International Journal of Scientific Research and Engineering Development-– Volume 8 Issue 6, Nov- Dec 2025

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Impact of AI on Critical Thinking and Creativity: A Review of Cognitive Effects in Education

Sneha J Saravaiya*, Samir Nitinbhai Joshi**

*(Computer Engineering, Atmiya University, Gujarat.
Email: saravaiya.sneha.j@gmail.com)

** (Assistant Professor, Atmiya University, Gujarat.
Email: samir.joshi@atmiyauni.ac.in)

----------**********----------

Abstract:

Artificial intelligence (AI) is becoming a major part of everyday learning, helping students and teachers save time, access information quickly, and learn in ways that suit their individual needs. At the same time, its growing influence has raised concerns about whether people—especially students—are beginning to depend on AI too much. This review looks at what recent studies say about how AI affects creativity, critical thinking, and independent problem-solving. The findings suggest that AI can be a powerful support tool when used wisely, but relying on it for ready-made answers may weaken important cognitive skills. The paper highlights the importance of finding a balance: using AI to assist learning without letting it replace the effort, reflection, and original thinking that humans need. In the end, the goal is to treat AI as a helpful partner—not a substitute—for human thought.

Keywords —Artificial Intelligence, Critical Thinking, Creativity, Cognitive Offloading, Education Technology, Learning Behaviour, AI Literacy, Independent Problem-Solving, Student Engagement, GenAI Tools.

----------**********----------

I. INTRODUCTION

In today's world, artificial intelligence is reshaping how humans perform certain tasks, from writing to research, problem-solving, collecting data, and even getting creative ideas. While it is true that AI offers speed and convenience and saves time, its growing use has raised questions about its potential impact on critical thinking and creativity. Critical thinking [the ability to analyse and reason independently] and creativity [the capacity to generate new and unique ideas] are crucial for innovation and decision-making. Numerous studies have recently shown that dependency on AI has resulted in reducing the creativity and critical thinking in people, especially students. This survey paper reviews existing research on the cognitive effects of AI use, examining patterns, trends, and implications observed across multiple studies. This review paper aims to highlight the importance of the thin line between AI assistance and the importance of essential human cognitive skills. We aim to inform educators, professionals, and researchers about balancing AI use with independent thinking and creativity.

II. BACKGROUND

Ever Ever since advanced AI tools and large language models (LLMs) like ChatGPT, DeepSeek, and Gemini became available for public use, both students and teachers have started relying on them more. It is true that these tools help save time and reduce the amount of work, but the problem begins when people start depending on them completely. Many recent studies have shown that too much use

of AI tools can lead to a decline in students' critical and cognitive thinking skills.

Because AI gives quick and ready to paste answers, students often stop trying to think deeply about a problem or find the solution on their own. Instead, they directly ask AI models for help. This raises an important question about how we can use AI for learning while keeping our ability to think, analyze, and solve problems independently.

Not only students, but teachers and the general population have started relying on LLMs to the point that even simple tasks such as basic mathematical problems are given to AI models. People have stopped bothering to solve the simplest questions and are not making any efforts at all. Teachers too, use AI systems for grading assignments, lesson planning, and content generating.

Beyond the classroom, this dependence has impacted on social life too. As AI becomes part of everyday life, and people have started to rely on it for decision-making, thus resulting in a reduction in confidence in one's own ideas and willingness to take risks or make mistakes, (Ken, 2011)

III. MAIN BODY

Examining AI's advantages and disadvantages is crucial given its growing influence in daily life and education. The main benefits and drawbacks of AI are summarized in the following section, with an emphasis on how they impact education, creativity, and independent thought.

A. Benefits of AI Tools in Learning

AI-tools have introduced several notable advantages in educational settings:

- Many studies show that AI helps make learning more personalized. It can adjust the content, speed, and level of support based on what each student needs. *(Benefits of AI, n.d.)*
- AI also contributes to more effective learning. It can provide summaries, check assignments, develop questions, help find areas in which student is struggling. This results in a lot of time savings for both educators and learners. *(Enhancing Learning Through AI: Generating Better Study Habits, 2024).*
- AI increases accessibility for a multiple of learners. It helps children who don't have enough resources, have disabilities, or study at various speeds. AI can offer translation, additional assistance, and other methods of presenting knowledge so that more students can comprehend the material. *(AI in Digital Learning: Benefits, Applications and Challenges, n.d.)*
- Engagement and feedback: Real-time feedback from AI tools can motivate learners to revise and reflect actively, resulting in more interactive learning process rather than passive reading. *(Hurter, 2024)*

B. Risks of Overreliance

But there are significant concerns associated with the increasing use of AI in education, especially if students start to rely too much on these.

- Several studies warn of a decline in creative thinking, independent problem-solving, and critical reasoning when AI is used as a substitute rather than a support. For example, a review found that over-relying on AI may limit students' opportunities to engage in independent problem-solving. (Al-Zahrani, 2024)
- When AI provides ready to write answers or solutions, students often skip the active mental process of grappling with problems, which is important for deep learning, and analytical skills. (Muhammad Abbas, 2024)
- Aside from cognitive impacts, issues such as academic integrity, plagiarism, and superficial learning emerge when AI tools

are used primarily as shortcuts. (Chunpeng Zhai, 2024)

Here, the idea of cognitive offloading—that is, transferring thinking activities from the learner to an external system—becomes pertinent: students' own cognitive engagement may decline if they depend on AI to come up with ideas, prepare answers, or solve issues. For instance, a recent article points out that relying too much on AI tools may eventually harm cognitive abilities and memory retention.

C. Balancing AI Use and Independent Thinking

Given the advantages and disadvantages, the main challenge now is how students and teachers can use AI wisely, making the most of its benefits without losing their own ability to think independently.

1) Studies and Research shows that AI works best when it's used as a support tool instead of replacing the thinking process. This means that students should try solving a problem on their own first, and then use AI to check, guide, or refine their work. This idea "struggle first, prompt later" is becoming a key point in recent studies on GenAI in learning. *(Mahir Akgun, 2025)*

2) Teachers and institutions can also create clear policies for using AI responsibly. These guidelines can explain when AI is allowed, how students should prompt it, how they should reflect on AI-generated ideas, and how to properly acknowledge AI contributions. This also helps develop metacognitive skills, where students think about their own thinking. *(Chunpeng Zhai, 2024)*

3) Frameworks such as **AI literacy**, **reflective learning**, and **human-in-the-loop models** help preserve active student engagement: for example, teaching students how to evaluate AI outputs critically, identify biases or inaccuracies, and use AI as a "thinking partner" rather than just an answer-machine. *(Willige, 2024)*

4) Overall, the goal is to use AI for tasks it handles well—like quick feedback, personalization, and accessibility—while still spending time on activities that require original thinking, such as open-ended questions, creative projects, teamwork, and reflection.

IV. DISCUSSION

The growing use of AI in education signifies a major change in the production, processing, and accessibility of knowledge. The assessment emphasizes that although AI tools offer benefits, especially in terms of efficiency, accessibility, and personalization, the human component of learning is still indispensable. The literature consistently shows that whether AI improves or degrades learning outcomes depends on the level of interaction. AI acts as a scaffold by providing feedback, alternate explanations, or viewpoints that can enhance comprehension after students have tried to think or solve a problem on their own. However, it tends to replace work with convenience when used carelessly or prematurely.

This observation aligns with broader cognitive theories suggesting that **effortful thinking strengthens neural connections and retention**. Cognitive offloading, while useful for managing information overload, becomes problematic when it extends to *core cognitive processes* such as idea generation or reasoning.

Another key insight is that the **impact of AI use varies with context**—students with strong self-regulation skills often use AI productively, while those seeking shortcuts are more prone to dependency. Thus, the challenge is not the technology itself but **how it's integrated into learning behaviors and classroom culture**.

Overall, the discussion underscores a crucial balance: AI should be positioned as a **partner in thought**, not a **replacement for thinking**. Both

students and educators share responsibility in maintaining this balance.

CONCLUSION

This review concludes that the educational benefits of AI—efficiency, accessibility, and personalization—are significant, yet their value depends entirely on **intentional and reflective use**. Overreliance on AI tools risks weakening independent thinking, creativity, and problem-solving skills, especially when learners bypass active engagement in favor of convenience.

Future educational approaches should focus on **AI literacy**, encouraging learners to understand, question, and critically evaluate AI outputs. Educators can play a central role by designing learning environments that promote **human–AI collaboration**, where the technology supports exploration and reflection rather than substitutes for effort.

Ultimately, the goal is not to limit AI's presence in learning, but to **redefine its role**—as an amplifier of human cognition, not its replacement.

ACKNOWLEDGMENT

The author expresses sincere gratitude to the educators, peers, and researchers whose work provided valuable insights into the evolving relationship between artificial intelligence and education. The author also acknowledges the use of AI-assisted tools, including ChatGPT (OpenAI), which were utilized to support language refinement, organization of sections, and improvement of clarity. All intellectual content, interpretations, and conclusions presented in this paper are solely those of the author.

REFERENCES

AI in Digital Learning: Benefits, Applications and Challenges. (n.d.). Retrieved from www.digitallearninginstitute.com.

Al-Zahrani, A. M. (2024). Unveiling the shadows: Beyond the hype of AI in education. *Heliyon*, .

Benefits of AI. (n.d.). Retrieved from provost.wsu.edu: https://provost.wsu.edu/benefits-of-ai

Chunpeng Zhai, S. W. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: a systematic review. *Smart Learning Environments*.

Enhancing Learning Through AI: Generating Better Study Habits. (2024, Sep 27). Retrieved from www.ucdenver.edu: www.ucdenver.edu/student/stories/library/stories-from-the-hub/enhancing-learning-through-ai-generating-better-study-habits

Hurter, B. (2024, Nov 27). *Top Benefits Of AI In Education For Teachers and Students*. Retrieved from element451.com: https://element451.com/blog/benefits-of-ai-in-education

Mahir Akgun, S. T. (2025). Struggle First, Prompt Later: How Task Complexity Shapes Learning with GenAI-Assisted Pretesting. *arxiv.org*.

Muhammad Abbas, F. A. (2024). Is it harmful or helpful? Examining the causes and consequences of generative AI usage among university students. *International Journal of Educational Technology in Higher Education* .

Rahme, R. H. (2024, June 30). *Addressing Inequities in Education: AI as a Double-Edged Sword (Part II).* Retrieved from mepli.gse.harvard.edu: mepli.gse.harvard.edu/our-fellows-at-work/addressing-inequities-in-education-ai-as-a-double-edged-sword-2

Willige, A. (2024, May 10). *From virtual tutors to accessible textbooks: 5 ways AI is transforming education*. Retrieved from www.weforum.org: www.weforum.org/stories/2024/05/ways-ai-can-benefit-education

