EFFECTIVENESS OF ICT-BASED LEARNING TECHNOLOGIES IN THE DEVELOPMENT OF ALGORITHMIC THINKING

Isroilova Lola
Associate Professor, Navoi State University
Abdurakhmonova Sadokat
2nd year student of Applied Mathematics at Navoi State University

Abstract. *The development of algorithmic thinking is considered one of the key objectives of modern computer science education. In recent years, the integration of information and communication technologies (ICT) into the educational process has created new opportunities for improving students' cognitive and problem-solving abilities. ICT-based learning technologies provide interactive environments that allow learners to visualize algorithms, analyze problems systematically, and construct step-by-step solutions. This study examines the effectiveness of ICT tools in fostering algorithmic thinking among students in the context of informatics education.*

Keywords. *algorithmic thinking, ICT in education, digital learning technologies, informatics education, computational thinking, interactive learning environment, programming education.*

The rapid development of digital technologies has significantly transformed the modern educational environment. Information and communication technologies (ICT) are increasingly integrated into the teaching and learning process, providing new opportunities for improving the quality of education and enhancing students' cognitive abilities. In particular, ICT tools play an important role in the development of algorithmic thinking, which is considered one of the fundamental competencies in computer science education.

Algorithmic thinking enables learners to analyze problems systematically, design step-by-step solutions, and implement them through computational processes. The concept of computational thinking as a universal problem-solving approach has been widely discussed in modern research, emphasizing its importance in the educational process [1]. In general secondary education, the formation of this type of thinking is closely related to the effective teaching of informatics and the application of modern digital technologies in the classroom.

Traditional teaching methods often focus mainly on theoretical explanations, which may limit students' active engagement in problem-solving activities. Researchers emphasize that modern educational environments should incorporate digital tools that promote analytical reasoning and structured thinking among learners [2]. Therefore, the integration of ICT-based learning technologies has become an important factor in creating interactive learning environments that stimulate logical reasoning and algorithmic problem solving.

Digital platforms, programming environments, and educational software provide opportunities for visualizing algorithms, modeling processes, and organizing collaborative

learning activities. These tools increase students' motivation and support the development of computational skills and logical thinking [3]. Consequently, studying the effectiveness of ICT-based learning technologies in the development of algorithmic thinking has become an important research direction in modern pedagogy and computer science education.

Algorithmic thinking is defined as the ability to formulate problems in a structured manner and develop clear sequences of actions for solving them. In educational practice, this skill is developed through tasks that require logical reasoning, pattern recognition, decomposition of complex problems, and the creation of algorithmic procedures. According to several studies, the development of algorithmic thinking is closely related to the implementation of digital learning environments and programming tools in the educational process [4].

One of the most effective approaches is the use of visual programming environments and interactive educational platforms. Such tools allow students to observe the logical structure of algorithms through graphical elements and simulations. By constructing algorithms visually, learners can better understand the relationships between actions and outcomes, which contributes to the formation of systematic thinking skills.

ICT technologies also enable teachers to organize problem-based and project-based learning activities. In such learning environments, students analyze problems independently, develop algorithmic solutions, and test them using digital tools. Interactive simulations and programming platforms allow learners to experiment with different approaches and evaluate the effectiveness of their solutions.

Another important advantage of ICT technologies is the possibility of personalized learning. Modern educational platforms often include adaptive learning systems that adjust tasks according to students' knowledge levels and learning pace. This approach helps maintain learners' motivation and gradually develop their algorithmic thinking skills through progressively complex tasks.

In addition, digital technologies support collaborative learning activities. Online learning platforms and digital classrooms allow students to work together in solving algorithmic tasks, exchange ideas, and discuss alternative solutions. Such collaborative interactions play an important role in strengthening analytical thinking and improving problem-solving strategies [5].

The integration of ICT-based learning technologies into the educational process significantly enhances the development of algorithmic thinking among students. Digital tools create interactive environments that support visualization, experimentation, and collaborative learning, which are essential elements in the formation of computational thinking skills.

The use of programming environments, educational platforms, and digital simulations allows students to better understand the structure and logic of algorithms. Furthermore, ICT technologies make it possible to organize learner-centered education, adapt learning materials to individual needs, and increase students' motivation to participate in problem-solving activities.

Overall, the effective use of ICT in informatics education contributes not only to the development of algorithmic thinking but also to the formation of analytical, logical, and creative abilities. Therefore, the integration of ICT-based learning technologies should be considered one of the important directions for improving the quality of modern education and preparing students for the challenges of the digital society.

References

1. Wing J.M. Computational thinking // *Communications of the ACM*. – 2010. – Vol. 53, No. 3. – P. 33–35.
2. Grover S., Pea R. Computational Thinking in K–12: A Review of the State of the Field // *Educational Researcher*. – 2013. – Vol. 42, No. 1. – P. 38–43.
3. Brennan K., Resnick M. New frameworks for studying and assessing the development of computational thinking // *Proceedings of the American Educational Research Association*. – Vancouver, 2012. – P. 1–25.
4. Kalelioglu F., Gulbahar Y., Kukul V. A Framework for Computational Thinking Based on a Systematic Research Review // *Baltic Journal of Modern Computing*. – 2016. – Vol. 4, No. 3. – P. 583–596.
5. Bocconi S., Chioccariello A., Earp J. The Nordic approach to introducing computational thinking and programming in compulsory education // *European Schoolnet*. – Brussels, 2018. – 84 p.