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Teaching Methods Used in the Process of Learning Robotics in General Secondary Schools

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Abstract: this article provides information about the methods of teaching robotics in general secondary schools. Also, the methods that have shown great efficiency in the use of robotics training are mentioned.

Key words: educational-cognitive, teaching methods, method, passive method, active method, interactive method, teaching forms

The socio-cultural concept of modern education is the basis for a new educational paradigm, which focuses on the process of enriching the rational-logical and emotional-psychic spheres of the student's personality, achieving a single direction of his mind, will and includes activity. These changes are made possible by significant changes in the technology of pedagogical interaction and qualitative renewal of all aspects of the educational process. The main tasks are to revise the content of education and change the relationship between teachers and students.

Overcoming the passivity of students' position is achieved through the use of new pedagogical technologies based on the educational process and active teaching methods. Currently, pedagogical technologies are defined in the literature as a complex integrated process that covers all aspects of knowledge acquisition, includes methods, ideas, tools and methods of organizing activities for analysis, planning, evaluation and problem solving. . In the development of technologies, it is necessary to include activities that encourage students to be active in the educational process.

Teaching methods - the process of interaction between the teacher and students, as a result of which the knowledge, skills and abilities provided for in the teaching content are transferred and mastered. Receiving training is a short-term interaction between a teacher and students aimed at transferring and mastering certain knowledge, skills, abilities.

According to the established tradition in the pedagogy of developed countries, teaching methods are divided into three groups:

1. Methods of organization and implementation of educational-cognitive activities:

- verbal, visual, practical (according to the source of providing educational material).
- productive, explanatory and illustrative, research, research, problematic, etc. (according to the nature of educational and cognitive activity).

– Inductive and deductive (according to the logic of presentation and perception of educational material).

2. Methods of controlling the effectiveness of educational-cognitive activities: oral, written examination and self-examination of the effectiveness of acquiring knowledge, skills and competences;

3. Ways of stimulating educational-cognitive activities: motivation, sense of responsibility, obligations, certain incentives in the formation of interest in acquiring knowledge, skills and abilities.

In teaching practice, there are other approaches to determining teaching methods, which are based on the level of awareness of learning material: passive, active, interactive, heuristic, etc. These definitions require further clarification, because the learning process cannot be passive and is not always a discovery for students.

The passive method is a form of interaction between students and the teacher, in which the teacher is the main actor and manager of the lesson, and the students act as passive listeners who obey the teacher's instructions. . In passive lessons, communication between the teacher and students is carried out through surveys, independent, tests, tests, etc. In terms of modern

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pedagogical technologies and the effectiveness of learning material by students, the passive method is considered the most ineffective, but nevertheless it has its advantages. This is a relatively easy preparation for the lesson by the teacher and an opportunity to present a relatively large amount of educational material in a limited time period of the lesson. Considering these advantages, many teachers prefer the passive method over other methods.

It should be said that in some cases this approach works successfully in the hands of an experienced teacher, especially if the students have specific goals aimed at studying the subject thoroughly [1].

Active method is a form of interaction between students and the teacher, in which the teacher and students interact with each other during the lesson, and here students are not passive listeners, but active participants of the lesson. If in a passive lesson the teacher was the main character of the lesson, here the teacher and students have equal rights. If passive methods imply an authoritarian style of interaction, active methods suggest a more democratic style. Many equate active and interactive methods, but despite the commonality, they have differences. Interactive methods can be seen as the most modern form of active methods.

Interactive method. Interactive means to be interactive, conversational, conversational. In other words, in contrast to active methods, interactive methods focus on a wider interaction of students not only with the teacher, but also with each other, and the priority of student activity in the learning process. In interactive lessons, the role of the teacher is reduced to the direction of the students' activities to achieve the lesson goal. The teacher also develops a lesson plan (usually these are interactive exercises and assignments during which the student learns the material). Therefore, the main components of interactive lessons are interactive exercises and tasks performed by students. An important difference from the usual interactive exercises and tasks is that by completing them, students not only consolidate the learned material, but also learn new ones.

The heuristic method is a method of organizing the student's educational and cognitive activity with predetermined tasks, levels of cognitive activity, educational activities and expected results to achieve didactic goals [2]. Since the elementary school robotics course includes at least mechanics (simple machines, mechanisms, structures, etc.), pneumatics (pumps, presses, manipulators, etc.) and energy (solar cells, hydro turbines)), then the participants of the educational process should learn independently, work with various sources of information, diagrams, instructions. Accordingly, the robotics course contains a small amount of theoretical material, as well as many educational video materials that introduce students to modern developments in the field of robotic systems.

I.Ya.Lerner and M.N.Skatkin identify the following basic educational methods:

Table 1. Classification of teaching methods according to I. Ya. Lerner and M. N. Skatkin

Method	**Explanation method**	**Possible forms of the lesson**
explanatory and illustrative	the teacher conveys the prepared information by various means, and the students perceive, understand and consolidate it in memory.	story, explanation, interview, presentation, report, briefing, exhibition, etc.
Reproductive	students learn information and can repeat it, repeat the activity method according to the teacher's instructions	exercises, algorithms, lecture etc.
way of presenting the problem	the teacher sets a problem and solves it himself, thereby showing the direction of thought in the process of learning. In this	conversation, game, assignment, generalization, etc.

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	case, students master the steps of solving integral problems and follow the logic of presentation.	
partial search (heuristic)	Participation of students in collective search, solving the problem together with the teacher	debate, discussion, independent work, observation, laboratory work, business game, etc.
Research	mastering students' methods of scientific knowledge, independent creative work.	project, creative tasks, research modeling, etc.

Each of the suggested teaching methods can be used as part of teaching robotics in school. The theoretical material included in the mandatory study before the design is carried out using the method of explanation and illustration and the method of presenting the problem. In the initial construction of models, the reproductive method of teaching is used, but in research and creative tasks, it is not. Heuristic and research methods are the most relevant for learning in the classroom as part of additional education, because they help to develop technical creativity of children. It is recommended to single out the following forms of conducting classes at the level of independent and creative work:

- presentation of creative assignments;
- research activities in the educational process;
- game form of examination (rotating game, quiz, quest);
- competition between participants;
– providing oral answers;
- practical task.

Scientific research, creative assignments, and student competitions are very important in the development of students' technical creativity. It is important to develop the following teaching methods [3]:

1. Technical understanding - the ability to correctly perceive spatial models, compare them with each other, recognize the same and find different ones. Many researchers say that working with technical objects also requires special mental abilities, good development of emotional functions, attention, as well as certain motor qualities: coordination, dexterity.

2. Spatial abilities - the ability to work with spatial images. Creativity is very important here.

3. Mechanical ability - knowledge of mechanics, mechanical thinking and understanding of mechanical laws.

4. Practical thinking - a form of thinking that includes goal setting, plans, projects. Developed practical thinking is able to help students master tasks of level 4 complexity when only part of the initial conditions are known.

5. Theoretical thinking is a set of intellectual processes and their results that provide solutions to problems related to technical activity.

Thus, the main form of students' activity in the development of educational robotics is independent intellectual and practical activity together with the form of group and individual work aimed at developing creative, technical thinking and spatial abilities [4]. According to the State Educational Standard, the results of mastering the program should be divided into personal, meta-subject and subject.

Personal results:

- knowledge of safe work rules;
- under the guidance of the teacher, to determine and express the simplest general rules of behavior (ethical norms) for all people in cooperation;
- a holistic perception of the surrounding world and the creative nature of man is formed;
- developed motivation for educational activities and personal meaning of learning;

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- interest in acquiring and expanding knowledge and methods of action, creative approach to tasks;
- creative reaction to problem situations;
- the ability to analyze and control one's actions is formed;
- a properly formed attitude to a healthy lifestyle, the presence of motivation for creative work, work for results.

Metatopic Results:

- to independently define one's own educational goals, set and form new tasks in educational and cognitive activities, develop motivations and interests of one's educational activities;
- the ability to independently plan ways to achieve goals, including alternatives, to consciously choose the most effective methods of solving educational and cognitive problems;
- the ability to connect one's actions with the planned results, to control one's activities in the process of achieving the results, to determine the methods of action within the proposed conditions and requirements, to adjust one's actions according to the changing situation;
- the ability to assess the correctness of the educational task, its ability to solve it;
- to have the basics of self-control, self-evaluation, decision-making and conscious choice in educational and cognitive activities;
- the ability to identify concepts, create generalizations, establish analogies, classify, independently choose the bases and criteria for classification, establish cause-and-effect relationships, logical thinking, draw conclusions (inductive, deductive and by analogy) and draw conclusions ;
- the ability to create, apply and change signs and symbols, models and schemes to solve educational and cognitive problems;
- semantic reading;
- the ability to organize cooperation and joint activities in the field of education with the teacher and peers; work individually and in a group: find a common solution and resolve conflicts based on coordination of positions and consideration of interests; formulating, arguing and defending your opinion;
- the ability to consciously use speech tools in accordance with the task of communication to express one's feelings, thoughts and needs, to plan and organize one's activities; have oral and written speech, monologue contextual speech;

– formation and development of competence in the use of information and communication technologies.

Subject results:

- to know the main basic topics of mechanics, energy, pneumatics;
- to know the main components of the used constructor;
- to know the structural characteristics of various models, constructions and mechanisms; types of movable and immovable links in the constructor;
- acquisition of basic design techniques;
- independent solution of technical problems in the design process (planning of future actions, self-control);
- application of acquired knowledge, techniques and design experience using special elements and other objects;
- describing the properties of objects and recognizing objects by their signs, distinguishing the important properties of objects;
- to carry out research and analytical activities on the practical solution of practical problems using the knowledge obtained in the study of academic subjects.

In conclusion, it should be noted that the correct use of selected teaching methods and methods in the teaching of other subjects is one of the most important aspects in the teaching of robotics. is considered

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