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METHODOLOGY FOR FORMING ALGORITHMIC COMPETENCIES IN STUDENTS BASED ON PROGRAMMING ELEMENTS

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Abstract. This article describes the methodology for forming algorithmic competencies in students based on programming elements. The essence of algorithmic competence and its role in developing students' logical thinking and problem-solving abilities are analyzed. Additionally, the didactic possibilities of visual programming environments, programming languages, e-learning resources, and project-based educational technologies are analyzed.

Keywords: algorithmic competence, algorithmic thinking, programming elements, computer science education, visual programming, Scratch, Python, digital competencies, problem-based learning, project-based learning, e-learning resources, logical thinking, student competence.

Introduction. Today, the rapid development of the digital economy challenges the education system with the task of fostering 21st-century skills in students. Among these skills, algorithmic thinking and algorithmic competencies are of particular importance. This is because in modern society, analyzing any complex problem, dividing it into step-by-step solutions, and achieving effective results require an algorithmic approach.

Algorithmic competence is an important tool not only in the process of learning programming but also in solving problems encountered in mathematics, natural sciences, and everyday life. Therefore, the development of students' algorithmic thinking through the teaching of programming elements in general secondary schools is recognized as one of the urgent pedagogical issues. Y. Zh. Smagulov and L. N. Karaseva emphasize that the formation of algorithmic competence serves to develop students' logical thinking, problem-solving, and evaluation skills [1]. Furthermore, the development of algorithmic competencies is inextricably linked to the digitalization of the educational process and the effective use of information and communication technologies [1].

In school practice, step-by-step teaching of programming elements, the use of visual programming environments, the application of project-based tasks, and the creation of problem situations are considered effective tools for forming students' algorithmic competencies [4; 6]. From this perspective, improving the methodology for developing algorithmic competencies based on programming elements is one of the priority areas of modern informatics education.

Literature review. The problem of forming algorithmic competencies has been extensively researched by foreign and domestic scholars. In particular, Y.Zh.Smagulov and L.N.Karaseva characterize algorithmic competence as an integrative competence related to mathematical literacy and the use of information and communication technologies. According to them, the construction, modeling, and application of algorithms in solving practical problems have a significant impact on the intellectual development of students [1].

E.V.Baranova, I.V.Simonova, M.I.Bocharov, and V.V.Zabolotnaia studied the importance of e-learning resources in developing algorithmic competence and substantiated that a system of tasks organized based on Bloom's taxonomy develops students' skills in creating, analyzing, and

evaluating algorithms. Researchers define algorithmic competence as the readiness to design algorithms and programs and the ability to apply them in practical activities [2].

F.Khazratov, researching the formation of professional competencies through object-oriented programming languages, notes the development of students' logical thinking, analytical abilities, and independent decision-making skills during the programming process [3]. The author emphasizes that programming languages are one of the primary tools for developing algorithmic thinking [3].

Z.Kh.Mamatova and S.U.Azamova, analyzing modern approaches to teaching programming languages in secondary schools, show that the use of programming tools such as Scratch, Python, and JavaScript develops students' algorithmic thinking and problem-solving competencies [4]. Their research highlights the effectiveness of project-based education and practical training [4].

In her research on improving the methodology for developing the programming competence of future informatics teachers, Y.E.Dzhumoboeva substantiates that problem-based learning, project activities, and the use of digital educational resources are important factors in developing algorithmic thinking [5].

A. Bozorov identified the pedagogical conditions for developing students' algorithmic thinking, creative approach, and practical skills using visual programming tools. The research results indicate that visual programming environments are an effective tool for developing algorithmic competencies in primary and secondary school students [6].

Main part. Analysis of research shows that algorithmic competence encompasses students' abilities to analyze a problem, break it down into smaller parts, develop a system of sequential actions, and evaluate the result. The use of programming elements in the formation of this competence creates important pedagogical opportunities.

The methodology for forming algorithmic competencies based on programming elements includes the following stages:

The first stage is the formation of algorithmic concepts. At this stage, students develop basic concepts such as algorithm, command, executor, condition, and repetition. Students master the basic elements of algorithmic thinking by expressing everyday life processes in the form of algorithms.

The second stage is the use of visual programming tools. Block programming environments like Scratch allow students to build algorithms without focusing on complex syntactic rules. In the process of visual modeling and creating animations, students practically understand the essence of sequence, branching, and repetition operators [6].

The third stage is the implementation of algorithms based on programming languages. At this stage, it is recommended to use high-level programming languages such as Python. Students acquire skills in expressing algorithms in the form of a program, processing data, and analyzing results [4].

The fourth stage is the execution of project and problem-based tasks. Students are given problems based on real-life situations. For example, tasks such as creating a calculator program, developing a simple game, or creating data sorting algorithms serve to develop algorithmic competencies [5].

The proposed methodology utilizes interactive methods, group work, digital educational resources, and electronic platforms. The system of tasks based on Bloom's taxonomy, proposed by Baranova et al., allows for the development of students' cognitive activity, ranging from memorizing knowledge to its analysis and evaluation [2].

It is also necessary to take into account the age and individual characteristics of students when forming algorithmic competencies. While it is advisable to use visual programming environments in the initial stages, a gradual transition to text programming languages in higher grades yields effective results [4; 6].

As a result, the educational process organized on the basis of programming elements allows students to comprehensively develop algorithmic thinking, logical thinking, problem-solving, creativity and digital competencies. This provides the necessary preparation for their future professional activities and successful performance in the digital society.

Conclusion. Thus, directing the process of teaching programming elements in secondary schools toward the formation of algorithmic competencies, the effective use of modern pedagogical technologies, and digital tools is an important factor in developing students' intellectual potential and preparing them in accordance with the requirements of the digital society. In the future, it is advisable to widely implement this methodology in practice and evaluate its effectiveness based on experimental studies.

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