

Effect of Artificial Intelligence on Students' Critical Thinking Skills

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ABSTRACT

Students are increasingly using Artificial Intelligence (AI) for learning, writing, and problem-solving. While AI tools offer convenience and efficiency, their impact on students' critical thinking skills remains an important area of study. Critical thinking is essential for analysing information, making decisions, and solving problems. This study examines how the use of AI affects students' critical thinking abilities. The research focuses on whether AI enhances or diminishes students' independent thinking skills. Using a survey-based approach, data are collected from students to assess their AI usage patterns and the perceived impact on their thinking skills. The findings aim to provide insights into the educational implications of AI and highlight the importance of balanced technology use in learning environments.

KEYWORDS

Artificial Intelligence, Critical Thinking, Education, Students, Learning Technology, Cognitive Skills, Pedagogy

INTRODUCTION

Artificial Intelligence (AI) has become a significant part of modern education. Many students use AI-powered tools for academic tasks such as completing assignments, generating ideas, solving problems, and accessing information. These technologies provide quick answers and personalised support, making learning more efficient.

However, the growing dependence on AI has raised concerns among educators and researchers. One major concern is its potential impact on students' critical thinking skills. Critical thinking involves analysing information, evaluating ideas, and making logical decisions. These skills are important for academic success and intellectual development. While AI tools can assist learning, excessive reliance on them may reduce students' ability to think independently. Some researchers argue that AI can enhance reasoning abilities, while others suggest it may encourage passive learning. Therefore, it is necessary to examine how AI usage truly affects students' thinking processes. This study aims to explore the relationship between AI use and students' critical thinking skills, contributing to a better understanding of AI's role in education.

Overview of Artificial Intelligence in Education

AI encompasses technologies such as machine learning, natural language processing, and intelligent tutoring systems that personalise learning experiences, automate assessment, and provide real-time feedback.

LITERATURE REVIEW

Artificial Intelligence (AI) is becoming increasingly common in education. Many students use AI tools for learning, writing, problem-solving, and information searching. Because of this growing use, researchers have started examining how AI affects students' thinking abilities, especially critical thinking skills. Critical thinking is an important cognitive skill that involves analysing information, evaluating ideas, solving problems, and making logical decisions. According to Facione (1990), critical thinking includes skills such as interpretation, analysis, evaluation, and reasoning. These skills are essential for academic success and independent learning.

Several studies suggest that AI can positively support students' learning processes. AI-based educational systems can provide personalised feedback, adaptive learning experiences, and immediate responses. Luckin et al. (2016) explain that AI technologies can improve learning by adjusting content based on students' individual needs. This personalisation can help students better understand concepts and engage more actively in learning. Similarly, Holmes, Bialik, and Fadel (2019) argue that AI can enhance higher-order thinking skills when used properly in educational settings. AI tools may assist students in exploring ideas, organising information, and developing problem-solving strategies. When students interact thoughtfully with AI systems, these tools can act as supportive learning partners.

Research also indicates that AI can help students develop metacognitive skills. Mayer (2002) suggests that interactive technologies can promote deeper learning by encouraging learners to reflect on their understanding. AI systems that provide guided questions, simulations, or practice exercises may stimulate analytical thinking and reasoning. However, other researchers highlight potential negative effects of AI use. One major concern is overdependence on AI, which may reduce students' independent thinking. Sparrow, Liu, and Wegner (2011) found that easy access to digital information can affect how people process and remember knowledge. When students rely heavily on AI tools, they may engage less in deep thinking and analysis.

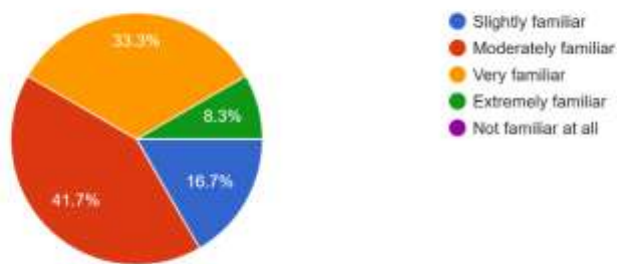
Kirschner, Sweller, and Clark (2006) emphasise that learning requires active cognitive effort. If students rely too heavily on automated tools, they may not fully develop their problem-solving and reasoning abilities. Sweller's (1988) Cognitive Load Theory also suggests that while technology can reduce mental effort, excessive automation may limit opportunities for meaningful thinking. Recent discussions about generative AI tools raise similar concerns. Kasneci et al. (2023) explain that although AI tools improve efficiency, they may also decrease critical engagement if students accept AI-generated responses without evaluation. Cotton, Cotton, and Shipway (2023) warn that AI tools could weaken analytical skills if learners substitute their own thinking with automated outputs.

Despite these concerns, researchers note that the impact of AI largely depends on how students use the technology. Long and Magerko (2020) highlight the importance of AI literacy, which involves understanding, evaluating, and critically interacting with AI systems. Students who are trained to question and verify AI outputs are more likely to maintain strong critical thinking skills. Overall, existing research shows mixed findings. AI can enhance students' learning and thinking when used responsibly and with proper guidance. However, excessive or uncritical reliance on AI may reduce independent reasoning and deep cognitive engagement. Therefore, instructional strategies and students' awareness play an important role in determining AI's effects.

RESULTS

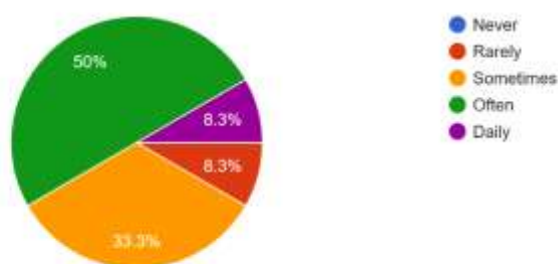
How familiar are you with Artificial Intelligence (AI)? Not familiar at all

12 responses



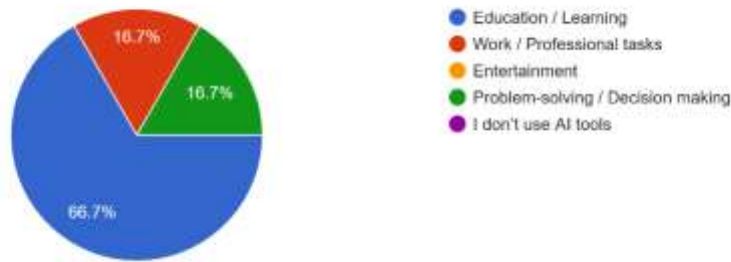
How often do you use AI tools (like ChatGPT, Gemini, Copilot, etc.)?

12 responses



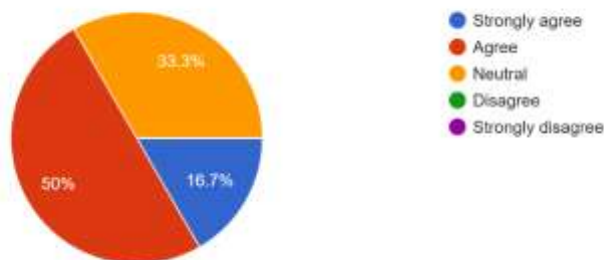
For what purpose do you mainly use AI tools?

12 responses



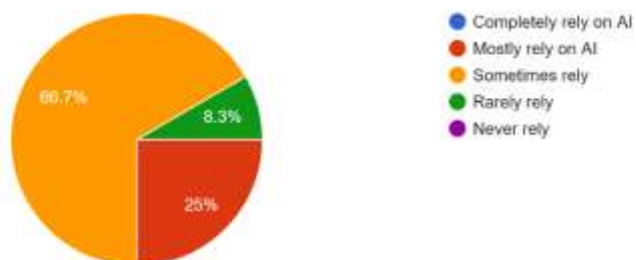
Do you feel AI tools reduce your need to think critically?

12 responses



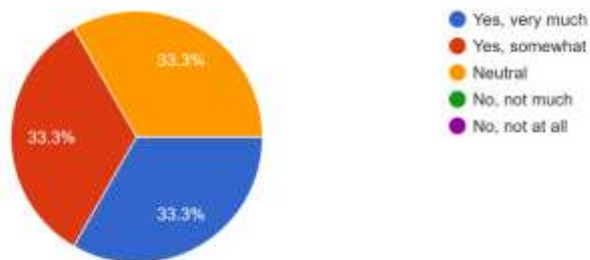
When using AI, how much do you rely on it instead of generating your own ideas?

12 responses



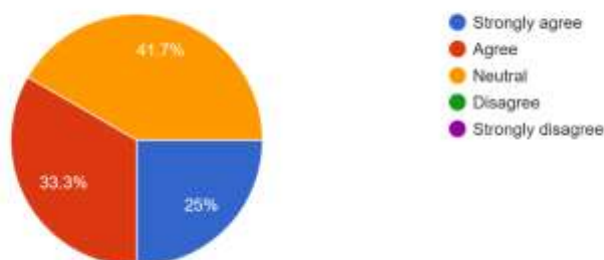
Do AI tools help you understand topics better?

12 responses



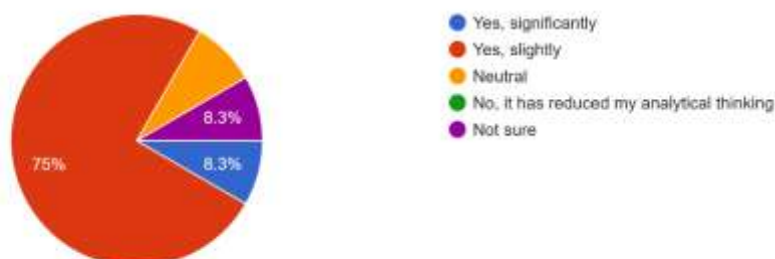
Does using AI make you think less deeply about problems?

12 responses



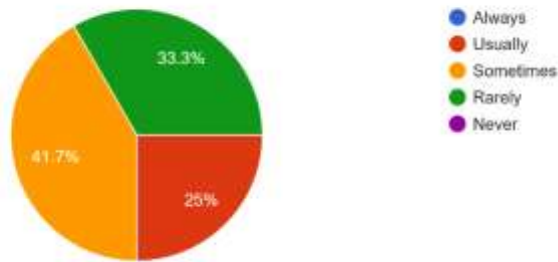
Has AI improved your ability to analyze information?

12 responses



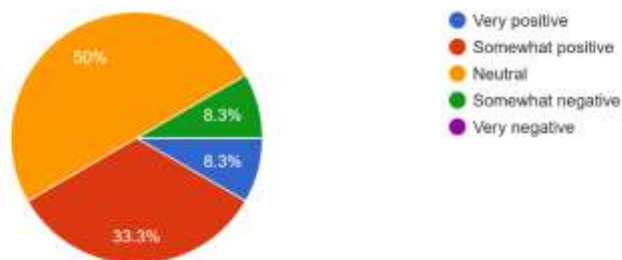
Do you verify AI-generated information with other sources?

12 responses



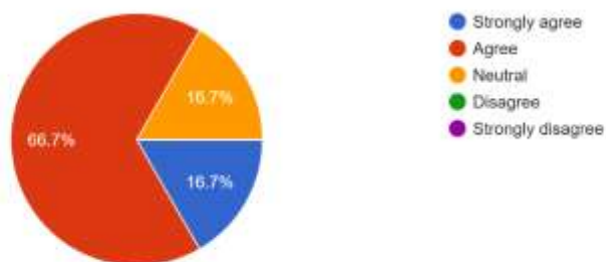
In your opinion, what is the overall impact of AI on human critical thinking?

12 responses



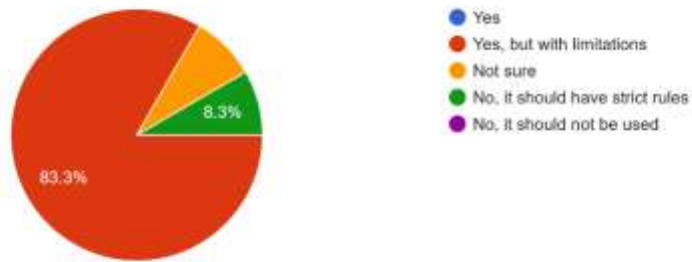
Do you feel AI encourages you to explore more ideas?

12 responses



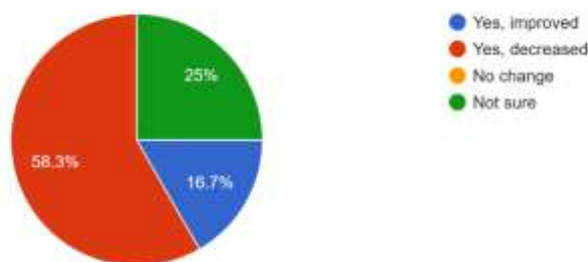
Should AI be used in education without restrictions?

12 responses



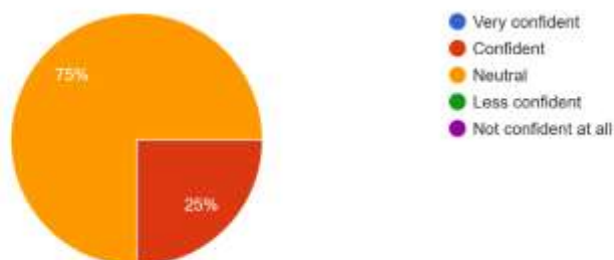
Do you believe your critical thinking skills have changed after using AI?

12 responses



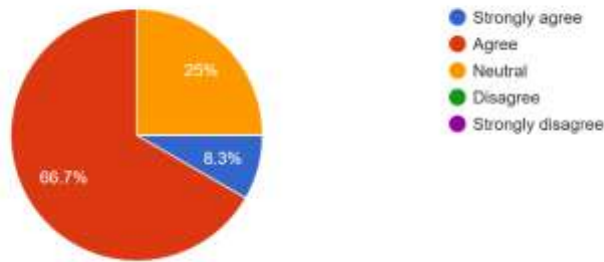
How confident are you in your own thinking without AI assistance?

12 responses



Should students be trained in critical thinking before using AI tools?

12 responses



OBJECTIVES

- To examine the effect of AI on students' critical thinking skills.
- To identify whether AI usage improves or reduces independent thinking abilities.
- To identify the positive effects of AI on analytical and problem-solving abilities.
- To explore the negative effects of AI, such as over-reliance and reduced independent thinking.
- To compare research findings across different subjects and learning environments. To suggest ways to use AI effectively to support critical thinking.

METHODOLOGY

This study uses a secondary research method, meaning it relies on analysing existing studies rather than collecting new data. These papers were chosen because they focused on the impact of AI on students' critical thinking skills. Each paper was reviewed to understand its purpose, method, findings, and recommendations. The information was then compared and combined to identify common themes, differences, and overall trends. This method helps to build a broad understanding of the topic from existing research.

CONCLUSION

Artificial Intelligence has become an important learning tool for students. The study indicates that AI offers several benefits, including quick access to information and improved efficiency in completing academic tasks. AI tools can support learning when used responsibly. However, excessive reliance on AI may reduce students' independent thinking and analytical abilities. Critical thinking skills develop through active engagement, reasoning, and problem-solving,

which can be weakened if students depend entirely on automated systems. Therefore, AI should be used as a supportive tool rather than a replacement for thinking. Educational institutions should encourage balanced AI usage and promote awareness about the critical evaluation of AI-generated information.

REFERENCES

- Facione, P. A. (1990). Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. American Philosophical Association.
- Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Centre for Curriculum Redesign.
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., et al. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences.
- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work. Educational Psychologist.
- Long, D., & Magerko, B. (2020). What is AI literacy? Proceedings of the ACM Conference on Human Factors in Computing Systems.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson.
- Mayer, R. E. (2002). Cognitive theory of multimedia learning. Educational Psychology Review.
- Sparrow, B., Liu, J., & Wegner, D. M. (2011). Google's effects on memory. Science.
- Sweller, J. (1988). Cognitive load during problem solving. Cognitive Science.
- Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Student perspectives on AI use. Assessment & Evaluation in Higher Education.