The Role of Generative AI (e.g., ChatGPT/Microsoft Copilot) in Enhancing Critical Thinking Skills: Opportunities, Risks, and a Pedagogical Framework

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Abstract

Tools for Generative Artificial Intelligence (GenAI), such as Microsoft Copilot and ChatGPT, are becoming more and more ingrained in educational workflows, bringing both hope and concern regarding the growth of students' critical thinking skills. Recent policy and empirical findings are compiled in this paper. literature to examine how GenAI can either scaffold higher-order thinking (analysis, evaluation,

reflection) or substitute excessive reliance for cognitive effort. relying on well-established Taking into account current research and theory, the paper proposes a framework called Prompt-Probe-Verify-Reflect (PPVR) to organize the use of GenAI as a partner in reasoning rather than a quick fix for obtaining answers. The review reveals the circumstances in which GenAI supports contexts and critical thinking through guided dialogue, verification tasks, and reflective prompts. where it might harm it (low metacognitive oversight, uncritical trust). In conclusion, the paper outlines the implications for curriculum design, evaluation, and ethical policy that is in line with emerging global direction

Keywords: AI literacy, generative AI, critical thinking, cognitive offloading, pedagogy, Microsoft Copilot, higher education

Introduction

Generative AI systems can produce fluent explanations, arguments, summaries, and code, which makes them attractive as educational assistants. At the same time, educators and policymakers are concerned that students may view GenAI as a "solution engine," which could weaken critical thinking skills. thinking through a lack of engagement, a lack of effort, and a misplaced trust in the outputs of machines. Recent

work indicates that GenAI can shift users' thinking toward verification, integration, and oversight, but it can also reduce the need to think when the tool is trusted. A common definition of critical thinking is self-directed, self-regulated judgment using skills like as self-regulation, interpretation, analysis, evaluation, inference, and explanation. In education, systems, and as automation alters what, developing these skills becomes increasingly important. humans must uniquely contribute—especially evaluative judgment, creativity, and reasoning in uncertain contexts.

1. **Purpose of this paper:**

a. To review how GenAI affects the mechanisms of critical thinking,

b. To find educational conditions that encourage critical thinking (as opposed to cognitive transferring).

c. to suggest a real-world model (PPVR) for structured GenAI integration in schools.

2. **Theoretical Background**

a. How Critical Thinking Is Defined?

i. Critical thinking is defined by the Delphi consensus report as a collection of cognitive abilities. (evaluation, inference, etc.) and dispositions (openness to new ideas, seeking the truth, systematicity), placing an emphasis on both mindset and performance. This definition is helpful for GenAI contexts due to the technology's ability to influence both: it can help skills (such as producing counterarguments), while reducing dispositions (such as truth-seeking) if students accept outputs uncritically.

b. Why the debate over generative AI in education is getting more heated

i. GenAI deployment is outpacing institutional and regulatory readiness, according to UNESCO. raising concerns about privacy, safety, equity, and the need for human-centered pedagogical design. In the meantime, stakeholders in higher education have expressed significant concern that If not implemented, generative tools may reduce student critical thinking and increase dependency. careful framing of instruction.

3. **Literature Review: How Generative AI Influences Critical Thinking**

a. Support for Critical Thinking (Augmentation Pathway) Evidence

i. According to a systematic review of studies from 2023 to 2024, ChatGPT can improve critical thinking. by making it possible for different points of view to be heard, by making analysis easier, and by providing evidence to back up claims construction—particularly when educators promote independent judgment and verification. Additionally, a mixed-methods investigation of university students revealed advancements in both early middle stages of cognitive presence, such as exploration, integration, and "triggering events." However, the "resolution" phase—where learners finalize judgments and apply

conclusions—was less consistently reached unless GenAI use was guided and collaborative rather than passive. Based on these findings, GenAI is most effective as a dialogic tool for investigating concepts and evaluating reasoning, not as a generator of final responses

b.   Risk Possibility of Critical Thinking Evidence

i. Research on GenAI in knowledge work shows that higher confidence in GenAI is associated with less enacted critical thinking, whereas higher self-confidence is linked to more critical thinking. thinking. The same study demonstrates that GenAI transforms critical thinking into activities like verification and response integration, which suggests that thinking changes rather than stays the same disappears—yet the level of effort may decline.The use of AI tools and "cognitive offloading," as related findings, may have a negative impact. relationships between critical thinking performance and frequent reliance on AI tools, mediated by dependence and reduced internal processing. At the policy level, OECD-linked reporting

warns that a hasty adoption of GenAI could undermine evaluative judgment and produce "false positives." mastery," pointing out that designs should support rather than hinder thinking.

c.   Synthesis: A Dual-Use Technology

i. When students are required to question, verify, and compare perspectives, it improves critical thinking, and justify reasoning.

ii. When students outsource fundamental reasoning steps, it undermines critical thinking, accept outputs as authoritative, or GenAI can be used to get around conflict that builds lasting understanding.

4.   Proposed Framework: Prompt–Probe–Verify–Reflect (PPVR)

This paper proposes PPVR, a structured classroom, to ensure that GenAI strengthens critical thinking. routine that is in line with the skills of critical thinking (such as evaluation, inference, and self-regulation) outlined in consensus models It also aligns with UNESCO's call for human-centered, pedagogically guided GenAI use.

a.   PPVR Stages

i. Stage 1 — Prompt (Goal + Constraints):

1.   Students craft prompts that specify purpose, assumptions, and constraints (e.g., "Provide two a variety of explanations; a list of uncertainties This encourages thoughtful investigation rather than passive spending.

ii.Stage 2 — Probe (Socratic Interrogation):

    1.   Students ask follow-ups: "What evidence supports this?" "What would falsify it?" "What assumptions are hidden?" This mirrors the dialogic, guided interaction associated with fuller cognitive presence outcomes.

iii.Stage 3 — Verify (Source and Logic Checking):

    1.   Students evaluate the quality of logic and cross-check claims against reliable sources. This aligns with GenAI-assisted critical thinking shifts toward integration and verification, according to research. Work.

iv.Stage 4 — Reflect (Metacognitive Self-Regulation):

    1.   Students write a brief reflection on what they accepted or rejected and the reasons behind it; what remains uncertain; what the AI did right or wrong, and how it changed its mind. Self-regulation is bolstered by this, and combats the risks of cognitive offloading.

5.   Classroom Implementation Design

    a.   An illustration of an activity (higher education or secondary)

i.Task: "Examine two policy options for reducing air pollution in urban areas."

    1.   Process:

    a.   Students uses GenAI to generate two arguments and counterarguments.

    b.   The student is required to make assumptions and request proof (Probe).

    c.   the student uses reliable sources to verify at least three claims (Verify).

    d.   The student justifies both their final stance and their reflection (Reflect).

ii.Teacher Role

    1.   Teachers become "thinking coaches," designing prompts, and becoming more than just content providers. rubrics and verification checkpoints—in accordance with policy calls for educational facilities designed specifically uses and structured adoption.

6.   Assessment: Using GenAI-Supported Tasks to Measure Critical Thinking

    a.   Why Does Traditional Assessment Fail?

i.When GenAI is able to produce polished final answers, only output quality can be evaluated. inadequate; a process-oriented assessment is required to capture student and reasoning steps. judgment. Discussions centered on the OECD emphasize the need for assessment models to evolve in assessing learners' engagement in addition to their submissions.

    b.   Proposed Rubric Dimensions (Aligned to Critical Thinking Skills)

i.The quality of the argument (claims supported, addressed counterarguments)

ii.The quality of the verification (source credibility, triangulation)

iii.Transparency in reasoning (explicit assumptions and logic checks)

iv.Metacognitive reflection (what changed and why)

7. Governance, equity, and ethical considerations

a. Privacy, age-appropriate design, institutional readiness, and other urgent issues are highlighted by UNESCO. and GenAI education tools' ethical validation. These issues are directly related to important thinking: students may internalize flawed reasoning if systems are opaque, biased, or unverified. patterns or perspectives that aren't fair. Equity matters because differential access to high-quality tools and guidance can produce unequal growth in critical thinking skills and AI literacy. Human-centered UNESCO approach implies both the capacity-building necessary for meaningful learning and access.

8. Future Research Agenda

a. Studies over time to see if GenAI scaffolding fosters long-term critical thinking gains throughout semesters.

b. Testing the "resolution gap" with controlled comparisons of guided versus unguided GenAI use and hypotheses about cognitive offloading.

c. Conceive of experiments based on educational GenAI systems designed specifically for inquiry and pondering rather than formulating responses.

9. Conclusion

a. Generative AI serves as a tool and is neither good nor bad for critical thinking in and of itself. promoter of educational design. There is evidence that GenAI can improve exploration, when used in structured, guided, and reflective settings, perspective-taking, and argument development ways. Conversely, overconfidence in the tool and uncritical reliance can reduce cognitive effortand encourage offloading, which could lead to "false mastery" and superficial learning. This paper contributes a practical framework—Prompt–Probe–Verify–Reflect (PPVR)—to implement GenAI as a reasoning scaffold in the classroom in accordance with critical thinking theory and emerging guidance for global policy. In the near term, educators can protect and strengthen critical thinking by making assessments that are focused on the process, requiring verification, and reflecting a graded component of work done with AI.

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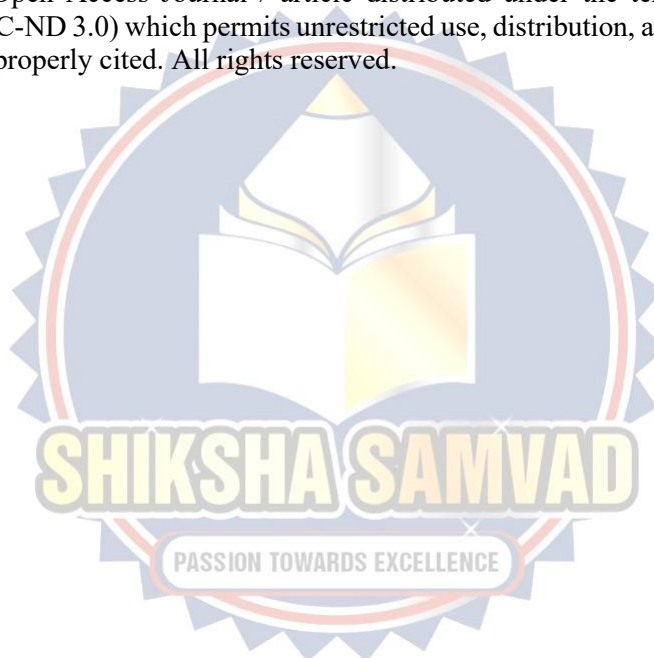b. UNESCO (update for 2023-2026). guidance for the use of generative AI in research and education

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