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FOREIGN EXPERIENCES AND ANALYSIS OF COMPUTER MODELING TRAINING

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A B S T R A C T

This article is devoted to the problem of teaching computer modeling in foreign countries. The article suggests that this problem can be solved by offering specific elements and action programs from primary school age. The article is unique, and on foreign experience it will be possible to make sure that the issue of modeling is relevant and important.

K E Y W O R D S

experience, modeling, national program, plan, technology, programs.

Introduction

The study of the experience of teaching foreign countries' students of computer majors, the analysis of regulatory documents (DTS, model programs) shows that traditional teaching does not set the goal of teaching students the computer modeling method, training a specialist He showed that he was independent of his specialty. Research has taught that specialized professional knowledge acquired by graduates in this field is abstract, unrelated to problem solving, and therefore not always required. Best practices require the following to be followed to overcome these shortcomings:

1) mastering computer modeling directly in the process of computer learning allows to provide better professional knowledge;

2) it will be necessary to introduce a course that will teach students to model in professional activities in accordance with the appropriate scientific methodology.

- In the foreign scientific research conducted on the issue, including N. Viner and A. Rosenbluta's scientific report "The role of models in science" ("Role modeley v nauke"), he says: "a new stage has begun in the development of modeling. This stage is characterized by great attention in the literature of philosophy and at the same time the increased attention of natural and technical specialists to the general methodological issues of modeling" [7].
- In these opinions of scientists, serious steps were taken in the study of modeling as a method of knowledge, its relations with other methods, the epistemological functions of models, and the description of the essence of various models. At the same time, it became clear that there are differences in the interpretation and understanding of a number of philosophical questions of modeling. Modeling is based on the assumption that the original and the model are similar. Both of these not only have a common nature, but also belong to processes and events of completely different classifications. On the basis of these ideas, we will do a comparative analysis of a number of unique opportunities and actual work of foreign countries in the field of teaching computer modeling.

- All the terms mentioned above are significantly different from information and communication technologies (ICT), which mainly use computer modeling as a tool. Summarizing the introduction of computer modeling teaching technologies and models into the educational practice of foreign countries, the existing systems of higher education are considered, and we highlight the following criteria for their implementation:
- the term used to define the role of the studied field of knowledge in the curriculum (compulsory / optional / other);
- the role of higher education in the curriculum (compulsory / optional / other);
- represents the field of knowledge as an integrated or independent component;
- proposed strategy and effectiveness;
- specialists responsible for the formation of meaningful content;
- a contingent of teachers in the training of modeling personnel.

In recent years, the content of higher education on computer modeling, as well as the role of modeling techniques for students in curricula and programs, has been the cause of intense discussion by the pedagogical community.

Based on the analysis of the results obtained during the research, many countries are introducing computer modeling into the curriculum. For example, the majority of countries (17 out of 21) participating in a study conducted by the European Network of Schools reported that they are ready to actively introduce computer modeling into learning development and educational practice [1].

Depending on the national education policy, individual countries use different models and approaches to this issue: some countries focus on 12 years of continuous education in computer science, others mainly at the ninth grade or high school level , and others are engaged only in higher education.

English education was one of the first to include computer modeling as a separate subject in the educational program [4]. Other countries have chosen to combine this field with other subjects, for example, making programming an interdisciplinary element reflected in the entire curriculum. The first approach seems to be the most natural alternative, but there are various reasons why some foreign countries choose the second one:

- lack of free content space in the curriculum or educational standard to include a new subject in the curriculum;
- allowing students to see and experience the use of modeling in various disciplines is a way to increase interest among groups of students who do not have profiling or deepening in the field of informatics;

Modeling is also becoming increasingly important in social fields, it provides a basis for the further development of ICT competencies and the formation of core competencies for solving increasingly complex problems. Because modeling has traditionally been primarily a university-level subject, there are no generally accepted standards for the content of lifelong learning in this field.

The global interest in this field is very new, the amount of research confirming the degree of influence of the proposed topics and directions on the formation of the student's personality is limited, so it is not wise to single out a separate educational subject at this stage.

Various models of introducing computer modeling, programming, and computational thinking into higher education are being considered. In order to achieve reliable results, it is necessary to synthesize current practice and thereby develop a common understanding of different approaches to accelerating computer modeling in education. Experiences in the following countries serve as a basis for modeling.

Each country has its own national education system, the current state of computer science in the curriculum, and the current state of student training.

Important questions to consider: What topics should be included in the study? What topics should be covered? In general, how is the topic represented in the entire educational system? What is the expected result of the change? Which specialists are responsible for the new content? What type of training should be offered to teachers? What changes have been made to teacher training programs? What are the criteria for evaluating the degree of achievement of the expected result? How and by whom is the training material developed?

In addition to modeling, the national educational models under consideration in countries are focused on digital competencies or the topic of broader computing or informatics. Modeling is rarely explicitly mentioned, but ideas are often introduced by modeling in one form or another. The most common model for teaching computer modeling is optional in higher education, which several countries have made mandatory at each stage of Education. There are also models to introduce learning to computer modeling only at the high school stage.

Informatics is a well-established academic term for the scientific discipline at the heart of current digitization and Information Technology. Computer science and computer technology are usually seen as complex. In foreign pedagogy, both concepts represent a common field of knowledge, where computer technology is not taken into account independently of Informatics. Programming and coding are usually used as a substitute for modeling when forming the content of a field related to the construction and implementation of algorithms. European experience suggests that most countries use modeling in their curricula and emphasize this orientation as a separate discipline or as a didactic unit. The globalization of the digital world is changing the content of this term, pedagogical and technical teams describe approaches to understanding the meaning from different positions. In recent years, the importance of computer modeling as a special form of human and machine interaction has increased. Computer modeling is based on" formation-related thought processes". [2].

The generalization of the experiment was carried out by reviewing the relevant documents for each country, publications from official sources and the results of an open study. The review was conducted in accordance with the principles of content analysis [6]. The main idea of content analysis is to analyze the material of the text, Shorten and generalize it according to criteria predetermined or added during synthesis.

Australia. Australia's higher education system is undergoing significant changes with the introduction of a national curriculum [7]. In 2015, Australia approved the national technology curriculum [8], which includes digital technology and design technology. As part of Digital Technologies (DT), children must develop modeling skills and learn how to implement solutions through data, digital systems, and modeling. According to the content concept, DT in the Australian curriculum is a "field of education" in the autonomous sciences alongside English, mathematics, natural sciences, humanities and social sciences, arts, foreign languages, health and physical education.

ICT capabilities generally correspond to learning goals in the field of DT, but also represent the metasubject core of competencies required in other areas of knowledge.

In Australia, a primary school includes the first year known as a foundation (f), followed by the first, second, and similar Years 6 or 7 (depending on the state), and the secondary school years 7 or 8 and 12. The objectives of the curriculum are organized around a number of groups for each phase, from F

to the upper course. While the goals and content of primary education are mandatory, high school students can choose specific trajectories in the field of DT learning.

The DT curriculum is characterized by an emphasis on the development of modeling skills and the degree to which digital technologies can be applied. The process begins in the F-2 range, with the study of the target game based on modeling. This will make it easier for readers to understand the relationship between the real and virtual worlds, make it easier to use technology in communication, understand the importance of clear instructions and a simple problem, feel the digital world.

In grades 3-6, they gain a broader understanding of the effects of technology, including family and group relationships, and can work on modeling more complex projects aimed at practical application of results. During this period, they begin to develop algorithms using visual software. During the 7-10 years of study, students go beyond the communicative framework of their original community, participating in the interaction of information, taking into account the norms of social and moral behavior. Using technology, they solve more complex problems by modeling and develop an understanding of abstract processes, using modeling to solve problems and create digital solutions.

- In higher education, the student's activities are independent and the opportunity is developed to be able to offer variative solutions based on modeling the proposed problem. It mainly applies research, new solutions, innovative ideas.
- Australian educators should generally be qualified to teach in various fields as well as have mastered the basics of computer modeling in depth[8]. Offers such as Massive Open Online Courses (MOOCs) [8] and systematic review of computer science resources, in-demand DT teaching curricula in the professional field if there is insufficient qualifications serve to provide adequate training assistance to teachers.
- England. In England, a new national curriculum came into force in 2014 [6], currently England is one of the few countries to focus on in-depth learning rather than as an integrated Department in computer modeling. Informatics science includes three structural components: informatics, information technology, and digital literacy. The main purpose of the science is to form the following set of skills in students [4]:
- understanding and application of its basic principles and concepts in computer modeling, including abstraction, logic, algorithms and data presentation;
- analysis of real problems from the point of view of modeling, having practical experience in computer modeling to solve such problems;
- application of new or innovative technologies in analytical assessment and computer modeling to solve practical problems;
- to be a responsible, competent, reliable and creative user of information and communication technologies.

In Finland, the mechanism for teaching computer modeling is included in the content of new national curricula updated in 2016, with an increased emphasis on digital competence as an interdisciplinary component. In the Finnish school and higher education curriculum, the content of computer modeling includes programming as a holistic element. school education modeling at the stage is taught in the content of mathematics for grades 1-2, mathematics and craft Science for grades 3-9. In addition, modeling is part of the numerical competence that encompasses all disciplines, which means that modeling can be integrated into all disciplines. in higher education, computer modeling is reflected in technologies based on modeling of topics in the content of all subjects.

In Finland, the National Board of Education and the Ministry of Education and culture funds projects, professional development and skill development programs to support teachers in mastering instructional pathways and mastering materials for Program training and integration into education.

In addition to initiatives supported by the state, various activities are also carried out by private subects, higher education institutions and organizations. In 2014, the Ministry of Education and Culture published a report on specialized programs for teacher training. One of the programs adopted considered teaching and teaching technologies in the digital environment.

In New Zealand, computer modeling refers to continuing education in higher education curricula, starting with school education. this process has been an autonomous subject of study for the last three classes of the main school since 2011. in the previous system, however, the focus was on teaching schoolchildren to use the computer correctly at the same stages of Education [2]. Programming and informatics are considered in the context of the direction of digital technologies: modeling and programming, human and computer interaction, artificial intelligence and computer modeling. Students form a primary vision of the above directions and technologies. After graduating from base school, students acquire skills about modeling technologies and areas of application of digital knowledge.

Work in Korea to train young people in computer modeling began in 2000. After South Korea'S ICT infrastructure was supplied with a computer for almost every class, computer-related content became almost mandatory. each lesson lasts more than 34 hours. in school curricula, the subject was designated as an optional subject. In 2007, computer education was replaced by Informatics in the national curriculum, with a focus on the principles and concepts of Informatics.

Since 2008, public policy in education has been shifted to the computer field extracurricular form of education at the school level. In 2018, a new curriculum was introduced in South Korea. The curriculum includes digital literacy, programming, and modeling. As the education system in South Korea is primarily textbook-oriented, new textbooks are currently being developed for the new curriculum.

The education system in the United States is decentralized. Each state has its own curriculum in this regard. At the same time, on the scale of the Republic, there is a trend towards the development of knowledge in computer modeling for all age groups. Leading organizations (ACM, CSTA, Code.org, CIC and NMSI) are working together to organize computer science education and develop core Informatics programs with 12 years of school education (K-12). Organizations constantly monitor the demand for the main directions and qualifications of specialists in the computer community: what should graduates of the K-12 program know and be able to do in the field of Informatics? What does the community expect from every student who graduates from elementary school, high school or high school? The basis of the study is the basis of the knowledge acquired in computer modeling, which provides fundamental learning that benefits each individual.

The purpose of the study is to determine the basic requirements and qualification requirements of a K-12 graduate who needs to learn computer modeling at the school stage in order to prepare for the modern requirements of the new century. Competency content refers to job requirements for computer modeling specialties or software engineers. The minimum content required defines 5 basic concepts and 7 practices. Concepts: devices, networks and communications, data and analysis, modeling and programming, and the effects of computing. Practice: Recognition and presentation of computational problems, Development and use of abstractions, creation, testing and repeated improvement of

computational objects, promotion of inclusive computing culture, communication about computing, and collaboration around computing.

A new advanced course called “CS Principles” was developed to support young people who wanted to study computer modeling at an advanced level, aimed at revealing a broad understanding of modeling capability and organized around 7 major computer ideas: creativity-based modeling, abstraction, data, algorithms, programming, the Internet, and global Impact [6].

Educational systems in the field of computer modeling of different countries differ significantly. This makes it difficult to find common features and generalize the experience according to similar criteria. At any stage of Education, interest in the computer has never been as high as it is now. Many countries have incorporated or intend to incorporate computer technology into their national curriculum in one form or another. At the same time, the educational systems of different countries are very different from each other. Comparing and summarizing this experience makes it difficult to learn from each other. the educational trend is in favor of computer thinking, the introduction of digital competencies, starting with primary education. in this regard, the computer is focusing on developing more advanced courses on the impact and importance of modeling on society.

The importance of computer modeling is rarely explicitly mentioned, but its ideas are often included in one form or another. A common model of teaching computer modeling is to make computer modeling mandatory in elementary school as a science, and optional in high school. In the future, some countries plan to formalize the mandatory nature of the study of this discipline at all stages of Education. The training and support of professional teachers with relevant knowledge and skills, the development of an appropriate system of teacher retraining in harmony with educational materials in the entire educational system consists of common goals for all countries. The success of the educational system is determined, first of all, by the potential of personnel who carry out public policy in direct contact with students.

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