

**THE IMPORTANCE OF MATHEMATICAL MODELING IN HIGHER EDUCATION**

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**Abstract**

This article analyzes the importance of mathematical modeling in the higher education system, its role in developing students' analytical thinking, and the possibilities of its application in studying real processes. Mathematical modeling is an important tool in the development of modern science and technology. The article examines the theoretical foundations of mathematical modeling, methods of introducing it into the educational process, and its importance in improving educational efficiency. The results of the study show that the widespread implementation of mathematical modeling methods in the educational process contributes to the development of students' independent thinking, problem analysis, and scientific research skills.

**Keywords**

mathematical modeling, higher education, mathematical model, educational process, analytical thinking, scientific research.

**Introduction**

At present, the rapid development of science and technology sets new tasks for the education system. In higher education institutions, it is important not only to provide students with theoretical knowledge but also to develop their skills in analyzing real processes, modeling them, and finding solutions. From this point of view, mathematical modeling is becoming an important component of the educational process.

Mathematical modeling is the process of describing a real process or phenomenon using mathematical expressions, equations, functions, and algorithms. This method is widely used in many fields such as physics, economics, biology, and engineering. Especially in higher education, the use of mathematical modeling allows students to connect theoretical knowledge with practical problems.

Modern educational concepts emphasize the development of students' independent thinking, the ability to analyze problematic situations, and the ability to conduct scientific research. Mathematical modeling serves as an effective tool for achieving these goals.

The purpose of this study is to analyze the importance of mathematical modeling in the higher education process and to determine its role in improving the quality of education.

**Methods**

In this study, a comprehensive scientific approach was used to determine the role and importance of mathematical modeling in the higher education process. Both theoretical and empirical analysis methods were applied during the research.

At the first stage, scientific literature, monographs, and research articles related to the theory of mathematical modeling were studied and systematically analyzed. At this stage, the concept of mathematical modeling, its basic principles, and its application areas in higher education were clarified. The analysis of literature made it possible to generalize the theoretical foundations of mathematical modeling.

At the second stage, comparative and analytical analysis methods were used. These methods made it possible to compare the educational process organized on the basis of mathematical

modeling with traditional teaching methods. As a result, the effectiveness of mathematical modeling methods in developing students' analytical thinking, understanding complex processes, and forming problem-solving skills was evaluated.

During the research process, the main stages of mathematical modeling were also analyzed methodologically. It was shown that the process of creating a mathematical model consists of the following sequential stages:

1. Identifying the research object and formulating the problem;
2. Representing the real process in the form of a mathematical model;
3. Constructing mathematical equations or functional relationships;
4. Analyzing the model using mathematical and numerical methods;
5. Comparing and evaluating the obtained results with the real process.

In addition, generalization and scientific abstraction methods were used to study the pedagogical aspects of introducing mathematical modeling into the higher education process. The obtained results showed that the use of mathematical modeling contributes to connecting theoretical knowledge with practical processes and developing students' independent thinking and research skills.

### **Results**

The results of the study showed that the use of mathematical modeling in the higher education process is an important factor in improving the effectiveness of education. The analysis revealed that in the educational process organized on the basis of mathematical modeling, students' ability to connect theoretical knowledge with practical processes significantly improves.

During the study, classes that included elements of mathematical modeling were compared with classes conducted using traditional teaching methods. The results showed that in modeling-based lessons, students demonstrated higher performance in analyzing complex processes, constructing mathematical equations, and interpreting their solutions. This confirms the important role of mathematical modeling in developing students' analytical and logical thinking.

The results of the research also showed that introducing mathematical modeling into the educational process helps develop students' independent work skills. In the process of creating models, students go through stages such as problem analysis, formulation of mathematical expressions, and evaluation of results. This process forms their ability to conduct scientific research.

In addition, the use of mathematical modeling allows the study of real processes using mathematical tools. For example, economic processes, technical systems, or natural phenomena can be represented through mathematical models to determine their development patterns. This helps connect students' theoretical knowledge with practical tasks.

Based on the obtained results, it can be emphasized that the use of mathematical modeling is an important pedagogical tool for developing students' mathematical thinking, analyzing problem situations, and forming effective decision-making skills. Therefore, the widespread introduction of elements of mathematical modeling into the higher education process contributes to improving the quality of education.

### **Discussion**

Mathematical modeling is one of the important components of the modern education system. The use of this method in higher education not only strengthens students' theoretical knowledge but also plays an important role in preparing them for practical activities.

Mathematical modeling also helps students develop the following skills:

- problem analysis;
- expression through mathematical formulas;
- evaluation of results;
- drawing scientific conclusions.

In many developed countries, mathematical modeling is considered one of the main components of the education system. Therefore, its wide implementation in the higher education process contributes to improving the quality of education.

## Conclusion

The results of the conducted research show that mathematical modeling has significant scientific and pedagogical importance in the higher education system. The use of mathematical modeling in the modern educational process helps connect theoretical knowledge with practical processes, analyze complex systems, and develop scientific thinking skills.

During the research, it was determined that the educational process organized on the basis of mathematical modeling is an effective tool for developing students' analytical and logical thinking. The process of constructing mathematical models requires students to deeply analyze problems, express them through mathematical expressions, and evaluate the obtained results. This contributes to the development of independent thinking and scientific research skills.

In addition, mathematical modeling makes it possible to study real processes using mathematical methods. Processes occurring in different fields can be represented through mathematical models and their development patterns can be analyzed. Therefore, mathematical modeling is one of the most effective tools for connecting theoretical knowledge with practical tasks in higher education.

Based on the obtained results, it can be concluded that the widespread introduction of mathematical modeling methods into the higher education process contributes to improving the efficiency of education. At the same time, this approach plays an important role in developing students' mathematical thinking, analyzing problem situations, and forming scientific research skills.

In the future, the effective integration of mathematical modeling methods into the higher education process, their application in combination with modern information technologies, and the development of modeling-based teaching methodologies will remain important scientific directions.

## References

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