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THE USE OF ARTIFICIAL INTELLIGENCE IN DEVELOPING CRITICAL THINKING SKILLS

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Abstract: Critical thinking is one of the most important competencies required for successful learning, professional decision-making, and responsible participation in contemporary society. The rapid development of artificial intelligence has created new opportunities for supporting the development of critical thinking skills through interactive questioning, problem-based learning, automated feedback, argument analysis, and exposure to multiple perspectives. At the same time, inappropriate use of AI may reduce independent reasoning if students rely on generated answers without evaluating their accuracy or logic. The purpose of this study is to analyze the role of artificial intelligence in developing students' critical thinking skills and to identify the pedagogical conditions necessary for effective implementation. A qualitative literature-based review was conducted using recent research on artificial intelligence in education, generative AI, critical thinking, problem-solving, feedback, and digital literacy. The findings suggest that AI can support critical thinking when it is used to stimulate questioning, compare arguments, identify logical weaknesses, generate alternative viewpoints, and provide formative feedback. However, the educational benefits depend strongly on teacher guidance, task design, AI literacy, and the preservation of active student reasoning. The study concludes that artificial intelligence should be used as a cognitive partner rather than as a substitute for independent thinking.

Keywords: artificial intelligence, critical thinking, education, generative AI, problem-solving, digital literacy, analytical skills, pedagogy.

Introduction

Critical thinking is widely recognized as a fundamental educational objective. It includes the ability to analyze information, evaluate evidence, compare viewpoints, identify assumptions, recognize logical inconsistencies, and make reasoned judgments.

These skills are increasingly important in a digital environment where learners are exposed to large amounts of information from different sources.

The development of artificial intelligence has made information even more accessible. Generative AI systems can produce explanations, arguments, summaries, examples, and answers within seconds.

This creates both opportunities and risks for education.

On the one hand, AI can provide students with multiple perspectives, generate questions, challenge assumptions, and provide feedback on reasoning [1].

On the other hand, if students simply accept AI-generated responses without evaluating them, the technology may reduce rather than strengthen critical thinking.

For this reason, the educational impact of AI depends not only on the capabilities of the technology but also on the pedagogical methods used to integrate it into learning.

Critical thinking develops through active intellectual engagement.

Students need to compare ideas, justify conclusions, identify evidence, and reflect on their own reasoning.

Artificial intelligence can support this process when it is used to create situations that require analysis rather than passive acceptance.

The purpose of this study is to examine how artificial intelligence can contribute to the development of critical thinking and to identify the conditions under which AI becomes a useful pedagogical tool.

Materials and Methods

This study used a qualitative analytical literature-review approach.

Scientific publications and international reports related to artificial intelligence in education, generative AI, critical thinking, problem-solving, argumentation, feedback, digital literacy, and student learning were reviewed.

The analysis focused on several areas:

- AI-supported questioning;
- argument analysis;
- comparison of multiple viewpoints;
- problem-based learning;
- formative feedback;
- error detection;
- evaluation of AI-generated information;
- development of digital and AI literacy.

The reviewed literature was interpreted from a pedagogical perspective, with particular attention to the balance between technological support and independent student reasoning.

Results

The analysis indicates that AI can support critical thinking through interactive questioning.

A conversational AI system can ask students follow-up questions that require explanation, justification, and reflection.

For example, instead of giving a direct answer, an AI tool can ask:

"What evidence supports your conclusion?"

"What alternative explanation could be possible?"

"What assumptions are you making?"

Such questions encourage deeper reasoning.

Artificial intelligence can also support argument analysis.

Students may enter an argument and ask the system to identify possible weaknesses, missing evidence, or alternative interpretations.

This creates opportunities for students to compare their own reasoning with AI-generated analysis.

However, the AI response should not be treated as automatically correct.

The student should evaluate whether the criticism is logically valid.

This process can itself become a critical-thinking exercise.

Another useful application is perspective comparison.

AI can generate multiple viewpoints on the same issue.

Students can then analyze similarities, differences, strengths, and weaknesses.

This is particularly useful in subjects such as social sciences, ethics, history, education, and language studies.

For example, students may compare two different explanations of the same phenomenon and identify which argument is better supported by evidence.

AI can also be integrated into problem-based learning.

Students can be given a complex real-world problem and asked to use AI as a source of possible solutions.

They can then evaluate the suggestions, identify risks, and justify which option they consider most appropriate.

This approach helps learners understand that AI-generated ideas are possibilities, not final decisions.

Another important finding concerns error detection.

Generative AI systems can sometimes produce inaccurate or misleading information.

Although this is a limitation, it can also be used pedagogically.

Teachers can intentionally provide students with AI-generated responses and ask them to identify errors, unsupported claims, or weak reasoning.

This transforms the limitations of AI into a learning opportunity.

Students learn that information should be verified rather than accepted automatically.

This supports both critical thinking and AI literacy.

Formative feedback is another important area.

AI can provide immediate comments on student reasoning, identify unclear arguments, and suggest areas that require stronger evidence.

When used carefully, such feedback can support revision and reflection.

The key is that students should remain responsible for improving their own work.

AI should not rewrite the entire answer for them.

The analysis also suggests that AI can support metacognition.

Students can be encouraged to reflect on how they reached a conclusion.

For example, after completing a task, they may ask AI to challenge their reasoning and then explain whether they agree with the critique.

This process helps learners become more aware of their own thinking.

Discussion

The findings demonstrate that artificial intelligence can support the development of critical thinking, but only under certain conditions.

The most important condition is that AI should not remove the need for intellectual effort.

Critical thinking develops when students actively analyze and evaluate information.

If AI provides a complete answer and the learner simply copies it, little meaningful reasoning takes place.

Therefore, task design is crucial.

Teachers should create activities that require students to critique, compare, justify, and revise AI-generated content.

For example, a student may be asked to compare an AI-generated argument with an academic source.

Another task may require students to identify logical weaknesses in an AI response.

Such activities encourage active engagement.

The role of the teacher remains central.

Teachers need to guide students in evaluating AI outputs and explain that these systems can generate confident but incorrect information.

This is particularly important because students may assume that fluent language indicates accuracy.

AI literacy should therefore be integrated with critical-thinking instruction.

Students should understand that AI systems generate responses based on patterns in data rather than human understanding in the traditional sense.

They should also learn to verify important claims using reliable sources.

Another important issue is cognitive dependence.

If students rely too heavily on AI for idea generation, writing, and problem-solving, their own analytical abilities may weaken.

Therefore, educators should use a gradual model.

Students can first solve a task independently.

Afterward, they may use AI to compare or challenge their answer.

This sequence preserves independent reasoning while still benefiting from AI-supported feedback.

The use of artificial intelligence can also support collaborative learning.

Students may work in groups to evaluate an AI-generated solution.

They can discuss which parts are correct, which are questionable, and what evidence is needed.

This promotes both critical thinking and communication skills.

Ethical awareness is another relevant dimension.

Critical thinking includes not only logical analysis but also evaluation of consequences and values.

AI-generated recommendations may have social, cultural, or ethical implications.

Students should therefore be encouraged to ask not only whether a solution is efficient but also whether it is fair, responsible, and appropriate.

UNESCO emphasizes the need for a human-centered approach to AI in education, including critical awareness, human agency, and ethical responsibility [2].

The OECD also highlights the importance of helping learners develop the ability to use AI critically and responsibly [3].

These recommendations support the idea that AI literacy and critical thinking should develop together.

Limitations

This study is based on published literature and does not include original experimental data.

The research field is developing rapidly, and many studies focus on short-term outcomes.

There is still limited evidence about the long-term effects of generative AI on independent reasoning.

Another limitation is that different educational levels and subject areas may require different approaches.

A method that works well in higher education may not be equally appropriate for younger learners.

Future studies should examine long-term changes in critical-thinking ability and compare different AI-supported teaching strategies.

Conclusion

Artificial intelligence can become a valuable tool for developing critical thinking when it is used to stimulate analysis, questioning, comparison, and reflection.

AI can generate alternative viewpoints, provide feedback, support problem-based learning, and create opportunities for students to evaluate the quality of information.

However, artificial intelligence should not replace independent reasoning.

The educational value of AI depends on whether students remain intellectually active.

The most effective approach is to use AI as a cognitive partner that challenges learners rather than as a tool that completes tasks for them.

Teachers should design activities that require students to verify information, justify conclusions, critique AI-generated responses, and reflect on their own reasoning.

When integrated responsibly, artificial intelligence can support the development of critical thinking, AI literacy, and independent learning skills that are increasingly important in contemporary education.

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