

Research on the Construction and Practical Path of Three-Dimensional Models in Junior High School Mathematical Modeling Teaching

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ABSTRACT

With the continuous innovation of educational concepts and the deepening of the reform of junior high school mathematics curriculum, mathematical modeling, as the core teaching strategy for cultivating students' mathematical practical ability and innovative consciousness, has increasingly highlighted its key role in the field of primary mathematics education. In view of the challenges currently faced by junior high school mathematics modeling teaching, such as ambiguous goal positioning, imperfect curriculum system and limitations of teaching methods, this study constructs a comprehensive and systematic teaching framework for junior high school mathematics modeling and deeply explores its specific implementation strategies. The research finds that this three-dimensional model significantly enhances students' mathematical modeling skills and problem-solving abilities, and boosts their interest and initiative in participating in mathematics learning.

KEYWORDS

Teaching of Mathematical Modeling in junior high school; Three-dimensional model; Practice path; Teaching strategy; Mathematical application ability

1 Mathematical Modeling and Junior High School Mathematics Teaching

1.1 The Role of Mathematical Modeling in Junior High School Mathematics Teaching

Mathematical modeling plays a core role in the field of primary mathematics education. It not only helps students deepen their understanding of mathematical principles, but also effectively promotes the development of their problem-solving skills and practical application abilities of mathematics^[1-2].

With the help of mathematical modeling, students can transform abstract mathematical principles into the scene expressions of practical problems. In the field of mathematics education, the presentation of some concepts and formulas is often highly abstract, which may cause confusion among learners. With the aid of mathematical modeling, educators can prompt students to apply theoretical concepts and formulas to real-world situations, thereby endowing mathematical knowledge with vivid and concrete forms of expression. For instance, when teaching quadratic equations with one variable, teachers can guide students to solve specific practical cases by constructing models, such as basketball throwing and maximizing benefits, thereby enhancing students' understanding of the connotation and practical value of the equations.

Mathematical modeling can also effectively enhance students' problem-solving abilities. In the practice of mathematical modeling, participants need to identify problems, construct models, analyze models and evaluate results. This continuous link tests the application of their logical reasoning and innovative consciousness. By adopting this method, students can not only solve practical problems, but also hone their thinking ability and innovative spirit in practice. The cultivation of this kind of ability is of vital importance for the all-round improvement of students' comprehensive quality.

In specific teaching practice, teachers can select appropriate practical problems, guide students to establish mathematical models, and promote their cooperative learning. As a result, students can not only achieve all-round growth in the field of mathematical modeling, but also significantly enhance their interest in the discipline of mathematics and their confidence in applying mathematical principles to solve real-world problems. Furthermore, educators should also focus on cultivating students' ability to apply mathematical knowledge to real life and enhancing their awareness of mathematical application. This concept is gradually becoming the mainstream direction of mathematics education reform.

1.2 Characteristics of Mathematical Modeling in Junior High School Mathematics Teaching

Mathematical modeling has remarkable characteristics in junior high school mathematics teaching, and these characteristics make it play an important role in cultivating students' mathematical ability and solving practical problems.

The teaching of mathematical modeling in junior high school focuses on stimulating students' innovative consciousness and improving their practical skills. During the period of mathematical modeling practice, students are encouraged to apply their imagination and innovative thinking to explore diverse solution strategies. This teaching

method is beneficial to inspiring students' innovative consciousness and promoting their thinking and problem-solving in multiple dimensions. In addition, mathematical modeling education also needs to test the validity and practicality of the model through specific practices and operational activities, thereby enhancing students' practical skills^[3].

Mathematical modeling teaching focuses on promoting the comprehensive integration and practical application of mathematical knowledge^[4-5]. During the modeling stage, students need to integrate the mathematical skills they have mastered, including but not limited to algebra, geometry, and probability, to create and analyze models. This interdisciplinary learning strategy can not only deepen students' cognition and mastery of mathematical knowledge, but also significantly enhance their knowledge transfer ability and comprehensive practical ability. Given that the foundation of junior high school students in the field of mathematics is generally weak, when teachers carry out mathematical modeling teaching, they should focus on strengthening and broadening the basic concepts and skills to ensure that students can participate in mathematical modeling practice without obstacles.

2 Research on the Instructional Design of Three-Dimensional Model Construction in Junior High School Mathematics Modeling Teaching

2.1 Determination of teaching objectives

When setting the teaching goals of mathematical modeling in junior high school, it is necessary to comprehensively consider the needs of students' ability cultivation to ensure the clarity, specificity and operability of the goals. The following is a detailed elaboration of the teaching objectives:

First of all, emphasis should be placed on cultivating students' mathematical abstraction ability. Mathematical abstraction ability is the cornerstone of mathematical modeling. It requires students to be able to extract key information from complex practical problems and then transform it into clear mathematical problems. Through training, students can gradually learn how to capture the essence of mathematics in the complex and diverse real world, which is an indispensable ability in the process of mathematical modeling.

Secondly, cultivating students' mathematical reasoning ability is one of the indispensable core goals in the educational process. In the practice of mathematical modeling, participants need to use mathematical tools for logical deduction and demonstration to ensure the accuracy and robustness of the constructed model. Through continuous practice and the guidance of mentors, students can gradually acquire the strategies and methods of mathematical deduction, thereby enhancing the efficiency and accuracy of their problem-solving.

Finally, cultivating innovative consciousness and practical ability has been established as one of the key goals of junior high school mathematics modeling education. In the practical activities of mathematical modeling, participants need to demonstrate innovative thinking abilities, actively explore and propose diversified problem-solving strategies. In addition, participants also need to carry out practical operations to verify the applicability and validity of the constructed model. Therefore, educators should advocate that students engage in bold exploration and innovative practice, and cultivate and develop their practical skills through practical operation activities.

The teaching of mathematical modeling in junior high school aims to comprehensively cultivate students' mathematical abstract thinking, logical reasoning skills, problem-solving abilities, as well as their innovative spirit and practical operation capabilities. By establishing specific learning goals, we can precisely plan teaching strategies and resource allocation, thereby significantly enhancing students' practical skills and problem-solving efficiency in the field of mathematical modeling.

2.2 Design of Teaching Content

When designing the content of junior high school mathematical modeling teaching, it is necessary to comprehensively consider students' cognitive levels and interest points, as well as the practical application value of mathematical modeling. The following is a detailed elaboration on the design of teaching content:

It is necessary to introduce the basic concepts and methods of mathematical modeling to students. This includes but is not limited to the definition of mathematical models, the purpose and significance of modeling, as well as common modeling methods, such as optimization models, statistical models, dynamic models, etc. Through the explanation of these basic knowledge, students can initially understand the framework and thinking of mathematical modeling.

The teaching syllabus should comprehensively cover the core links and operation processes of mathematical modeling, aiming to systematically cultivate students' ability to apply mathematical tools in solving practical problems. This process covers multiple key steps such as problem identification and analysis, model selection and construction, data collection and preprocessing, and model solution and verification. By gradually guiding students to master specific processes, it can effectively promote the development of their logical reasoning ability and problem-solving skills.

2.3 Teaching Strategy Design

In the field of mathematical modeling education in junior high schools, it is extremely crucial to select effective teaching methods, which significantly affect students' enthusiasm for participation, learning outcomes and the development of comprehensive skills. In view of this, this article focuses on the discussion and analysis of the teaching strategy of cooperative learning.

The teaching method of collaborative learning aims to promote the development of students' teamwork awareness and communication skills. In the educational practice of mathematical modeling, teachers can guide students to form cooperative learning groups, aiming to promote the improvement of their collective discussion and problem-solving abilities.

This educational model can not only enhance the communication and collaboration abilities among students, but also promote their common development and progress in the process of mutual teaching and assistance. Through cooperative learning, students can learn how to communicate effectively with others, how to divide tasks and collaborate, and how to solve the conflicts and problems that arise in the team.

3 Research on the Construction and Practical Path of 3D Models in Junior High School Mathematical Modeling Teaching

3.1 The Continuous Development Path of Junior High School Mathematical Modeling Teaching

In order to achieve the continuous development of junior high school mathematics modeling teaching, it is necessary to construct a comprehensive and long-term development plan. First of all, the education department should formulate a clear teaching syllabus and officially incorporate mathematical modeling into the junior high school mathematics teaching system to ensure that all students can receive systematic training in mathematical modeling. Meanwhile, schools should provide corresponding teaching resources, including professional teachers, appropriate teaching materials and necessary teaching equipment.

Implementing a regular and systematic teaching evaluation and feedback mechanism is an indispensable link in the educational process. By implementing a regular learning outcome assessment mechanism, educators can precisely monitor students' academic progress, thereby identifying and addressing potential problems that may arise during the learning process, and adjusting treatment plans in a timely manner to promote the optimization and improvement of teaching effectiveness. Furthermore, educational institutions should encourage exchanges and seminars among teachers to share effective teaching practices and strategies in mathematical modeling, thereby collectively enhancing the teaching quality of such courses.

3.2 Teacher Professional Development and Training

Teachers play a core role in guiding the teaching process of mathematical modeling in junior high school. To ensure that educators have sufficient professional capabilities and teaching effectiveness, periodic professional growth and development plans as well as training programs should be implemented. Such activities cover forms such as workshops, seminars and online courses, and their goal is to enhance educators' understanding and operational skills in the theoretical and practical aspects of mathematical modeling teaching.

Promoting teachers' participation in teaching research and project activities of mathematical modeling can not only significantly enhance their professional skills and knowledge depth, but also effectively stimulate their enthusiasm and innovative drive in the teaching process. By carrying out relevant research and practice projects, educators can deepen their understanding of the current trends and teaching strategies in the field of mathematical modeling, and then effectively integrate these insights and practical experiences into their daily teaching activities.

4 Conclusion

This study explored the practical path of mathematical modeling teaching in junior high school and proposed a series of operational implementation strategies.

These strategies include selecting mathematical problems that are close to life, realistic and situational as teaching cases, designing progressive mathematical modeling teaching activities, and adopting diverse teaching methods and evaluation means. Through teaching practice, students can comprehensively apply the mathematical knowledge they have learned in the process of solving practical problems, deepen their understanding of mathematical concepts, and gradually improve their skills in mathematical modeling.

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