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THE IMPORTANCE OF MATHEMATICAL MODELING IN THE DEVELOPMENT OF MATHEMATICAL COMPETENCE SKILLS IN STUDENTS

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Annotation: The article describes the issues of the importance of mathematical modeling in the development of mathematical competence skills in students of higher educational institutions and ways of their use.

Key words: Model, mathematical model, mathematical competence, mathematical modeling, mathematical apparatus.

Improving the teaching of mathematics in higher education institutions is one of the urgent problems, because despite the fact that most of the graduates have a sufficient level of theoretical knowledge in this subject, they face certain difficulties in the practical application of this knowledge in the course of their professional activities. will come. The effective solution of these problems requires paying attention to the formation of mathematical competence in students, using the principles of modern teaching methods and pedagogical technology. Because the importance of teaching mathematics in higher education institutions is that mastering this subject at a sufficient level:

helps to deepen understanding of general engineering and special subjects;

a lot of knowledge and qualities necessary for a specialist are formed (because they are based on the ability to use mathematical equipment).

Based on this, the considered problem is closely related to improving the training of specialists through the means of mathematical knowledge and mathematical methods. The solution of these problems rightly leads to the search for such opportunities in mathematics, which, as a result of its application, forms the ability of students to use mathematical apparatus in the process of teaching mathematics. As a result, it increases the possibilities of preparing the future specialist for practical professional activity. This is reflected in the formation of mathematical competence skills in students.

Based on the goals of higher education institutions, it is considered appropriate to introduce modeling elements through the main direction of education, and as a result of its application, students will have ideas about the essence and method of mathematical modeling formation, as well as for their future activities. acquires necessary simple and specific mathematical models and develops them in the course of future professional activities.

Currently, the teaching of mathematical modeling methods in higher education institutions constitutes only a certain part of the training of future specialists, and as a result, the training of modern, competitive specialists in a certain sense does not meet today's requirements. The potential of mathematics is especially evident in the training of specialists in economics, technology and medicine (mathematical modeling is not used to a sufficient degree).

In our view, it is easier to describe mathematics itself than to convey to students the understanding of "The fact that a large number of subjects are taught in higher education institutions: the development of mathematical modeling methods and the methods developed to solve today's problems" is dying.

Solving issues related to the future specialty through mathematical modeling:

improving the training of future specialists through the teaching of mathematical modeling;

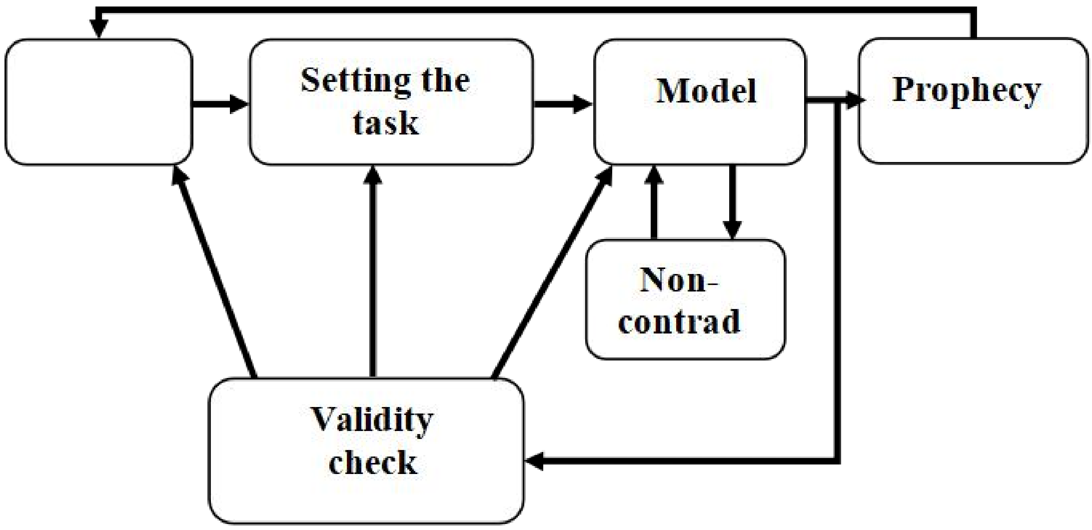
elimination of contradictions in teaching mathematics constitutes the content of the work and determines its relevance.

However, acquiring mathematical knowledge alone is not enough to perform this or that practical task in practice, it is also necessary to develop skills in transferring the initial expression of a given practical task into the language of mathematics, i.e. the mathematical skills that arise in specific practical situations. knowledge of task setting methods is required.

The task of mathematical modeling is to describe the "existing world" in the language of mathematics, which makes it possible to have a sufficiently clear idea of its most important features and to make it possible to predict events that may occur in the future. This is exactly what the term "mathematical modeling" represents.

It is known that, as a rule, some real situations are considered the starting point in practice, and these present the researcher with tasks that require finding a solution.

The process of separating tasks that can be mathematically analyzed is often continuous and requires not only mathematical knowledge, but also many skills in that field. The real situation is described in a mathematical model (see Figure 1).



Real

situation

Figure 1. The way to develop a mathematical model.

As a result of the analysis of the real situation, a task that allows mathematical description is performed. Often, along with setting the task, the process of determining the main or important aspects of the event is carried out. Then, the determined significant factors are transferred to the language of mathematical concepts and values, as well as the ratio between these values is regulated, as a result of which a mathematical model is created.

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As a rule, this is considered the most difficult stage of the modeling process, and no general recommendations can be given for its implementation. Only after the mathematical model is developed, it should be tested.

Real situations are modeled for different purposes. The main one is to predict new results or new properties of the event. Often in such cases, in all probability, they take place in the future, and they can also apply to predictive events. These cannot be directly investigated experimentally (for example, space probes and their program predictions).

Other models are built to make the measurement scale more convenient. For example, using a linear scale thermometer for temperature is a mathematical model.

Mathematical models of technical objects are widely used in automated design systems. Such models can be made at micro, macro, and metoscales, and they differ from each other according to the level of detail by considering the processes in the object.

The system of special derivative differential equations is considered a mathematical model of a technical object on a microscale, and they express processes in a complete environment with defined boundary conditions.

A mathematical model is created for objects that are the subject of research in the theory of automated control and the theory of mass service.

Determining the nature of the mathematical variable under consideration is considered an important solution to be adopted in the initial process of modeling, and usually they are divided into two classes:

1. Accurately measurable and controllable comments.

2. Stochastic variables that cannot be measured precisely and have a random description.

The modeling process does not end with obtaining one or another mathematical model. Because, at first, it is necessary to carry out a re-transfer from the mathematical language to the language representing the initial task. It is necessary not only to understand the mathematical essence of the obtained solution, but also to understand what it represents in the existing world.

Most technical objects belong to the class of complex systems, and the study of such systems consists of:

input parameters;

factors and output parameters;

determining the relationship between the quality indicators of the function of the technical object;

determining the level and importance of factors that optimize the output parameters of a technical object.

There are two approaches to working with mathematical models of complex systems: deterministic (explanatory) and stochastic (random).

In the deterministic approach, the model is developed on the basis of a detailed study of the mechanism of the phenomenon and is usually imagined in the form of a system of differential equations.

In this case, the mathematical apparatus of modern control theory can be used to perform the task of optimization.

The deterministic approach is used in the study or description of well-organized systems, in which it is possible to isolate a phenomenon or process that has a single physical nature and depends on a small number of input parameters. This situation limits the use of the deterministic approach.

A stochastic approach is used in the study and mathematical description of poorly studied or diffuse systems. In such systems, it is impossible to distinguish certain events and clearly define "insurmountable obstacles". An example of such a poorly organized system is any technical process.

The mechanism of phenomena is not fully known for poorly organized systems, in which the development and optimization of mathematical models is solved using statistical methods through experiments.

In such cases, the model of the technical object is imagined as a cybernetic system or a "black box". For this, the researcher looks for the relationship between the output parameters and many input parameters, that is, free variables, and he performs this task completely unaware of the mechanism of events taking place in the system.

Mathematical models require universality or completeness, accuracy, precision and economy (see Figure 2).

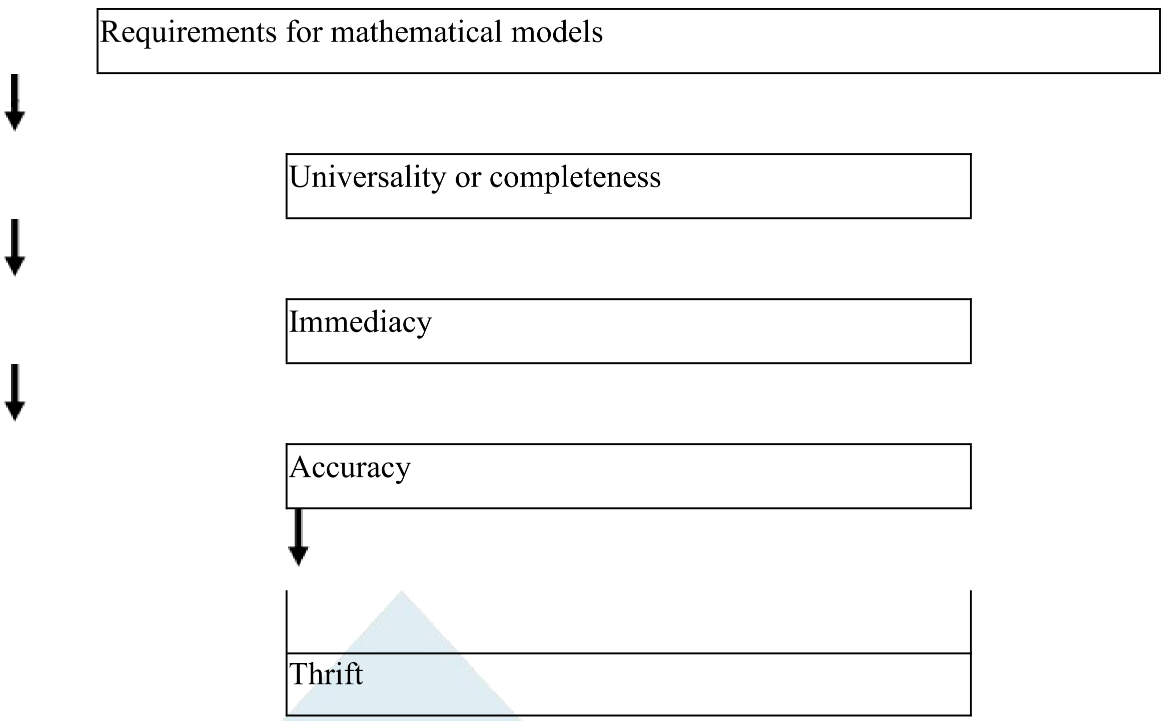

Figure 2. Requirements for mathematical models.

The universality of the mathematical model is the complete representation of the property of the real object. Many mathematical models are designed to represent the physical or information

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processes that an object undergoes, and do not describe the properties that make up the elements of the object (such as geometric shapes).

There are several aspects of model validity testing. First, the mathematical basis of the model must be non-contradictory and obey all the rules of mathematical logic. Second, the model should accurately describe the initial real situation. However, the conclusion about the accuracy of the proposed model is significantly subjective in such an examination. A model can be forced to describe something that exists, but it is not that existence.

The accuracy of the mathematical model is characterized by the degree of compatibility between real objects and their value parameter indicators, which are calculated using the evaluation of the model data.

The efficiency of the mathematical model is characterized by the computing resources spent on its implementation, i.e. machine time T_m and memory consumption P_m. Naturally, the lower these costs, the more economical the model.

The validity of the model depends on the following conditions (see Figure 3)::

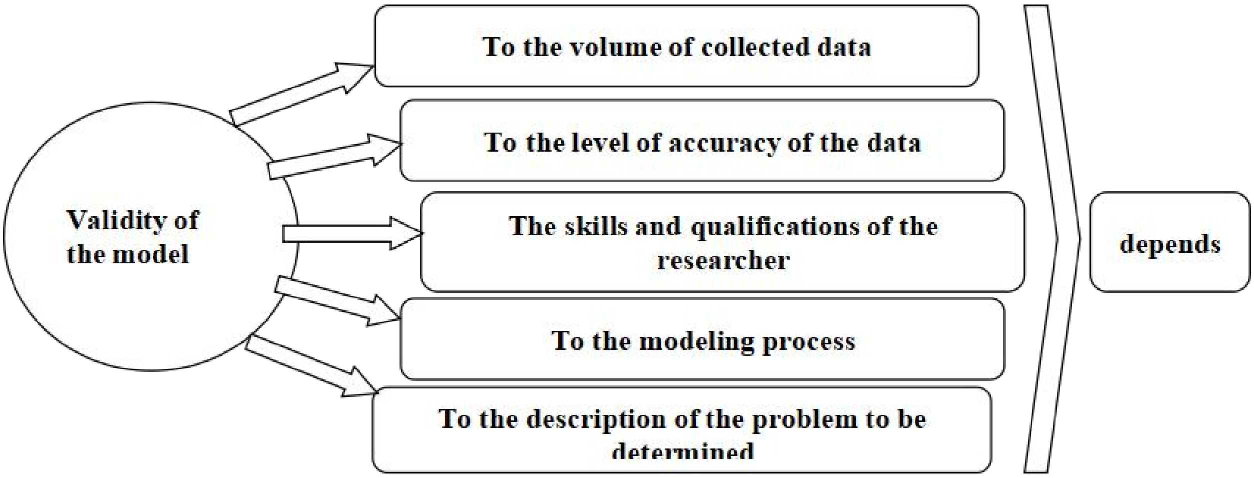

Figure 3. Dependency condition of the model.

The demand for high economy of the model, on the one hand, the demand for high accuracy and universality level, on the other hand, as well as the wide area of accuracy, on the other hand, are contradictory. Satisfying all these requirements in harmony depends on the uniqueness of the task being solved, the hierarchical level and aspects of the design.

The development of game theory, mathematical programming, mathematical statistics and other branches of the field of applied mathematics served as an important impetus for the rapid development of various industries.

In conclusion, the use of mathematical modeling and mathematical competence in teaching higher mathematics in higher education institutions serves to develop students' academic skills and improve their professional skills.

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