

Impact of Generative Artificial Intelligence on Learning, Cognition, and Writing Skills: A Review of Recent Studies

Shreya Shukla

*G.H. Raisoni college of
engineering and management,
Nagpur, India*

Ajay Chavhan

*G.H. Raisoni college of
engineering and management,
Nagpur, India*

Sahil Kolande

*G.H. Raisoni college of engineering
and management, Nagpur, India*

Vaishnavi Rana

*G.H. Raisoni college of
engineering and management,
Nagpur, India*

Sujal Patil

*G.H. Raisoni college of
engineering and management,
Nagpur, India*

Dr. Priti Bihade

*Research Guide
HOD – CSE(Cybersecurity)
G.H. Raisoni college of engineering
and management, Nagpur, India*

Abstract-

Artificial Intelligence (AI), particularly generative AI tools such as ChatGPT, has quickly become a significant influence in contemporary education. These technologies are not only changing how students acquire knowledge but also how they process information, express ideas, and engage with learning materials. This review paper compiles insights from various recent studies to explore the impact of AI in areas such as personalized learning, writing enhancement, cognitive growth, and student involvement. The collective research indicates that AI can greatly enhance academic achievement by offering immediate feedback, helping with writing, and fostering self-directed learning. Alongside these benefits, new ideas like prompt engineering and AI literacy are increasingly important for students to use these tools effectively. Nevertheless, the studies also point out several challenges, such as excessive dependence on AI, a decline in critical thinking abilities, and issues concerning ethics and data security. In summary, the findings suggest that AI holds substantial promise for improving education, but it should be used thoughtfully. The most successful approach seems to be a balanced strategy where AI aids in the learning process while human involvement ensures the development of critical thinking and ethical use.

Keywords

Artificial Intelligence, Generative AI, ChatGPT, Prompt Engineering, AI Literacy, Education, Cognitive Learning, Human-AI Interaction

Introduction

Artificial Intelligence has emerged as one of the most significant technological advancements in recent times, and its impact on education is becoming more noticeable. The introduction of generative AI tools has begun to change traditional approaches to teaching and learning in meaningful ways. These tools can produce responses that resemble human speech, explain difficult subjects, and even support students in finishing their assignments. In today's classrooms, AI is being used in different ways, including intelligent tutoring systems, automated grading tools, and writing assistants. These technologies help create tailored learning experiences, allowing students to study at their own speed and get instant feedback. This not only enhances their understanding but also helps teachers manage their workload more efficiently. At the same time, the growing use of AI in education has sparked several important concerns. One key issue is the potential for students to rely too heavily on AI tools, which might weaken their ability to think on their own. There are also concerns about the reliability of content created by AI and the ethical considerations involved in using such technologies. This paper brings together findings from various research studies to offer a clear and comprehensive view of how AI is influencing learning, cognitive abilities, writing skills, and broader educational practices. It also highlights the importance of developing new competencies, such as prompt engineering and AI literacy, to ensure that these tools are used in a thoughtful and responsible manner.

Research Objectives

This study is intended to:

- Investigate how AI influences learning, thinking, and writing abilities
- Explore the importance of prompt engineering and understanding AI in educational settings
- Recognize the obstacles and areas that need more research when using AI in learning
- Offer suggestions for better ways to incorporate AI into education effectively

Research Methodology

This study employs a systematic literature review to carefully examine and analyse existing research in a fair and objective way. Relevant academic papers were collected from well-known databases such as Scopus, Google Scholar, ResearchGate, and the ACM Digital Library.

- Selection Criteria

The studies included in this research were selected based on the following conditions:

- The study focuses on the application of AI in education
- It covers topics related to prompt engineering or AI literacy
- It discusses results regarding learning, student engagement, or cognitive effects
- It was published in English

- **Exclusion Criteria**

The following types of studies were excluded:

- Research that is unrelated to education
- Purely technical AI studies without any educational context
- Duplicate or non-peer-reviewed materials

- **Analysis Method**

A qualitative content analysis was conducted to:

- Identify key themes
- Compare findings across different studies
- Evaluate the limitations and gaps in current research

This structured approach helps ensure that the findings are reliable and accurate.

Literature Review

- AI in Personalized and Self-Regulated Learning

AI plays a crucial role in promoting self-regulated learning by enabling students to control their learning pace, set goals, and monitor progress. Intelligent tutoring systems provide personalized feedback and adaptive learning pathways, enhancing student autonomy. Critically, while AI improves independence, excessive reliance may reduce learners' ability to engage deeply with content, highlighting the need for balanced usage.

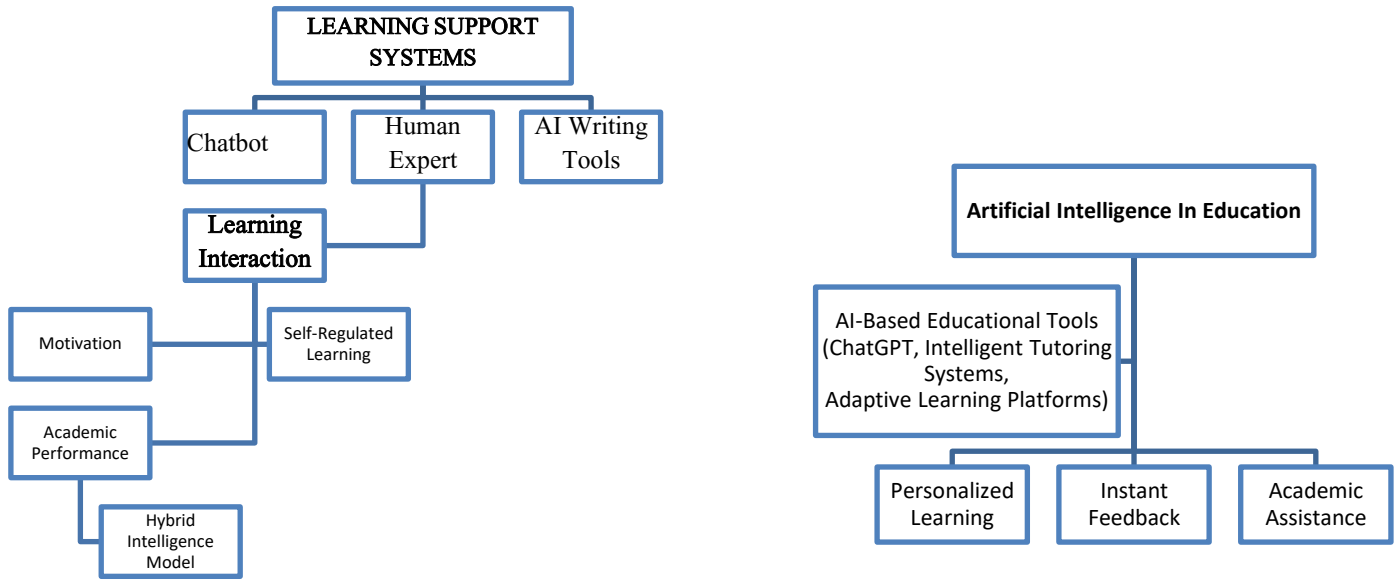


Fig 1: Role of AI in Personalized Learning

➤ AI and Cognitive Development

AI tools have a major impact on how people think by making tasks like reading, writing, and solving problems easier. Although this can make work more efficient, it might also lead to cognitive offloading, where students rely more on AI rather than improving their own ability to reason. This situation brings up worries about how thinking skills develop over time, highlighting the need to use AI alongside training in critical thinking.

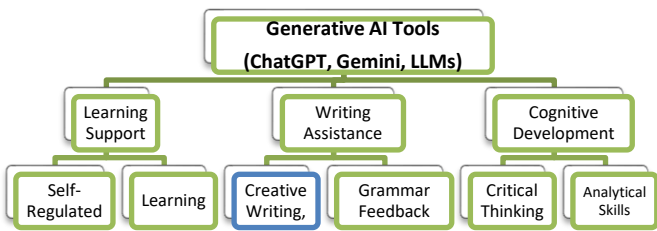


Fig 2: Role of Generative AI in modern education systems

➤ AI-Assisted Writing and Creativity

Generative AI has transformed academic writing by assisting with idea generation, grammar correction, and content structuring. Studies show that AI enhances creativity, reduces writer’s block, and improves writing

quality. However, critical analysis reveals that overuse of AI may limit originality and independent thinking. Therefore, AI should be used as a supportive tool rather than a replacement for human creativity.

Fig 3: Conceptual framework of Artificial Intelligence applications in education

➤ Prompt Engineering as a Core Skill

Prompt engineering is becoming more widely acknowledged as an essential digital skill. Well-structured prompts, which include a defined role, relevant context, and clear instructions, help AI systems produce precise and meaningful outputs. Studies show that designing effective prompts can greatly enhance learning results. Nevertheless, the absence of established training frameworks hinders its broader implementation within educational institutions.

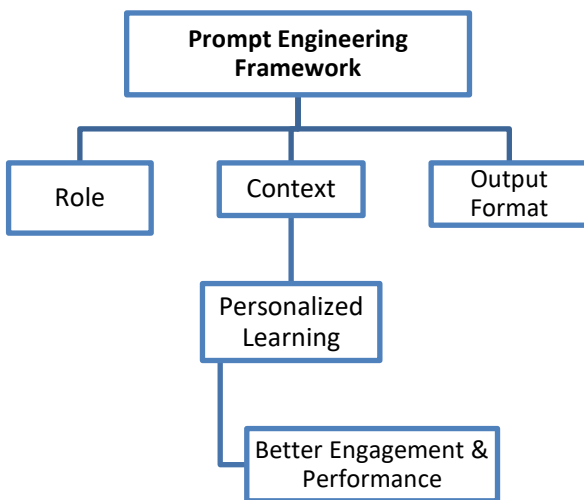


Fig 3: Conceptual framework of Prompt Engineering

➤ AI Literacy and Critical Thinking

AI literacy involves understanding AI systems, evaluating outputs, and recognizing limitations. It is essential for preventing blind reliance on AI-generated content. Studies highlight that students with higher AI literacy demonstrate better critical thinking and decision-making skills. This reinforces the need to integrate AI literacy into educational curricula.

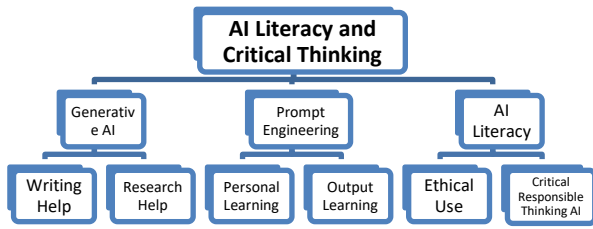


Fig 4: Concept of AI Literacy and Critical Thinking

➤ Human–AI Collaboration

Human–AI collaboration enhances creativity and productivity when AI is used as a supportive partner. Research shows that students achieve better outcomes when they actively engage with AI rather than passively accepting its outputs. This collaborative model represents the concept of hybrid intelligence, combining human judgment with AI capabilities.

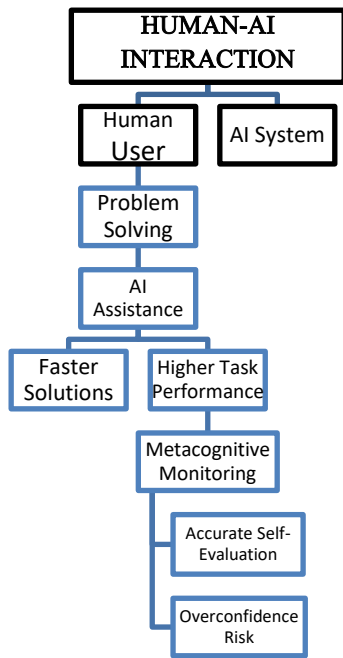


Fig 5: Structure of Human-AI Collaboration

Comparative Analysis

The reviewed studies provide complementary insights into AI integration in education. While all researchers acknowledge AI’s benefits, their focus varies across prompt engineering, writing enhancement, and AI literacy.

A critical comparison reveals that:

-Prompt engineering improves interaction quality

-AI enhances creativity and performance

-AI literacy ensures responsible usage

However, all studies emphasize the importance of ethical considerations and balanced implementation.

Table-1: Comparison of Gen AI on Learning, Cognition and Writing Skills

Study	Focus Area	Methodology	Key Finding
Fan et al.	AI impact on students	Review-based	Improves learning but may weaken critical thinking if overused
Veenman; Fleming & Lau	Metacognition	Theoretical review	Self-assessment is crucial; both humans & AI can be overconfident
Fernandes et al.	AI & academic outcomes	Experimental	Improves performance but reduces self-awareness
Hattie & Timperley; Carless & Bound	AI feedback	Comparative analysis	Mixed feedback helps; overuse harms deep learning
Dahri et al.	Self-regulated learning	Mixed-method study	AI supports independent learning
Fu & Hiniker	AI & cognition	Prompt analysis	Enhances understanding but may cause detachment

Cen & Shakibaei	AI writing	Experimental study	Boosts creativity and motivation
Chen et al.	Cognitive effort	Randomized experiment	Increases efficiency but lowers effort
Kasneci et al. (2024)	AI in education	Systematic review & meta-analysis	Improves performance but increases dependency
Zhu et al. (2024)	AI answering queries	Comparative evaluation	Provides accurate academic explanations
Huang et al. (2024)	AI trends	Bibliometric analysis	Rapid growth in tutoring & adaptive learning
Lee et al. (2024)	Student perception	Survey-based Study	Helpful for writing and language learning
Paula Serra & Angela Oliveira	Prompt frameworks	Systematic review	Structured prompts improve outcomes
David James Woo, Kai Guo & Hengky Susanto	Digital literacy	Experimental	Enhances creativity, reduces writer's block
Denis Federiakin et al.	Digital literacy	Conceptual	Prompt design affects accuracy
Yvonne Walter	AI literacy	Theoretical	Needed to avoid overdependence

Research Gaps

Despite major progress, there are still several areas that need more attention:

- There is not enough research on how long-term cognitive effects of AI tools last
- There is no standard curriculum in place for teaching prompt engineering
- There are not enough clear guidelines to ensure ethical use of AI
- Most research is focused on general education rather than across different fields

These issues show that more study and exploration are necessary.

Future Directions

Future research should focus on:

- Creating standardized educational programs that teach AI and prompt engineering
- Carrying out studies to assess the long-term impact of AI on individuals and society
- Setting up clear ethical guidelines and rules for the responsible use of AI
- Expanding the use of AI in various educational fields and subjects
- Training teachers to use AI effectively in their classrooms
- Improving the clarity and transparency of AI systems so they are easier to understand

Conclusion

Artificial Intelligence is changing education by making learning more personalized, engaging, and efficient. It helps with writing, learning, and solving problems, and encourages students to be more active in their studies. However, how AI is used can affect its effectiveness. Relying too much on AI might harm brain development and reduce critical thinking skills. Therefore, it is important to use AI in a way that supports rather than replaces human intelligence. The future of education will depend on using AI as a helpful tool while upholding strong ethical standards and being aware of its broader effects.

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