

APPLICATION OF MATHEMATICAL MODELING IDEAS IN SECONDARY SCHOOL TEACHING

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ABSTRACT

To meet the needs of social development and talent training in the new era, the "General High School Mathematics Curriculum Standards (2017 Edition)" puts forward the core literacy of mathematics discipline, and takes mathematical modeling as one of the six core literacies of mathematics discipline, increasing the importance of mathematical modeling. Combined with the background and concepts of mathematical modeling, this paper aims to study the application of mathematical modeling ideas in junior high school teaching, put forward the problems of mathematical modeling ideas in secondary school teaching, and put forward suggestions for mathematical modeling teaching to promote the development of mathematical modeling.

Keywords: Mathematical modeling, secondary school teaching, apply.

I. Introduction

A. Research Background

In order to meet the development requirements of the new era, the "General High School Mathematics Curriculum Standards (2017 Edition)" points out: "Mathematics core literacy is the comprehensive performance of thinking quality, key abilities, emotions, attitudes and values with the basic characteristics of mathematics, which is gradually formed and developed in the process of mathematics learning and application, and mathematics core literacy includes mathematical abstraction, mathematical modeling, intuitive imagination, mathematical operation, and data analysis^[1]. In the new curriculum standard, it is proposed that the overall performance of core literacy is to observe the real world from a mathematical perspective, to think about the real world with mathematical thinking and to express the real world with mathematical language, mathematical modeling is an important part of the core literacy, but in the process of student learning, it involves the modeling ideas of solving practical problems, and the students' mastery is low, and in the teaching process, teachers teach less modeling ideas and do not pay enough attention to them. Mathematical knowledge is logical and abstract, students learn mathematics knowledge in depth, students' mathematics performance continues to decline, the enthusiasm of learning mathematics continues to decrease, students think that learning mathematics is for exams, and do not apply mathematical knowledge in daily life, can not apply what they have learned, so mathematical modeling ideas are very important in the learning process of students.

As a teacher, in the process of teaching, we should continue to implement the core literacy of the new curriculum standards, pay attention to students' awareness of modeling, and let students use modeling to solve practical problems and make numbers. Learning becomes a bridge between life and the classroom, allowing students to understand and learn modeling concepts and ideas, and cultivating students' ability to deal with mathematical problems^[2]. The fundamental point of using mathematical modeling is mathematical expressions, which are also the most critical problems of abstract models, which help students derive the relevant models of independent variables and dependent variables in mathematics based on life examples, and establish mathematical models through expressions, highlighting the important and difficult

points in teaching, and solving students' difficulties in abstract problems.

B. Research Significance

For the education industry, the idea of mathematical modeling is a new mathematical idea, and the idea of modeling is as important as the idea of combining numbers and shapes, so as to promote the renewal and development of the education industry, and constantly update the educational concept and education method. For teachers, learning and understanding modeling ideas can better impart knowledge to students, and teach knowledge in a simple and interesting way, for example, in the high school derivative part, the knowledge of mathematical analysis can be used to make students better understand the limits. For students, mathematical modeling can help students establish spatial and three-dimensional thinking, break through the limitations of mathematical calculation, and enable students to learn to use mathematical language to build mathematical models, find out the variables in problems, establish mathematical expressions, and use functions to calculate results. In the process of mathematical modeling, students can improve their ability to raise, analyze and solve problems, improve their ability to collect and analyze data, and cultivate students' ability to learn independently and work in teams. By understanding the ideas of mathematical modeling in advance, students can better understand mathematics and choose a mathematics major when choosing a college major.

II. Related Concepts

A mathematical model is an abstract concept based on a specific goal, through the use of mathematical tools to simplify the assumption of a specific object, and transform it into mathematical formulas, algorithms, tables, diagrams, etc., in order to better describe and understand complex phenomena. Mathematical modeling is a comprehensive practical activity, which is based on mathematical thinking, through the analysis of actual scenarios, put forward relevant mathematical synthesis problems, use mathematical calculations to solve practical problems, and compare the results with reality to verify the feasibility and effectiveness of the model. It is designed to help people better understand and solve real-world problems, thereby improving the efficiency and quality of learning^[3]. The commonly used modeling in middle and high school mathematics includes parametric modeling, geometric modeling, etc., and mathematical modeling is used to solve practical problems^[4].

III. The Application of Modeling Ideas in Secondary School Teaching

A. Set up Life Situations

Mathematical modeling is generated around real scenarios, and setting up various scenarios in mathematics teaching is conducive to students to understand the basic knowledge of mathematics, for example, when learning the area of a diamond, you can create a diamond-shaped garden for students to refer to, and when learning positive and negative numbers, the positive and negative numbers are related to temperature, these problems are closely related to life, and can be understood in combination with common sense of life. When learning cones, when the surface area is constant, find the minimum base area and high values of the cone volume, and then students need to build a mathematical model to solve it. In teaching, connecting with real life can increase students' interest in learning mathematics and fall in love with learning mathematics.

B. Improve Students' Problem-Solving Ability

Students should not only learn the basic knowledge in books, but also learn to draw inferences from one another, apply modeling ideas to the process of mathematics succession, conduct some training on conventional topics, and learn to transform difficult problems into conventional topics to increase students' responsiveness. For example, when learning the volume of rectangular squares, such a question often arises, build a rectangular swimming pool, the volume of the swimming pool is 8 cubic meters, if the price of the bottom of the pool is 100 yuan per square meter, and the price of the pool wall is 120 yuan per square meter, then

what is the minimum price of this swimming pool? The common idea of this kind of problem is to use the equation model to solve, first set the length of the pool to x , then write the width, set the lowest price to y , and use the equation model to solve, this problem embodies the idea of mathematical modeling, and continuously improves students' problem-solving ability and cultivates creative thinking.

C. Train the Use of Mathematical Language

In the process of mathematics learning, it is necessary to use the language of mathematics to express the real world, which is the requirement of mathematics in the core literacy, and the language of mathematics is also indispensable in mathematics learning. For example, in the process of mathematics learning, the mathematical language includes: S for area, V for volume, X for independent variable Y for dependent variable, \sin for sine function \cos for cosine function, etc., the use of these symbols is more standardized, more mathematical logic, and embodies the idea of mathematical modeling.

D. Use of Computers

Using the function function in the MATLAB software toolbox to solve the modeling, the corresponding geometry will be obtained, and the relevant ideas of the function will be used to expand the ideas for students and improve the openness. In math classes, computers are often used, and when drawing images, for the accuracy of the images, the `ezplot` function in the MATLAB software can be used to draw the images, which will increase students' interest in modeling. The use of computers provides students with poor intuitive imagination with three-dimensional figures, better understands the charm of three-dimensional geometry, and improves students' mathematical ability.

IV. The Problems Existing in the Application of Modeling Ideas

A. Insufficient Motivation for Learning

With the deepening of mathematics learning and the strengthening of the logic and difficulty of knowledge, students' learning motivation is weakening, which will lead to low concentration, inability to concentrate and listen carefully, poor learning results, and even loss of confidence in learning mathematics. In middle and high school learning, teachers have less introduction to mathematical modeling, resulting in students having less understanding of mathematical modeling and not understanding the mode of modeling, so students will lack interest in learning modeling. Compared with the basic knowledge of mathematics, mathematical modeling is more difficult, mathematical modeling still has a large amount of calculation, when thinking about the problem, it is necessary to start from multiple angles, and it is also necessary to use computers and other means to model, which increases the difficulty of learning, and students will feel that they do not understand and cannot learn in the process of learning, and these feelings make students' learning motivation continue to decline, and finally give up because there is no sense of achievement.

B. The Computer Level Is Weak

With the popularization of computers, information technology is more widely used in teaching, in teaching, teachers' own mathematical modeling level is insufficient, can not use the functions in the MATLAB software toolbox, can not teach students relevant modeling ideas and knowledge, teaching effect is poor, so that students' modeling level can not be improved^[5]. In the process of learning mathematical modeling, mathematical modeling is difficult and complex, and the basic knowledge level and computer operation level of students are insufficient, and it is difficult to complete a mathematical modeling problem. Therefore, the lack of computer proficiency hinders the learning of mathematical modeling for students and teachers, which is not conducive to the development of mathematical modeling ideas.

C. Poor Ability to Cooperate

In junior high school teaching, group teaching is widely used, and students' cooperation ability is strong, but in high school, students' learning tasks are increasing, and students'

learning time is tight, and schools and teachers pay insufficient attention to group learning, which will produce the situation of students single person and single table, which is not conducive to students' cooperation and communication. Mathematical modeling requires three parts: modeling, programming and thesis, and it is difficult for one person to be competent in the study of mathematical modeling. If a person learns mathematical modeling without the help of group members, it will be difficult to complete mathematical modeling, affect students' enthusiasm for learning mathematics, and is not conducive to the continuous learning of mathematical modeling.

D. Insufficient Ability to Solve Practical Problems

The purpose of students to learn mathematics is to prepare for the college entrance examination and get into a good school, not to use mathematics in life. In the process of learning mathematics, students learn to solve practical problems poorly, and they are unable to apply what they have learned. When learning derivatives, students have a good grasp of the concept and formula of derivatives, once the question of the maximum value and the minimum value is changed, for example, if $f(x) = \ln(x^2 + 1)$, $g(x) = (x - m)$ is known, such that $f(x) > g(x)$, then the range of the value of m , this kind of problem cannot be converted into the maximum value problem. Students learn the relevant solid geometry proof methods, but in the actual process, it is still difficult for students to learn the related problems of proving coplanarity.

V. Solutions for the Application of Modeling Ideas

A. Cultivate Correct Motivation for Learning

As a teacher, it is very important to cultivate students' motivation to learn mathematics in teaching, and the famous method of cultivating learning motivation is ABCS, which uses the motivation model of ABCS to stimulate students' interest in learning mathematics and improve their enthusiasm for learning mathematical modeling^[6]. Teachers should start from practical life, start from the small things in life, attract students' attention, and let students understand mathematical modeling by guiding them to observe and do it hands-on, so as to improve students' learning motivation, so that students think that they have the ability to learn mathematical modeling well and improve their self-confidence. When students make progress in mathematical modeling, teachers should give encouragement so that students can gain satisfaction. Teachers should learn educational knowledge, understand students' psychology, improve teachers' teaching skills, update educational concepts, and constantly cultivate students' correct learning motivation, so that students can become interested in mathematical modeling.

B. Improve the Level of Computers

The computer level occupies an important position in mathematical modeling, plays an irreplaceable role in the processing of information data, and can also process data to verify the accuracy of the model. As a teacher, improving computer skills can not only make PPT and make the content more attractive to students, but also help students understand the basic knowledge of computers, apply computer knowledge to mathematical modeling, and impart the knowledge of mathematical modeling to students, so that students can understand the fun of mathematical modeling. For example, when students learn function images, they can use examples in life, a glass of boiling water, record every 1 minute, what kind of changes occur in the temperature of the water, and use the relevant data obtained to draw a scatter plot in a more standardized way, and compare it with the scatter plot drawn by the student with a ruler, so that students can understand the charm of the computer and learn mathematical modeling.

C. Conduct Group Study

In the process of learning mathematical modeling, each student's understanding and solution ideas for the same problem will be different, and group learning allows students to discuss and share their own opinions. In the process of learning, students need to communicate and

cooperate with each other, students need to learn in all aspects, communicate with classmates if they don't understand, learn from each other's strengths, give full play to their own advantages, and continuously improve the level of modeling. Group learning can make full use of the advantages of students, some students have strong hands-on ability, higher computer level, strong expression skills, etc., these advantages can be fully utilized in mathematical modeling, so that each student can produce a different direction in learning mathematical modeling, have a sense of participation, give full play to the potential of each student to learn mathematics, and let students fall in love with mathematical modeling.

D.Improve the Ability to Solve Practical Problems

In the process of teaching, teachers should integrate practical problems into the problems, take the basic knowledge mastered by students as the starting point, reduce the gap between students and mathematical modeling, so that students can participate in the learning of mathematical modeling more actively and actively, and train students to apply knowledge. Teachers should work the selection of topics and choose topics that are in line with practical problems, so that students can have a sense of satisfaction in solving problems. Teachers should pay attention to students' learning of mathematical modeling in real time, and formulate learning tasks for students based on students' learning conditions, so that students can complete the learning tasks of mathematical modeling and improve students' sense of achievement. Teachers should also have a corresponding reward mechanism to reward students for their progress, so that students have a steady stream of motivation to learn and maintain students' learning motivation to learn mathematical modeling. In the process of learning mathematical modeling, students can start from observation, analyze problems, carry out reasonable modeling, and cultivate mathematical modeling thinking.

VI.Conclusions

Cultivating students' mathematical modeling thinking is of great help to improve mathematics learning ability and interest in mathematics, and should be valued by teachers and the education industry, but there are still some difficulties in the promotion of mathematical modeling ideas and models due to the influence of educational concepts and teachers' professional ability. The integration of mathematical modeling ideas into teaching should become the focus of teachers' exploration and application in practical teaching, so that students can continue to understand the knowledge of mathematical modeling and improve their interest in modeling. As a teacher, it is necessary to integrate modeling knowledge and ideas into teaching that is suitable for the actual learning situation of students, so that teachers can teach in the nearest development area, so that students can have a sense of accomplishment and will not have learning difficulties. At the same time, teachers apply computer and other technologies in teaching, and use modeling models more, so that students can generate modeling ideas and stimulate students' motivation to learn mathematical modeling. Finally, teachers should pay attention to students' basic knowledge of mathematics, and the two complement each other and develop together, so that students can use mind maps to learn and form a unique mathematical system. Therefore, if the idea of mathematical modeling in China wants to flourish in teaching, it needs the continuous efforts of teachers and the education industry.

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