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COMPETENCE OF COMPUTER MODELING IN THE CONTEXT OF MODERN EDUCATION

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Abstract: The study of computer modeling at various stages of the educational process - from school to university is considered, competencies acquired by students in the study of computer mathematical modeling are formulated and the need for further development of competencies acquired at school is substantiated. A new approach to teaching students of mathematical directions is proposed preparation of mathematics and computer science by means of computer modeling. This technique is built on the principles of the competence approach, interdisciplinary connections of the educational disciplines of mathematics and computer science, contributes to the formation of research competence.

Keywords: computer modeling, research competence, mathematical modeling, student training, interdisciplinary communication, Cognitive, Praksiologik, Motivational, Reflexive, Components.

INTRODUCTION

The formation of a modern educational paradigm is associated with a change in the knowledge-based approach in teaching academic disciplines to a competence-based one, with the formation of modern functional literacy in

students, the development of skills for searching for new knowledge, its critical analysis and integration, the ability to live and work in conditions of uncertainty. Changes in society and science and technology are creating new problems in the education system. Today, university graduates are not required to have specific knowledge and skills, but to have an integrated competency that ensures that they are prepared to apply their knowledge and skills to succeed in a particular field. Such changes focus on improving the higher education system, which is tasked with shaping professional competencies, as well as training teachers who are ready to take on new tasks in the education system.

MATERIALS AND METHODS

Although there is a formal definition of the concept of mathematical and computer models, it is possible to convert a mathematical model into a computer model using information technology tools. Due to the close connection between the mathematical apparatus of a personal computer and the means of calculation, it is possible to construct a computer model for any mathematical model. It is recommended that the content of mathematical competence, which provides the use of mathematical analysis and modeling methods, be determined on the basis of mathematical modeling stages [3], as they are formed in conjunction with the components of professional activity defined in the State Education Standards: 1. Mathematics issue formalization phase. 2. The stage of implementation of mathematical modeling methods. 3. The stage of analyzing the information and checking its compliance with the model.

Problem design is the first stage of modeling, aimed at developing the student's mathematical culture and acquaintance with mathematical language, more active application of knowledge gained in the process of creating mathematical models in their professional activities. At the formalization stage, the system under study is described: that is, its purpose, nature of activity, resources used and normative parameters are determined, the object of modeling is studied, available data are analyzed, constraints and assumptions are identified. The functional

dependencies that connect the variables and parameters of the model are identified, the specified elements are introduced: ie variables, assignment parameters, indices, on the basis of which the mathematical notation of the problem is performed. It is therefore proposed to highlight the identified model composition as a separate component. It is also suggested to include mathematical modeling competence as an integral part of mathematical competence. The concept of mathematical modeling competence can be found in pedagogical theory [4]. This competence plays a key role in the professional component of mathematical competence, as mathematical modeling becomes a working tool for the professional activities of a graduate of any information technology direction.

The competence of mathematical modeling is defined in the process of solving professional problems as the ability to implement and apply mathematical knowledge and methods in the construction, analysis and interpretation of mathematical models. Therefore, special software tools and environments in the professional activities of mathematical modeling; - the ability to implement the use of software packages predetermines access to the content of mathematical competence; - Mathematical modeling tools in application software packages. One of the tasks of higher education institutions, which is receiving serious attention today, is to organize independent educational activities of these students. Experimental studies have shown that metacognitive activity enhances students ’ability to understand the meaning of what is being studied in different areas of knowledge [5], which successfully develops metacognitive skills, including allowing us to consider mathematics as the key to teaching. Both local and foreign researchers have been involved in the formation and development of various components of metacognitive competence, including A.L. Brown, J.H. Flavell, A.V. Karpova, M.A. Cold and so on can be mentioned. Develop self-discipline and organizational skills in an electronic environment is a promising direction of pedagogy [6, 7]. This allows for the implementation of teaching methods that

contribute to the development of knowledge and metacognitive skills, allowing students to reflect on the actions they have taken.

That is, in contrast to the existing and above-mentioned components of students' mathematical competence in the field of information technology, it includes the following competencies: design in software packages, mathematical modeling, self-organization throughout human life, and it is suggested that metacognitive competence, which characterizes readiness for self-study, be incorporated into mathematical competence. The introduction of this competence requires new requirements for the results of training of graduates set by the state educational standard of higher education, international standards, as well as modern trends in the implementation of e-learning environment, the independence of students' knowledge, self-education. The formation of the ability to learn is of particular importance.

Following the views on the concepts of meta cognitivism, reason and reflective activity [10, 11], it is proposed to highlight the main components of metacognitive competence in teaching modeling in an electronic environment, through which the student manages the learning process: - Goal setting - component aimed at acquiring the ability to set goals in the implementation of mathematical activities. - Planning - the component helps to develop independent decision-making skills in determining the amount of mathematical material being studied and effective learning priorities. - Regulation - the component is aimed at understanding the advantages of using mathematical apparatus in professional activities and developing the ability to cope with problematic moments. - evaluation - the component reflects the ability to analyze and evaluate the effectiveness of its mathematical activities. Based on identified components, metacognitive competence is characterized by an individual’s ability and readiness to expand general and professional horizons based on self-organization and continuous learning, including its components: goal setting, planning, regulation, and evaluation. enters.

It is also proposed to consider mathematical competence in the construction of its structural-semantic model within the framework of a four-component structure consisting of cognitive, phraseological, motivational-value and reflexive-evaluative components [12, 13]. The cognitive component of mathematical competence is applied to the amount of mathematical knowledge required to work with mathematical concepts, categories, theories, and laws using special symbols. At the same time, a distinctive feature of the professional component of the bachelor of computer science is the development of sufficient knowledge to apply mathematical modeling methods independently in professional activities, including the use of automated software packages. The praxeological component includes skills, abilities and experience in the practical application of mathematical knowledge in professional activities is responsible for the ability to construct real-world objects in mathematical language and to create models based on the specific situational conditions of professional activity.

The main content of the praxeological component in the preparation of bachelors in computer science is the ability to identify important parameters of the original object in the construction of mathematical models, in addition to mastering the methods of mathematical modeling in software packages, used to obtain new information in the modeling process. This skill reflects the professional competence of the mathematical modeling apparatus and the instrumental capabilities of mathematical sets in solving professional problems.

Structural and meaningful model of mathematical competence

Components	**Competence components**			
	Cognitive	**Praksiologik**	**Motivational**	**Reflexive**
Demonstration of ability	Knows mathematical language and mathematical	Knows how to build real world objects using special	Mathematical tasks understand the	onducts critical analysis can be

	symbols	characters in mathematical language	importance of formula	expressed in real mathematical symbols
Competence of Computer Modeling	knows the mathematical apparatus of the main sections of computer modeling and is able to determine the purpose of computer modeling	well versed in computer modeling techniques, knows how to model professionally	understands the importance of equipment for computer modeling, understands the need to create computer models and solve practical problems	assesses the level of skill in computer modeling, knows the apparatus for constructing mathematical models
Competence of Computer Modeling in an E-Learning Environment	knows the functionality of applied mathematical software packages	has the instrumental capabilities of mathematical packages for solving practical problems	understands the professional excellence of mathematical modeling. Understands the benefits of software packages	the ability to evaluate model parameters obtained in an e-learning environment
Metacognitive competence	knows computer modeling,	can define goals and	understands the benefits of	analyzes the process and

	knows effective ways of organizing activities	prioritize computer simulations	computer simulation equipment for professional development works in the context of the 'lifelong learning' trend	level of self-education, implements computer modeling activities through self-organization, through self-management and self-assessment

The motivational-value component defines a personal attitude to mathematical activity and a set of value orientations in solving professional problems and is aimed at forming a positive attitude to mathematical activity as part of professional activity.

RESULTS AND DISCUSSIONS

What role does computer modeling play in the training of a computer science teacher? It is not difficult to emphasize that the content of this subject is absolutely necessary for mastering by students, starting from a school computer science course and teaching modeling concepts. We can say that computer modeling provides a basis for the application of information technology in the teaching process. However, if we talk about the implementation of qualitatively new technologies of teaching computer science (project and research work of students, the implementation of various forms of work with gifted children, etc.), then students can use the subject "Computer Modeling" we need to be equipped with the knowledge and skills needed for research and projects that are done at the right level.

Directions of information technology are reflected in the specificity of the profession of graduates and the importance of mastering the mathematical apparatus to create mathematical models and the professional advantages of applying mathematical modeling methods in specialized programs in solving professional problems. The reflexive-evaluative component determines the ability to self-assess, analyze, plan, and achieve set goals in the process of mathematical activity. The professional direction of mathematical competence allows to understand the essence of the studied phenomena, to understand the problems in the process of professional activity and to critically analyze the level of their mathematical readiness for decision-making, the chosen mathematical model. Thus, summarizing the components and components of mathematical competence, a structural model of mathematical competence of bachelors in the areas of information technology of teaching, given in the table above, was developed. Thus, computer modeling can generally be thought of as a modeling process based on computer technology. In this case, the computer can be used to solve the analytical model and to simulate the behavior of the modeled object and to visualize the simulation results. When considering the types of models, it seems to us that it is necessary to clearly define the position of the simulation models in the above classification of abstract models. Although simulation models have a serious mathematical content, they seem to us to have an intermediate position between mathematical and information models. If modeling is used to simulate complex systems, it is not possible to fully describe the system simulated using mathematical tools alone.

However, the basis of the simulation model is an algorithm that is a more informative concept than mathematics in this respect. Thus, in our view, simulation models are not just a mathematical model. Nevertheless, mathematical simulation plays a very important role in modeling, which does not allow us to classify these models as information only.

The next part of the course focuses on the stages of mathematical modeling:

• problem formulation;

• definition of modeling goals (understanding, management, forecasting);

• design (determination of model parameters);

• search for a mathematical description of the model;

• create a mathematical model;

• model research (solution);

• Analysis and interpretation of simulation results.

CONCLUSION

The novelty of the proposed content-based model is the content of mathematical competence, which allows to organize teaching in an electronic environment, and to define it as part of mathematical competence is a metacognitive competence that characterizes a person's ability and readiness to self-organize and lifelong learning competence. On the basis of the proposed content-based model of mathematical competence, it was proposed to create an effective methodology for the formation of mathematical competence in the teaching of modeling to bachelors of computer science in the electronic environment in the future. The proposed structural and meaningful model of the bachelor's mathematical competence in the field of information technology is presented in four components, including cognitive, praxeological, motivational-value and reflexive-evaluative components, as well as components of mathematics. competencies: formalization competence, mathematical modeling competence, mathematical competence, modeling in software packages, and metacognitive competence.

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