



Section 2. General pedagogy

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SCIENTIFIC AND THEORETICAL ANALYSIS OF FOREIGN RESEARCH ON THE DEVELOPMENT OF CRITICAL THINKING OF STUDENTS IN THE ERA OF ARTIFICIAL INTELLIGENCE

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Abstract

The article presents a scientific and theoretical analysis of modern foreign studies devoted to the development of critical thinking of students in the context of rapid digitalization and the introduction of generative artificial intelligence (AI). Based on systematic reviews, metaanalyses and bibliometric studies, key trends, methodological approaches, cognitive effects and risks of using AI in educational practices are revealed. Special attention is paid to pedagogical strategies that ensure the development of critical thinking when students work with AI systems.

Keywords: *critical thinking, artificial intelligence, generative AI, higher education, cognitive skills, foreign studies*

The development of students' critical thinking in the era of the rapid spread of artificial intelligence (AI) technologies is becoming one of the key tasks of modern higher education, since it is critical thinking that ensures students' ability to analyze information, evaluate evidence, form arguments and make informed decisions in conditions of uncertainty. In foreign scientific literature, critical thinking is considered as a metacompetence of the 21st century, which determines the intellectual autonomy of a person and his ability to withstand cognitive automation caused by the widespread introduction of digital technologies (Facione P., 2015).

The emergence of generative AI models such as ChatGPT, Claude, Gemini, and LLaMA radically transforms students' cognitive processes, changing the structure of learning activities and creating new conditions for the formation of analytical, reflective and argumentative skills. Foreign studies emphasize that critical thinking in the context of AI should be considered not only as the ability to analyze information, but also as a complex cognitive process, including the ability to assess the reliability of data, identify logical errors, recognize algorithmic bias and form one's own reasoned position (Ennis R.,

2018). In the classical works of Facione, Ennis, and Halpern, critical thinking is defined as conscious, reflective thinking aimed at making informed decisions (Halpern D., 2014). However, in the age of AI, this definition is expanding: now students must be able to critically interact not only with texts and facts, but also with digital systems that offer readymade solutions.

This requires a higher level of metacognitive control, the ability to selfregulate, and the ability to analyze one's own cognitive strategies (Zimmerman B., 2008). A systematic review by Balart, Diaz, and Shryock (2026) analyzes 63 empirical studies on the impact of generative AI on students' critical thinking (Balart T., Díaz B., Shryock K., 2026). The authors conclude that AI promotes the development of reflective thinking when used in structured tasks involving analysis, comparison, argumentation, and evaluation of alternative points of view. Conversational AI models encourage students to form arguments, as they allow them to model discussions, ask clarifying questions, and receive critical feedback.

However, in the absence of pedagogical control, AI can reduce the intellectual autonomy of students, since students tend to accept AI responses without verification, which leads to cognitive "offloading" – the transfer of mental operations to a digital system. A metaanalysis of Springer Nature (2025–2026) confirms that about half of the studies record a statistically significant improvement in critical thinking when using AI (*Educational Psychology Review*). The greatest effect is observed when AI is used for argument analysis, reflection, peer review, and evaluation of reasoning. For example, AI is able to identify logical errors, unproven statements, and weak arguments, which helps students improve their own texts. However, the authors emphasize that the effectiveness of AI depends on the level of students' independence: if a student uses AI as a verification and analysis tool, critical thinking develops; if AI becomes a source of ready answers, cognitive activity decreases.

Bibliometric research in the *Journal of Computers in Education* (2025–2026) demonstrates the rapid growth of publications on critical thinking and AI (*Journal of*

Computers in Education). The most common topics are "AI-supported critical thinking", "GenAI in higher education", and "AI-driven assessment", which indicates the global interest of the scientific community in the problem of student interaction with AI. Researchers note that after 2023, there has been a sharp increase in the number of papers devoted to the ethical aspects of using AI, including issues of data reliability, algorithmic bias, and intellectual honesty of students.

The theoretical models used in foreign research are also undergoing changes. Bloom's Revised Taxonomy is used to assess levels of cognitive complexity, allowing researchers to determine which levels of thinking are activated when working with AI (Anderson L., Krathwohl D.). Cognitive Load Theory helps to analyze the redistribution of cognitive resources: AI reduces the load on memory and basic operations, but increases the requirements for analytical and reflective thinking (Sweller J., 2016). Self-Regulated Learning Theory explains why students with a high level of self-regulation benefit more from AI than students who are prone to automatic decisionmaking (Zimmerman B., 2008). Argumentation Theory is used to analyze the quality of arguments formed by students when interacting with AI.

Foreign studies pay special attention to pedagogical strategies that have proven their effectiveness. Among them are: the use of AI to generate feedback that requires analysis and reflection; modeling discussions with AI and subsequent reflection; the use of AI as a peerreview tool; critical evaluation of AI responses aimed at identifying errors, biases and logical inconsistencies. These strategies allow students not only to receive information, but also to analyze it, compare it with their own knowledge, form arguments and develop cognitive flexibility.

At the same time, foreign studies reveal a number of risks. Among them are a decrease in independent thinking, uncritical acceptance of AI responses, the formation of false confidence in the correctness of information, and dependence on automated solutions. Excessive use of AI can lead to cognitive degeneration – a gradual decrease in students' ability to perform complex mental operations without the help of digital systems. In

addition, the problem of valid assessment of critical thinking in the context of AI remains unresolved: traditional tools do not take into account the impact of digital technologies on cognitive processes.

Another important dimension in the analysis of foreign research is the study of communicative practices that shape students' cognitive behavior when interacting with AI. In structured academic environments, students demonstrate higher levels of reflection and argumentation, while in informal digital communication they tend to rely on automated responses. This difference highlights the need for pedagogical design that integrates AI into learning activities in a way that stimulates analytical thinking rather than replacing it.

Foreign researchers also emphasize the importance of ethical literacy as part of critical thinking. Students must be able to recognize algorithmic bias, evaluate the transparency of AI systems, and understand the limitations of automated tools. Ethical awareness becomes an integral component of critical thinking in the age of AI, ensuring responsible and informed use of digital technologies.

Despite the contradictions, foreign studies agree on one thing: AI can become a pow-

erful tool for developing critical thinking if its use is integrated into pedagogical design aimed at analysis, reflection and argumentation. In the age of AI, critical thinking is becoming not just an educational goal, but a necessary condition for the student's intellectual autonomy. Therefore, the development of critical thinking requires the introduction of structured pedagogical strategies, teaching students critical interaction with AI, the development of new methods for assessing cognitive skills and the formation of an ethical culture of using digital technologies.

In general, the results of the analysis suggest that artificial intelligence is becoming a powerful factor in the transformation of the educational environment, creating both unique opportunities and significant challenges for the development of students' critical thinking. Effective use of AI in higher education is possible only if students develop critical interaction skills with digital systems, develop reflexive and argumentative abilities, and receive pedagogical support aimed at maintaining intellectual autonomy. Thus, critical thinking in the age of AI should be considered as a strategic competence that determines the quality of training of future specialists and their ability to be productive in a technologically saturated environment.

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