' growing reliance on AI, it is captured more about subjective experiences of academic users of AI than about the impact of AI on their learning processes. The participants used AI as a starting point when dealing with academic tasks and had the feeling that it changes their ideas about learning, efforts, and intellectual ownership. The experience of the participants was shared not from the perspective of circumstances that caused it but the formations of the dependence.

The participants said that AI had some advantages over the human tutors. AI was appreciated for its speed, availability, and absence of judgments. In contrast, the respondents noted that human educators were incomparable in their ability to question views and facilitate the development of critical thinking.

Table 1: Themes, subthemes and quotes

Theme	Subtheme	Quote	Participant / Method
Negotiating credibility in AI outputs	Conditional trust	"I trust it, but not with everything, especially factual claims — I always need to verify."	P2, FGD1
	Active verification	"I always end up checking what AI tells me."	P5, INT
	Constant skepticism	"I use it, but there's always a doubt at the back of my mind."	P7, FGD2
AI Engagement	Academic support	"I use it to structure assignments."	P1, INT

	Idea generation and brainstorming	"I use it for brainstorming."	P3, FGD1
		"I use it for planning and scheduling."	P6, INT
		"At midnight before a deadline, there is no one else to ask, and AI genuinely helps."	P8, FGD2
Cognitive offloading and change in thinking patterns	Perceived decrease in critical thinking	"I don't honestly analyse the way I used to; I skip steps now because AI fills them in."	P4, INT
	Increased academic clarity	"When I am stuck, AI explains things more clearly than my books."	P9, FGD2
Growing reliance on AI	Influence on identity	"It is very easy to let it do everything. I catch myself doing it and feel guilty."	P2, INT
	Perceived increased dependence	"I feel my thinking is not fully mine anymore. Like I am outsourcing parts of my thinking."	P5, FGD1
		"I genuinely cannot imagine starting an essay without opening and asking AI first. That worries me."	P10, INT
		"I am not working as hard as I used to."	P3, FGD2
AI versus Human Educators	Influence of human educators	"My teacher pushes me if I say something vague, but AI will just accept and validate."	P6, FGD1
	Emotional support	"AI helps me when I feel stuck, but the ideas then feel less mine when I rely too much on it."	P8, INT
Drivers of AI reliance	Easy access	"It is very freely available and always there, that's why everyone uses it, and so do I."	P1, FGD2
	Constant availability	"Every prompt gives you something useful; we don't need any training."	P7, INT

Themes	Subthemes	Quotes
Negotiating credibility in AI outputs	Conditional trust Active verification Constant skepticism	"I trust it, but not with everything, especially factual claims I always need to verify" "I always end up checking what AI tells me" "I use it, but there's always a doubt at the back of my mind"

AI Engagement	Academic support Idea generation and brainstorming	"I use it to structure assignments" "I use it for brainstorming" "I use it for planning and scheduling" "At midnight before a deadline, there is no one else to ask, and AI genuinely helps."
Cognitive offloading and change in thinking patterns	Decrease in critical thinking Increased academic clarity	"I don't honestly analyse the way I used to; I skip steps now because AI fills them in." "When I am stuck, AI explains things more clearly than my books."
Growing reliance on AI	Influence on Identity Increase dependence	"It is very easy to let it do everything. I catch myself doing it and feel guilty" "I feel my thinking is not fully mine anymore. Like I am outsourcing parts of my thinking." "I genuinely cannot imagine starting an essay without opening and asking AI first. That worries me." "I am not working as hard as I used to."
AI versus Human educators	Influence of human educators Emotional support	"My teacher pushes me if I say something vague, but AI will just accept and validate." "AI helps me when I feel stuck, but the ideas then feel less mine when I rely too much on it."
Drivers of AI reliance	Easy access Constant availability	"It is very freely available and always there, that's why everyone uses it, and so do I." "Every prompt gives you something useful, we don't need and training."

Discussion

The thematic analysis generated six themes exploring the participants engagement with AI tools as collaborators in academic work and how it impacts their critical thinking skills. The two research questions will be considered in the course of this discussion. Themes 1 (negotiating credibility), 2 (AI engagement), and 6 (drivers of dependence on AI) directly connect to RQ1 (students' use of AI tools); on the other hand, Themes 3 (ideas about cognitive offloading and changing ways of thinking), 4 (increasing dependence on AI), and 5 (AI versus human teachers) directly correspond to RQ2 (students' views on AI's effect on their ability to think critically). Each of these themes is discussed further with reference to the relevant literature.

- Negotiating credibility in AI outputs:

Across both the individual interviews and the FGDs, participants have illustrated their relationship with AI output as conditional. That is, they have negotiated whether they can trust AI or not. During FGDs, participants reported several incidents in which AI provided confident, well-formatted responses that were factually incorrect. These experiences made them question the output produced by AI, prompting them to cross-verify their outputs; however, they did not always do so systematically. The participants described that the process of cross-checking and verifying was extremely tedious and somewhat paradoxical. During their interviews, the participants noted that the process of checking the output sometimes took longer than finding the information independently would have. This aligns with Yamamoto et al.'s (2025) findings that the factor of trust in AI is experience-dependent and dynamic rather than fixed. Similarly, Smit-Mutegi et al. (2025) have observed that skepticism does not reliably translate into protective verification behavior. This present study adds to these quantitative accounts a layer of contradiction that students were not only aware of AI being unreliable, but also caught between the convenience of using AI as a reliable source and the discomfort of knowing that it was not.

- AI Engagement

It has been observed that students AI use has extended beyond their academic tasks. While academic tasks dominated, such as structuring essays, summarizing readings, generating or brainstorming ideas and discussion points, grammar correction, etc., a substantial number of participants also described using AI for personal uses. Personal uses included scheduling, meal planning and making any important decisions. This suggests that AI has become something closer to a general cognitive extension, acting like a prosthetic, than to a specific academic aid. This finding suggests that students gradually begin to rely on AI, creating a dependence not just on academic support but also on emotional support.

Moreover, the participants instantly reflected on the metacognition demand involved in formulating effective prompts. They described learning through trial and error, that vague prompts produced unsatisfactory outputs and clear, sharp prompts required them to clarify their own thinking first. This aligns with Walter's (2024) argument that prompt literacy constitutes a form of critical engagement with AI, a skill that requires explicit articulation of what one wants to know.

- Cognitive offloading and change in thinking patterns

This theme generated the most direct and consequential accounts of the influence of AI on how students think. The analysis revealed a consistent duality where students described AI as useful for simplifying complex material, but also noticed that something had changed. They observed that their own ability to engage with the material and think critically diminished. Critical thinking skills were described in varied but convergent ways, like skipping reasoning steps, deferring synthesis to AI and noticing in hindsight that unassisted critical thinking now felt harder than it once had. This experiential account maps closely onto Carr's (2011) cognitive offloading thesis. The contrasting subtheme that talks about increased academic clarity examined that students valued AI's ability to explain certain difficult concepts in an easier language when lectures and textbooks had left them confused. Here, AI appeared to function as a scaffolding resource in the Vygotskian sense, supporting understanding without substituting for it. However, the question remains if this scaffolding relationship remains productive over time or gradually declines the overall thinking capacity of an individual.

Moreover, AI was also credited with enhancing creativity within the students, but at the same time, the students also felt stuck, suggesting connections that they could not consider independently. This resulted in concerns among the students that the ideas they produced with AI assistance felt less original and described noticing a reduced intellectual effort in their academic work. This duality is consistent with Luckin et al.'s (2016) work, which describes the distinction between AI as augmentation and AI as a replacement.

- Growing Reliance on AI

This is one of the significant findings of the study. The students described a pattern they were aware of, but found it difficult to change. They recognized that they were relying on AI instead of engaging with tasks independently, and many of them saw this as a concerning issue. However, despite this awareness, they continued to feel a strong sense of using AI, making it hard to shift or resist their approach. Even more astonishing was how AI influenced their intellectual identity. Several participants discussed in the sense that their thinking was no longer fully their own, that their ideas were produced with the assistance of AI and could not be attributed to them in the same way as ideas they could once work out by themselves. This dimension of AI does not seem to appear in existing quantitative research on AI and education, and it makes a point to an area where psychological inquiry may have a distinctive contribution to make. This increasing reliance is described and suggested more as a habit formation, in ways that opening AI before even attempting any task, being unable to imagine writing or finishing an assignment with the assistance of AI. This was one of the closely related and widely shared concerns.

- AI versus Human Educators

The participants consistently described the value of human educators and teachers and the qualities they identified as AI cannot provide. Several participants spoke about human educators being irreplaceable, particularly because they aid students to push to their limits, they dispute the student's opinion to enhance their thinking skills, resulting in increased intellectual capacity and critical thinking, which AI cannot do, as AI tends to affirm and elaborate on the content presented only. The study by Holmes and Tuomi (2022) inquiries about the direct implications for AI's use in formative educational contexts, which is consistent with this study's findings that the recognition of AI's tendency towards agreement and elaboration rather than challenging the individual. Simultaneously, participants acknowledged AI's practical availability at moments when human support would not be available, such as late-night deadline anxiety, answering certain questions that are very basic or if students might feel embarrassed to ask during classes, or simply a

lack of access to a human educator. What we also see upcoming is not a binary preference for human over AI but a more nuanced allocation of dependency in areas of AI for immediate use, solitary and logistical concerns, whereas human educators are preferred for relational, challenging, and to enhance the intellectual capacity of the students.

- Drivers of AI Reliance

Multiple AI tools are free, always available and require absolutely no prior training to use them in order to produce any kind of output. This accessibility was described dually, that is, appreciatively and with a great sense of risk. This is because the very ease with which AI can be used to produce any output and to finish any academic task without attempting to do so any task independently. Johnson et al. (2024) describe that AI should be used with caution to decrease the risk of critical dependency. Similarly, the participants in this study have also appeared to have arrived at a version of this conclusion.

The findings of this present study describe that the student population is neither enthusiastic about using AI nor are they straightforwardly resistant to it. What has emerged is more complex, where students are caught between the genuine functional value of AI tools and are practically acknowledging that their engagement with these tools is affecting something about how they think and how their thoughts start feeling less original, leading to a decrease in their critical thinking skills. This difficulty students experience in acting on their own concerns is one of the central findings of the study.

Carr's (2011) cognitive offloading research provides a productive lens for these findings. Students who mentioned that they skipped reasoning steps, students who delegate their thinking to AI and finding ways to work independently are difficult processes. Carr described corresponding to the gradual externalization of cognitive work. This study describes that these students were not aware of the risks AI poses and continued using it anyway. This motivation is a more complex and structural issue, and it has direct implications for how digital literary education is designed.

This study's findings, specifically theme 1, align with and contribute to those of Yamamoto et al. (2025) and Smit-Mutegi et al. (2025). These students have found an identical gap between expressed skepticism and actual verification behavior, whilst this current study suggests that this gap is not only a matter of inconsistency but also reflects a genuine cognitive-affective conflict. The participants described that students constantly have the need to verify the AI outputs, and that is a time-consuming, effortful process. The students knew that AI might produce errors in its outputs, but it coexisted uncomfortably with the convenience of acting as though it were reliable. Digital literacy interventions are significant in the context of teaching students to verify, but also address the motivational and structural conditions that make them use it. Theme 2 elaborates on the emergence of prompt construction as a skill that aligns with Walter's (2024) study about prompt literacy. The kind of literacy that would require a certain amount of critical engagement from these students. Another theme about psychological outcomes, like dependency and identity concerns, represents the most significant contributions of this study. Several participants who described feeling that their language was no longer their own, suggested that AI tools use is being incorporated into students' cognition and identity in ways that extend well beyond just using AI for academic tasks.

The contrast between AI and human educators carries a significant implication. The participants have identified that students feel AI does not challenge them, makes them take accountability and does not help push them to excel beyond their capacities. The present findings specify one key dimension of that context that the presence or absence of human intellectual challenge. Moreover, in order to enhance critical thinking, AI should be used as a resource rather than an authority and maintaining human feedback should be mandatory.

While expanding access to AI tools is feasible, ensuring that such access leads to deep learning rather than just outputs that appear efficient but lack critical thinking or cognitive engagement requires deliberate, context-specific pedagogical strategies.

Limitations

There are four limitations when interpreting the findings of this study. The first is the sample size; the study draws on a small sample (n=10) of students from private universities in Mumbai. The patterns that have been observed are reflective of the students' experiences within this specific context and cannot be generalized to STEM students, public

universities, or any different geographical locations without significant caution.

Secondly, the study was conducted using a cross-sectional design and, therefore, is based on retrospective accounts generated by the study participants. While participants did report changes in their thought processes and how they used AI, it is difficult to definitively establish when these changes occurred or how they developed over time, which would require the use of a longitudinal design that measured baseline and follow-up outcomes.

Thirdly, since it's a qualitative study, the degree to which students openly disclosed their use of AI may have been influenced by this shared context. Although this influence was attempted to be mitigated through various means, it is not possible to eliminate it.

Finally, all of the participants were utilizing freely-accessible AI tools and not any tools that would have been provided through institutional support. Therefore, it is likely that the study findings are different from what would be obtained in those institutions where AI is formally supported within the organization or incorporated into teaching and learning, as previous research has shown that the types of outcomes experienced from informally using AI.

Conclusion

The research that has been carried out examined the use of AI tools by undergraduate students at private universities in Mumbai, as well as their views on how the tools help develop critical thinking abilities. In total, six themes emerged from the respondents' contributions regarding the manner of AI usage. All participants expressed conditional trust in the output of AI tools. Furthermore, they actively and continuously use AI for various academic and personal purposes. Alongside AI usage, there appears to be a risk of impairing independent reasoning skills. Nevertheless, AI has been able to provide clarity of concepts for the students, which has led them to rely on AI despite discomfort regarding this reliance. The students continue to appreciate the contribution of their human teachers and the results reveal that various factors, especially accessibility, have influenced their current pattern of reliance on AI tools.

In short, the study finds that students almost did not resist using AI, but rather made an effort to adapt to its use in the academic sphere. Overall, this little study can be seen as an exploratory one in terms of the applicability of Carr's cognitive offloading concept to the study of AI in private Indian universities.

Suggestions

Future research needs to acknowledge the longitudinal aspect of the findings presented here; specifically, to identify whether the cognitive and identity changes that students reported are lasting or transitory, and to include research on the same themes from different disciplinary, institutional, and national contexts. Research using mixed methods designs that include qualitative accounts from students along with pre- and post-measurements of critical thinking performance would also be highly valuable for the education community. Additionally, we need pedagogical frameworks that reflect the lived experiences of students as opposed to what educators or educational platform designers believe to be the students' experiences, and these frameworks should be designed with equity as the primary design objective.

References

1. Antoniou, C., Pavlou, A. and Ikossi, D.G. (2024), "Let's chat! Integrating ChatGPT in medical student assignments to enhance critical analysis", *Medical Teacher*, pp. 1-3, doi: 10.1080/0142159x.2024.2421997
2. Bahroun, Z., Anane, C., Ahmed, V. and Zacca, A. (2023), "Transforming education: a comprehensive review of generative artificial intelligence in educational settings through bibliometric and content analysis", *Sustainability*, Vol. 15 No. 17, p. 12983, doi: 10.3390/su151712983
3. Braun, V. and Clarke, V. (2006), "Using thematic analysis in psychology", *Qualitative Research in Psychology*, Vol. 3 No. 2, pp. 77-101, doi: 10.1191/1478088706qp0630a
4. Carr, N. (2011), *The Shallows: What the Internet Is Doing to Our Brains*, W.W. Norton and Company, New York, NY
5. Díaz, B. and Nussbaum, M. (2024), "Artificial intelligence for teaching and learning in schools: the need for pedagogical intelligence", *Computers and Education*, Vol. 217, p. 105071, doi: 10.1016/j.compedu.2024.105071
6. Essien, A., Bukoye, O.T., O'Dea, X. and Kremantzis, M. (2024), "The influence of AI text generators on critical thinking skills in UK business schools", *Studies in Higher Education*, Vol. 49 No. 5, pp. 865-882, doi: 10.1080/03075079.2024.2316881
7. Facione, P.A. (1990), *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and*

- Instruction, *American Philosophical Association*, Newark, DE, available at: <https://eric.ed.gov/?id=ED315423>
8. Grand View Research (n.d.), AI in Education Market Size and Share: Industry Report 2030, available at: <https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-education-market-report>
 9. Holmes, W. and Tuomi, I. (2022), "State of the art and practice in AI in education", *European Journal of Education*, Vol. 57 No. 4, pp. 542-570, doi: 10.1111/ejed.12533
 10. Järvelä, S., Nguyen, A. and Hadwin, A. (2023), "Human and artificial intelligence collaboration for socially shared regulation in learning", *British Journal of Educational Technology*, Vol. 54 No. 5, pp. 1057-1076, doi: 10.1111/bjet.13325
 11. Johnson, N., Seaman, J. and Seaman, J. (2024), "The anticipated impact of artificial intelligence on higher education", *Online Learning*, Vol. 28 No. 3, doi: 10.24059/olj.v28i3.4646
 12. Li, T., Ji, Y. and Zhan, Z. (2024), "Expert or machine? Comparing the effect of pairing student teacher with in-service teacher and ChatGPT on their critical thinking, learning performance, and cognitive load in an integrated-STEM course", *Asia Pacific Journal of Education*, Vol. 44 No. 1, pp. 45-60, doi: 10.1080/02188791.2024.2305163
 13. Luckin, R., Holmes, W., Griffiths, M. and Forcier, L.B. (2016), *Intelligence Unleashed: An Argument for AI in Education*, Pearson, London, available at: <https://www.pearson.com/content/dam/corporate/global/pearson-com->
 14. Paul, R. and Elder, L. (2006), *Critical Thinking: Tools for Taking Charge of Your Learning and Your Life*, 2nd ed., Pearson Prentice Hall, Upper Saddle River, NJ
 15. Smith-Mutegi, D., Mamo, Y., Kim, J., Crompton, H. and McConnell, M. (2025), "Perceptions of STEM education and artificial intelligence: a Twitter (X) sentiment analysis", *International Journal of STEM Education*, Vol. 12 No. 1, doi: 10.1186/s40594-025-00527-5
 16. UNESCO (2021), *AI and Education: Guidance for Policy-Makers*, UNESCO, Paris, available at: <https://unesdoc.unesco.org/ark:/48223/pf0000376709>
 17. Walter, Y. (2024), "Embracing the future of artificial intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education", *International Journal of Educational Technology in Higher Education*, Vol. 21 No. 1, doi: 10.1186/s41239-024-00448-3
 18. Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T. and Du, Z. (2024), "Artificial intelligence in education: a systematic literature review", *Expert Systems with Applications*, Vol. 252, p. 124167, doi: 10.1016/j.eswa.2024.124167
 19. Yamamoto, M., Xu, S., Kee, K.F. and Li, W. (2025), "Testing a dynamic model of trust in AI: how trust develops and affects critical thinking in the American workforce", *Journal of Trust Research*, pp. 1-20, doi: 10.1080/21515581.2024.2445505
 20. Zawacki-Richter, O., Marín, V.I., Bond, M. and Gouverneur, F. (2019), "Systematic review of research on artificial intelligence applications in higher education: where are the educators?", *International Journal of Educational Technology in Higher Education*, Vol. 16 No. 1, Article 39, doi: 10.1186/s41239-019-0171-0