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Methods of teaching computer science in the system pedagogical knowledge

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Abstract: Modernization of education began to wear a permanent, permanent character in the modern world, since the dynamics of changes in the needs of individuals, society and the state for education is steadily growing. For quite a long time, the main subject of the modernization of school education was its content. However, in recent years, it has become increasingly clear that the center of gravity of the renewal and development of education should be shifted towards methods, innovative forms and means of education. The system-activity approach as a methodology for constructing state standards of general education closely links educational results with certain types of schoolchildren's learning activities. It is clear that the use of new types of educational activities will force to look for new innovative forms of their implementation. The subject of the methodology of teaching informatics and a place in the vocational training system for an informatics teacher. Computer science as a science and a subject in school. The connection of teaching methods of computer science with pedagogy, psychology and computer science. Methodical system of teaching computer science in a secondary school. General characteristics of its main components (goals, content of training, methods, forms and means of training).

1. Introduction

The subject of informatics teaching methods has a special place in the system of vocational training for an informatics teacher as a whole. Computer science as a science and a subject in school is bearing fruit at this time. The connection of the methods of teaching computer science with pedagogy, psychology and computer science is this part of the methodological system of teaching computer science in a secondary school. General characteristics of its main components (goals, content of training, methods, forms and means of training).

The introduction to the school of the general subject "Fundamentals of Informatics and Computer Engineering" began the formation of a new field of pedagogical science - the methodology of teaching computer science, the object of which is computer science training. A computer science teaching methodology course appeared in the country's universities in 1985. In 1986, the publication of the methodological journal "Computer Science and Education" began. According to the classification of scientific specialties, this section of pedagogy, which studies the laws of teaching computer science at the present stage of its development in accordance with the goals set by society, has received a new name - "Theory and Methods of Teaching and Education (computer science; by educational level)". In accordance with the State educational standard of higher vocational education, specialty 030100 "Informatics" (2000), the MPI course became known as "Theory and Methodology of Teaching Informatics". However, the established name "Methodology of teaching computer science" continues to be used in the names of training courses, textbooks, regulatory documents. An important role in the development of computer science teaching methods was played by didactic studies of the goals and contents of general cybernetic education, accumulated by the domestic school before the introduction of the subject of computer science, the practical experience of teaching students the elements of cybernetics, algorithmization and programming, elements of logic, computational and discrete mathematics, etc. In accordance with the general goals of teaching, the



methodology of teaching computer science sets itself the following main tasks: to determine the specific goals of studying computer science, as well as the content of the corresponding general educational subject, and its place in the curriculum of high school; to develop and offer the school and the teacher-practitioner the most rational methods and organizational forms of training aimed at achieving the goals; consider the totality of computer science teaching aids (textbooks, software, hardware, etc.) and develop recommendations for their use in the practice of the teacher. A number of publications rightly noted that over a very long period the content of the methodological training of a future computer science teacher was the weakest part (and the most poorly provided part) of his professional training.

The content of the subject of MPI defines its two main sections: the general methodology, which examines the general theoretical foundations of the methodology of teaching computer science, the combination of basic software and hardware, and the private (specific) methodology - methods for studying specific topics of the school course in computer science on propaedeutic, basic and core stages of training. The methodology of teaching computer science is a young science, but it is not being formed from scratch. Being an independent scientific discipline, in the process of formation it absorbed the knowledge of other sciences, and in its development it relies on the results they obtained. These sciences are philosophy, pedagogy, psychology, age-related physiology, computer science, as well as generalized practical experience in the methods of other secondary schools. As N.V. notes Sofronova, "the teaching of computer science at the modern level is based on information from various fields of scientific knowledge: biology (self-governing biological systems such as humans, other living organisms), history and social studies (social systems), the Russian language (grammar, syntax, semantics and etc.), logic (thinking, formal operations, truth, falsehood), mathematics (numbers, variables, functions, sets, signs, actions), psychology (perception, thinking, communication). " In the context of global informatization of all branches of human activity and the penetration of informatics into all other sciences, we can safely say that the teaching methods of informatics are connected with almost any science. This connection was especially strengthened in connection with the transition of the system of general secondary education to specialized education: no doubt, elective computer science courses will be in demand in all profiles and school disciplines.

Goals and objectives of teaching computer science at school

The main goals of teaching computer science at school are formulated in normative documents. However, it should be noted that both the subject and content of the computer science course, as well as its objectives, are still widely discussed and debated. The first draft of the state educational standard in computer science (1997) notes three aspects of the general educational significance of the course and, accordingly, three areas in teaching computer science:

- "worldview aspect" related to the formation of ideas about a system-information approach to the analysis of the world, the role of information in management, the specifics of self-governing systems, the general laws of information processes in systems of various nature;
- "Algorithmic (programmer's) aspect", which is now associated more with the development of schoolchildren's thinking;
- "user" aspect associated with the formation of computer literacy, the preparation of students for practical activities in the context of widespread use of information technology. "

Pedagogical functions of the computer science course

The pedagogical functions of the computer science course, like any educational field, as well as the school subject reflecting it, are determined by the contribution of the educational field to solving the main tasks of general education:

- formation of the foundations of a modern scientific worldview;
- development of thinking;
- preparing schoolchildren for practical activities, work and continuing education.

2. Practical part

In recent years, robotics has been introduced into the computer science course, which has become of great interest to current technical developed children.

Robotics is an applied science engaged in the development of automated technical systems. Robotics relies on disciplines such as electronics, mechanics, and programming.

Robotics is one of the most important scientific and technological achievements in which there are problems with artificial intelligence. At the present stage, problems of robotics are found in the school. Lego robots are built into the learning process.



Fig. 1. Robotic device

In modern society, robots are being introduced into our lives; many processes are being replaced by robots. Fields of application of robots are different: medicine, construction, geodesy, meteorology, etc. There are a lot of processes in life, a person can't even imagine without robotic devices (mobile robots): a robot for all kinds of children's and adult toys, a robot - a nurse, a robot - a nanny, a robot - a housekeeper, etc. Specialists with knowledge in this area are in great demand. And the question of introducing robotics into the educational process since elementary school is relevant. If a child is interested in this area from a very young age, he can discover so many interesting things. Therefore, the introduction of robotics in the educational process and extracurricular hours are becoming increasingly important and relevant. The main equipment used in teaching children robotics in schools is LEGO Mindstorm constructors. In our area, methodological recommendations have been developed for embedding robotics in the educational process. LEGO Mindstorms is a constructor (a set of mating parts and electronic components) for creating a programmable robot. First introduced by LEGO in 1998.

All school kits based on the LEGO® constructor of the FirstRobot NXT are designed for students to work mainly in groups. Therefore, students simultaneously acquire cooperation skills, and the ability to cope with individual tasks that are part of the overall task. In the design process, to ensure that the created models work, and meet the tasks that are set for him. Students get the opportunity to learn from their own experience, to be creative in solving the problem. Students master the tasks of varying difficulty in stages. A key step-by-step principle for LEGO® education provides students with the opportunity to work at their own pace.

The constructor of PervoRobot NXT allows the teacher to improve, take new ideas that allow you to attract and retain the attention of students, organize learning activities using various subjects and conduct integrated classes. Additional elements contained in each set of designers allow students to create models of their own invention, to design robots that are used in life.

These constructors show students the relationship between different areas of knowledge. At computer science lessons, solve problems in physics, mathematics, etc. Models of the NXT FirstRobot Constructor give an idea of the work of mechanical structures, of force, motion and speed, to perform mathematical calculations. These sets help to study sections of computer science - this is modeling and programming.

The purpose of using Lego - design in the system of additional education is to master the skills of initial technical design, the development of fine motor skills, the study of the concepts of design and basic properties (rigidity, strength, stability), the skill of interaction in a group. At the disposal of children are designers equipped with a microprocessor and sensor sets. With their help, a student can program a robot - a smart machine to perform certain functions.



Fig. 2: Models of the NXT FirstRobot Constructor give an idea of the work of mechanical structures

The main task of modern education is to create an environment that makes it easier for a child to discover his own potential. This will allow him to act freely, knowing this environment, and through it the surrounding world. The new role of the teacher is to organize and equip the appropriate educational environment and encourage the child to cognition and activity.

The new FSES require the development of the basics of design and development, and robotics programs fully satisfy these requirements. The educational environment of LEGO combines the LEGO sets specially arranged for classes in the group, a carefully thought out system of tasks for children and a clearly formulated educational concept.

What is LEGO design? LEGO-construction is one of the most famous and widespread pedagogical systems nowadays, which widely uses three-dimensional models of the real world and a subject-game environment for teaching and developing a child. Lego translated from Danish means “smart game”. The LEGO designer encourages to work, equally, both the head and hands of the student. The designer helps children to realize their ideas, build and fantasize, enthusiastically working and seeing the end result. It is LEGO that allows you to study while playing and study in the game.

In this, I see the relevance of introducing the “Fundamentals of Robotics” course at school.

The main goal of the course is to educate a creative, technically competent, harmoniously developed personality with logical thinking, able to analyze and solve problems associated with programming and algorithmization.

Studying the “Fundamentals of Robotics” creates the prerequisites for socializing the personality of students and provides the opportunity for continuous technical education, and mastering computer technologies using lego kits and other robot designers is the way for schoolchildren to modern promising professions and a successful life in the information society. Of course, occupations with work technology will not lead to the fact that all children will want to become programmers and robot builders, engineers, researchers. First of all, classes are designed for the general scientific preparation of schoolchildren, the development of their thinking, logic, mathematical abilities, research skills. The robot does not give ratings and does not give homework, but it makes you work mentally and constantly.

In the last academic year, the school received equipment for organizing classes in robotics in the framework of the republican project "Profile engineering classes." This course helps us solve the following educational problems:

- Development of creative abilities of children.
- Formation of communication skills.
- Formation of an active “I concept”.

Simplicity in building a model, combined with the great constructive capabilities of LEGO, allow children to see a do-it-yourself model at the end of the lesson that fulfills their own task.

The course program can be conditionally divided into two large parts:

- Design
- Programming

Being engaged in designing, children learn simple mechanisms, learn to work with their hands, they develop elementary design thinking, fantasy, and study the working principles of many mechanisms.

Children are tireless designers, their creative capabilities and technical solutions are witty, original. Schoolchildren learn to construct “step by step”. Such training allows them to move forward at their own pace, stimulates the desire to learn and solve new, more complex problems. Any recognized and appreciated success leads to the fact that the child becomes more self-confident.

During the lessons, the communicative activity of each child increases, the ability to work in pairs, in a group is formed, and creative abilities develop.

At the programming stage, students move to a higher level: the gaming component begins to give way to a serious thoughtful study of the LEGO environment, which requires thoughtfulness and patience.

Lego is always a new discovery, a new idea! A new impetus to the development of innovative thinking ... Robotics is fun! Thanks to robotics, my students became active, observant, quick-witted. The world does not stand still, it is always developing, and who knows, maybe it is my students who will create a nanotechnology device or a new robot of the 21st century.

I hope that my students after mastering the skills of robotics will quickly move on to solving complex technical problems and become glorious successors of engineering professions.

3. Conclusion:

Given the above problems, at the moment the robotics program at school is still not available everywhere. However, even without the use of special equipment, designers, and real robots in school programs in computer science and ICT, it is worth starting a study of the introduction to robotics. This will make it possible to familiarize students with the subject, and will also help in further steps in this field of knowledge. In this case, it is enough to conduct only two classes, after which the children will be able to independently engage in robotics.

The basics of robotics for children in elementary school will allow students to understand what a robot is and how it works. Also, children will be interested to know that the concept of "robot" was invented by science fiction writer Karel Chapek in the distant 1920. These are the basics of robotics, allowing you to plunge into a world full of amazing inventions and high technologies that instantly excite a huge interest in this science in children.

In addition, the basics of robotics will help children who choose to study robots in further education. Technologies do not stand still, they are constantly evolving, and it is entirely possible that it is your child or student who will construct a nanorobot that can treat complex diseases. The program of robotics at school is a huge step towards the technologies of the future, towards the development and perfection of technologies.

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