DEVELOPMENT OF STUDENTS' CALCULATION SKILLS IN THE PROCESS OF TEACHING THE SCIENCE OF "DIGITAL CONTROL SYSTEMS"

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Abstract: This article talks about the development of students' computing skills during the teaching of "Digital Control Systems", the essence of the concept of computational thinking, the analysis of various definitions given to it, and the methodological basis of developing computational thinking. Also, the use of mixed educational technologies in the development of computational thinking is presented.

Key words: calculation, thinking, cognitive, teaching, education, digital methods, computational thinking, computer thinking, computer technology, teaching methodology.

The emergence and development of computer technology gave a strong impetus to the use of computing technology in almost all fields of science. In the modern world, it is practically standard to include the analysis of experimental data and the analysis of computational experiments along with theoretical research in scientific work. The concept of "calculation" can be seen not only as performing arithmetic operations, but also as a much broader concept, a way of thinking, a basis for any scientific research.

To date, many foreign scientific and educational organizations are actively developing the concept of "mobile technologies". Including the US National Academy of Sciences, the British Computer Society (BCS, The Chartered Institute for IT), the International Society for Technology in Education (ISTE), the Computer Science Teachers Association (CSTA), the international non-profit Stanford Research Institute (SRI), Google academy and others.

The subject of "Digital Control Systems" focuses on the formation of a culture of using high-level information technologies and a new scientific outlook of students in higher education institutions. The ability to think outside the box is important for professionals in any field, especially for students whose future careers are related to computer science, which is developing rapidly.

Therefore, studying science requires from students not only a high level of mathematical training and professional knowledge of modern computer technologies, that is, a specially developed thinking that allows easy transition from problem formulation to solution, and serves as an impetus for the formation of competence to create a problem-solving algorithm.

According to V.S. Kornilov, digital management systems "help the expansion of students' worldview: they gain an understanding of the interpenetration and mutual enrichment of scientific methods, approaches and methods developed in different fields of knowledge" [2].

In the training of specialists in higher education institutions, there is a contradiction between the large amount of professional and general cultural information necessary for the

professional activity of a future specialist in a certain field and the time limit allocated for obtaining higher education.

This contradiction can be overcome by introducing mobile technologies into the educational process together with the development of appropriate methodological support. That is, it is necessary to form a science information environment that allows students to work independently, as well as cognitive and research activities that develop computational thinking, practical and developing knowledge, based on the modern capabilities of mobile technologies.

If we look at the history of digital control systems, it goes back to the times when Archimedes studied the number p bilaterally using the calculation algorithm in 220 BC. Over time, approximate methods of solving various mathematical problems were formed in departments of computational mathematics, and based on them, the content of teaching numerical methods was formed.

In the second half of the 20th century, along with the development of computer technologies, Numerical control systems for solving problems in mechanics, physics, chemistry, science and other fields of technology: endoscopic surgery, computer diagnostics, tomography, fusion reactors and many other areas familiar to the modern world began to develop rapidly. Today, no field can be imagined without computer technology. The emergence of new algorithms for digital control systems, parallel computing, the use of neural networks, genetic algorithms, developments in the field of creating a quantum computer will bring new changes to this field. Computational thinking, along with theory and practice, became the main pillar of the thought process, with the help of formal operations on numbers, certain mathematical results were obtained.

Nowadays, the science of "Digital control systems" is an important subject in the training of specialists in many fields, and the numerical analysis of mathematical models is an effective research tool in any practical development.

Regardless of the field of study, the main forms of teaching in the study of "Digital control systems" are lectures and laboratory or practical exercises. Organizational, methodological and information tasks are delivered to students through lectures. It is in the lectures that the teacher reveals the conceptual apparatus of the science of "Digital control systems", gives a complete understanding of the science and shows its connection with other disciplines of professional training.

An active form of teaching is laboratory or practical training, which helps to strengthen students' theoretical knowledge, increase the effectiveness of teaching, and acquire professional skills.

Traditionally, great attention is paid to independent work of students. Independent work can be divided into the following types: traditional independent work of students outside of class, which is done independently at a time convenient for students; independent work during the

lesson under the supervision of the teacher; information and communication independent work using information technologies [5].

As a set of working tools for solving practical problems in the study of numerical control systems, specialized mathematical sets are increasingly used to activate the educational process. I. V. Belenkova believes that the use of specialized software increases the professional information competence of future specialists. However, the choice of software significantly changes the approaches to teaching "Digital Control Systems" [1].

Yu.I. Kapustin describes the model of mixed education as a model of using distributed information and educational resources using elements of asynchronous and synchronous distance education in full-time education [3]. Blended learning focuses on developing the skills of independent work, teamwork, and collaboration.

Many studies on blended learning technologies have highlighted its positive aspects:

- every student will have the opportunity to learn the necessary knowledge and skills in a convenient format;
- planning and understanding what needs training should meet and what results it will bring;
- provision of effective educational management tools;
- reducing the time and financial costs of training without losing the advantages of the traditional approach;
- enriching and complementing technologies and teaching methods;
- active social communication of students with each other and teachers;
- the presence of the teacher is almost constant;
- the possibility of teaching regardless of time and place;
- variety of didactic approaches;
- improving the quality of education (including through the use of more effective educational tools);
- individual control over training;
- the natural development of modern work, organization of means of communication by students;
- the priority of the student's independent activity;
- organization of individual support for the educational activities of each student;
- integration of educational and methodological online and offline reusable content.

Many Internet services (cloud technologies, social networks, communication tools) can be used to organize mixed education. But it is more effective to use special software that provides centralized management of the educational process. It has the ability to use various formats of educational materials, supports modern standards in the field of distance education, provides means of communication between participants of the educational process. Such systems make it possible to effectively organize the educational process and independent work of students,

to increase the interest of students by introducing new forms of education, to develop the professional competences of students, their social and professional mobility.

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