TECHNOLOGY FOR DEVELOPING ALGORITHMIC THINKING OF SCHOOL STUDENTS USING THE SCRATCH PLATFORM

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Abstract. *This article analyzes the didactic capabilities of the Scratch visual programming platform in developing algorithmic thinking in school students. With the help of the Scratch environment, issues of developing students' skills in creating an algorithm, dividing a problem into parts, identifying logical connections, and using conditional and iterative operators are highlighted. Additionally, the effectiveness of project activities organized based on Scratch, game technologies, and visual programming elements in developing algorithmic thinking is substantiated based on scientific sources.*

Keywords: *Scratch, algorithmic thinking, visual programming, programming education, competence, logical thinking, project activity, students.*

In a modern society where digital technologies are developing rapidly, the competence of algorithmic thinking is being recognized as one of the important intellectual qualities of the individual. Algorithmic thinking is important not only in programming activities but also in the systematic analysis of problems encountered in daily life, the step-by-step planning of their solutions, and the making of optimal decisions. Therefore, developing the algorithmic thinking of students in general secondary schools is one of the urgent pedagogical tasks.

Today, the Scratch visual programming environment is widely used as one of the effective tools for forming algorithmic thinking. The Scratch programming environment was developed by the Massachusetts Institute of Technology (MIT) and provides students with the opportunity to learn the basics of programming without complex syntactic rules. The block structure of the platform simplifies the programming process and serves to focus students' attention on the content of the algorithm rather than the syntax of the program [1].

Research shows that the Scratch environment is an important pedagogical tool for developing students' logical and algorithmic thinking, problem analysis, sequencing, and forming a creative approach [3].

Scratch is a visual programming environment in which program codes are created by connecting blocks of different colors. This approach allows students to focus on understanding algorithmic processes rather than the complex process of writing code. The Scratch program contains blocks of actions, events, control operators, looping cycles, condition operators, and variables, which serve to master the basic elements of algorithmic thinking [1; 2].

In the Scratch environment, students master algorithmic concepts during practical activities by creating animations, interactive stories, educational games, and various

models. Such activities develop not only students' programming skills but also their analytical and creative thinking [6].

An important advantage of the Scratch platform is that it engages the student in the educational process as an active creator. The student becomes not a master of ready-made knowledge, but a subject who creates a new product. This fully complies with the requirements of the constructivist approach to education.

Algorithmic thinking is a type of thinking aimed at the step-by-step solution of complex problems. The Scratch environment serves to develop the following algorithmic competencies:

- analysis of the problem;
- break the task into smaller parts;
- planning the sequence of actions;
- use of conditional operators;
- organization of repeating processes;
- checking results and correcting errors.

In a study conducted by Vidal and co-authors in Chile, it was found that classes organized using Scratch significantly improved students' logical and algorithmic thinking indicators. Researchers note that Scratch makes it easier to master algorithmic concepts compared to traditional programming languages [3].

In the Scratch environment, students learn to divide complex problems into separate sub-tasks, develop algorithms for them, and then combine these algorithms into a single project. This process leads to the development of decomposition skills.

The technology for developing algorithmic thinking using Scratch consists of the following stages:

Stage 1. Motivational stage. At this stage, students develop an interest in programming. Simple animations, games, and interactive projects will be presented. Students are introduced to the Scratch environment.

Stage 2. Formation of algorithmic concepts. At this stage, basic algorithmic structures such as sequence, branching, and repetition are studied. Students begin to create simple algorithms. The use of condition operators and loops is reinforced through practical assignments [2].

Stage 3. Project activity. Students develop various projects independently or in groups. Algorithmic thinking is actively developing in the process of creating games, animations, virtual laboratories, and educational programs.

Projects such as "Labyrinth," "Mathematical Quiz," "Moving Robot," and "Traffic Rules" created on the basis of Scratch are effective tools for developing algorithmic thinking [5].

Stage 4. Reflection and analysis. Students test the created projects, correct identified errors, and evaluate the results. The process of debugging (finding and fixing errors) develops algorithmic and critical thinking [5].

As a result of using the Scratch platform:

- the level of algorithmic thinking of students increases;
- logical thinking develops;
- problem-solving competence is formed;
- creativity and innovative thinking are developed;
- skills of collaborative work are formed;
- interest in programming increases.

In the studies of Velasco-Ramírez and Otero-Escobar, it was statistically proven that technopedagogical strategies developed based on Scratch significantly improved algorithmic thinking indicators [4].

Also, Velykdan's study showed that using the Scratch platform can develop students' algorithmic and logical thinking, decompose complex tasks, and form strategic planning and critical thinking competencies [5].

In the scientific works of A. Bozorov, it is substantiated that visual programming environments create favorable pedagogical conditions for forming students' programming competencies [6].

Thus, the Scratch platform is an effective pedagogical tool for developing the algorithmic thinking of schoolchildren. Visual programming technology allows for the mastery of complex programming concepts in a simple and understandable form. In the educational process organized using Scratch, students acquire important competencies such as algorithm creation, problem analysis, decomposition, the use of conditional and iterative structures, and error detection.

Activities organized on the basis of a project develop students' independent thinking, creativity, and critical thinking. Therefore, integrating the Scratch platform into the informatics curriculum of general secondary schools should be considered one of the important factors in forming 21st-century competencies in students.

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