WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 3, Issue 11, Nov., 2022

ROBOTICS IN SCHOOL AS A TOOL FOR FORMING THE STUDENT'S OPERATIONAL THINKING STYLE

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Abstract: in this article, robotics is considered as a means of forming and developing operational thinking of schoolchildren. In addition, the founders of operational thinking and their characteristics are covered in detail.

Keywords: robotics, design, operational thinking, LEGO

The development trends of the current society place high demands on the individual as the implementer of socio-economic innovations. Currently, at various stages of the world education system, great attention is being paid to the problems of studying the mechanism of developing creative imagination, improving its content, improving the methodology of developing creative imagination and different thinking abilities of general secondary school students. Consequently, it has become an urgent necessity to determine the theoretical basis for solving the problems related to hypothesis at the first stage of school education.

The need for schoolchildren to actively use modern information and communication technologies and to form the foundations of information culture, the basis of which is an operative way of thinking, education offered by pedagogues takes priority over the need for more active use of robotic opportunities. [1].

"The formation of operational thinking style skills should begin simultaneously with the development of basic mathematical concepts and ideas," which naturally allows "the introduction of the operational style of thinking into the system of skills and abilities formed by the school." Also, its active formation can be used as a means of learning school informatics and information technologies in classroom and extracurricular activities.

A.P. Ershov proposed to replace the name of the programming method of thinking with "operational", thereby emphasizing its constructiveness and the ability to divide (structure) the description of a complex action into structural operations. In other words, in this new definition of the term, two important components of the characteristics of the operational style of thinking were identified - the algorithmic component in the description of the information process and its operational production. According to the knowledge approach, the quality of education is

measured by the amount of knowledge a student has acquired during the educational process, while the competency-based approach assesses the ability to use and apply knowledge without diminishing the role of knowledge. practical application of existing knowledge in qualitative characteristics of learning. However, after carefully considering the list of skills and abilities included in the operational style of thinking (see below), it is easy to notice that the operational style of thinking in Ershov's interpretation is broader than the algorithmic thinking that is often mentioned in didactics today.

So let's name some of the skills that make up the operational style of thinking.

1. The ability to plan the structure of actions necessary to achieve the goal using a set of tools.
2. Ability to create information models to describe objects and systems.
3. The ability to organize the search for information necessary to solve the problem.
4. Discipline and structure of language means of communication.
5. Timely access to the computer to solve problems related to various fields of science.
6. The ability to organize interaction with a computer and its peripheral devices (keyboard, mouse, scanner, digital input from a camera...).

It seems necessary to form these skills in all those who are in contact with computer technologies, that is, to ensure the effective use of the resources of the modern information society with the majority of people on our planet.

The characteristics of the operational thinking style were initially related to the skills and abilities necessary for a professional programmer, which allowed representatives of this profession (as well as non-professional users) to actively use the powerful tool of the new era - the computer. These skills, associated with a single (albeit promising) specialty, seemed narrowly focused, technological. However, such an assessment of them also forced us to talk about the importance of such a psychological category as the operational style of thinking in connection with the wide and constantly growing distribution of computers and their high, rapidly growing productivity.

But while the thesis about the need to study computer science in secondary school is correct (it will be discussed below), the evidence for this thesis goes beyond the problems of professional training of programmers. In fact, the role of the skills and abilities listed above turns out to be much more important than "technological" knowledge, which allows to increase the productivity of computer equipment and the efficiency of its use (despite the economic importance of the task). In philosophical, social and pedagogical aspects, each of them has an independent (and very important) importance in the system of mental actions necessary for a modern educated person.

Thus, the ability to plan the structure of targeted actions is necessary in every scientific research, in any industry, in the army, in public life, in everyday life. It is especially important for a teacher to be able to plan his activities: the plan is a defining document in the teacher's activity.

The ability to create information models is a special case of the ability to correctly build models in general. This skill is necessary in any scientific research, in any design or technological development, when the creation of a new object must precede the (perhaps very expensive or dangerous) modeling stage. The student model as a system of acquired knowledge, skills and abilities is the object of didactics.

The ability to organize information search is necessary in any scientific, creative, technical work, regardless of where and how the information is stored: in the archive, library, computer memory. The relevance of the ability to find the necessary information in any situation encountered in pedagogy is related to the realization that it is impossible to transfer the entire fund of knowledge accumulated by mankind for thousands of years to a young person within the framework of school education. these conditions must be taught to the young to learn. This thesis is the justification of the principle of continuous education announced by didactics.

Human-to-human communication is no less a discipline than machine-to-machine or human-to-machine communication. The lack of such a quality significantly complicates the communication of people. Usually in society, those who can find a common language with each interlocutor are highly valued. It is especially important for the teacher to build his statements from phrases that are understandable to a certain contingent of students: one and the same fact can be discussed with a third-grader, a graduate student or a university professor. However, in each of these cases, information is conveyed in different parts depending on the level of knowledge of the interlocutor.

The ability to equip one's activity with tools, ie. In each situation, regardless of what tools a person has at his disposal - a notebook, a slide rule, a calculator - it is important to find the appropriate tools for solving the task. The need for such quality is more evident in the case of computers.

Such a global social task - raising generations of young people with a new way of thinking - could not be formulated and defined earlier, because there were no scientifically based methods, recommendations, programs, technical and personnel for the formation of skills and abilities. listed above. In addition, such a task cannot be solved within the framework of traditional school subjects, because none of the scientific subjects, the content of which is reflected in school subjects, has a sufficiently developed conceptual reserve to carry out appropriate actions. Neither the

humanities, nor the biological sciences, nor physics, astronomy, or chemistry, nor even mathematics has such a system of concepts in its composition. Only informatics can offer society such much-needed didactic tools.

The analysis of the experience of teaching robotics in schools of developed countries shows that the design of robots in the lower grades is mainly based on robotics circles and mainly on the use of LEGO WeDo First Robot kits. This builder allows you to assemble robotic models using programs based on free distributed programming.

The use of LEGO construction technology can be seen as the implementation of the concept of "constructionism". According to this concept, students learn when they actively use or create knowledge, rather than based on initial information. And they learn most effectively when building meaningful things for themselves: they do not receive ideas from outside, but create them [2]. Based on extensive scientific research in the fields of cognition, psychology, evolutionary psychology, and epistemology, S. Papert shows how robotics can be used as a pedagogical method and, as a result, a powerful way for students to learn from their own practical experience [3].

S.Papert also concluded that the student will develop if there are conditions for creative activity in an appropriate environment that allows active creation of new products. Working in such an environment, the student uses and creates new abstract concepts, which helps him develop abstract thinking. In general, such an environment can be both computer and development environments based on the integration of computers and real devices.

Research by Papert and his colleagues has shown that when working with learning robots, students learn many key skills called "metacognitive skills," especially in the areas of creative and critical thinking. Necessary qualities of modern specialists, such as the ability to communicate and cooperate, are also being formed.

According to the author, the computer is, first of all, a tool that can give a natural, unformalized character to the educational process, change the nature of teaching, make it more interesting and effective, deepen the assimilation and generalization of the acquired knowledge. possible This fully applies to modern educational robotics, which implements Papert's idea of microworlds, giving us some models of the real world that the learner can create and build.

Based on the author's ideas and under his guidance, and in 1986 at the Massachusetts Institute of Technology with the support of LEGO, a "programmable brick" - a device that connects to the outside world using various sensors and actuators - was created. This has fundamentally changed the approach to creating learning robots. The LEGO company created the NXT microprocessor, which is partially based on the

Programmable Brick technology, equipped with various sensors and controlled by special software.

As a result, it became the basis of programmable learning robots.

Let's look at some characteristic features of the formation of robotics and project-based operational thinking in school.

One of the main tasks in the design of a robot is the correct and careful assembly, which is carried out according to certain rules. Knowing the rules and following the order of the meeting constitutes one of the most important components of the operational thinking style in the student - the ability to plan a structure of targeted actions.

After the goal is set, the student learns to plan his actions to design a new robot or modify the original one. The action plan can be presented by the student himself or together with other students in different forms (verbal, written, graphic) [4]. Younger students learn to break down a general problem into smaller parts, propose and test hypotheses, and decide what to do with unexpected results.

For younger students, they learn to design and work with a robot primarily based on games. The game stimulates the activity of students, instills a sense of satisfaction. Due to the presence of a number of game actions in working with robots, the lessons are very interesting and allow for a deeper acquisition of knowledge, information skills and abilities. In the process of game action, such components of the operational style of thinking are formed, such as the ability to build information models necessary for the implementation of any type of activity to create new objects, and the ability to equip one's activity with tools. In each situation, they learn how to find suitable tools for solving a task, in particular, how to choose one or another parts and devices, as well as how to use them to solve a specific task of controlling the robot's movements.

The ability to build human communication according to the authority of the parties is no less than human-machine interaction. The project of robots is closely related to the process of communication with students, because "first the student is told what he wants to build, from which parts, etc., which later helps the student determine the final result.". In addition, teamwork allows for the formation of the ability to properly distribute responsibilities among all participants in the process of designing and controlling the robot, and contributes to the ability to participate in the collective development of ideas.

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