The Application of Teaching and Modeling in College Mathematics

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Abstract: Mathematical modeling is a process of solving practical problems by applying mathematical ideas and methods. This process includes the exploration and discovery of the real world as well as the creation and application of mathematical models. Integrating the thought of mathematical modeling into the teaching content of college mathematics can effectively cultivate the ability of college students to solve practical problems by using mathematical knowledge. Based on the author's learning and practical experience, this work first analyzed the theoretical analysis of mathematical modeling and its important role in college mathematics teaching, and then put forward the application measures of mathematical modeling idea in college mathematics teaching.

1. Introduction

Higher education is the highest form of general education in China. The mathematics teaching of higher education is mainly based on higher mathematics, which covers single calculus, multiple calculus, probability and mathematical statistics, ordinary differential and so on. According to the different specialties, the study of professional mathematics knowledge will also be carried out. Therefore, the mathematics courses offered cover the main contents of modern mathematics, which cultivate and exercise students' logical reasoning, abstract thinking and mathematical analysis means [1]. However, it is difficult for students to establish and transform effective mathematical models when dealing with practical problems, which directly reflects that our higher mathematics education lacks the cultivation of mathematical application analysis when impart higher mathematics knowledge [2]. This is the direct reason why this work suggested introducing mathematical modeling into college mathematics teaching.

2. Theoretical Analysis of Mathematical Modeling and its Important Role in College Mathematics Teaching

Mathematical modeling in a narrow sense refers to the whole process of describing and solving problems in mathematical language for specific practical problems. Therefore, it belongs to the category of practical application of mathematics. The whole process can be divided into three steps: mathematical abstraction, logical organization and analysis of practical problems. From a broad point of view, any form of subject analysis can use the method of mathematical modeling. For instance, the numerical solution of engineering problem is to simplify the engineering problem into a mathematical model that can be solved, and then to obtain the response results of interest by mathematical analysis method [3]. Therefore, mathematical modeling is a scientific, accurate and solving process for practical problems. Through the promotion of mathematical modeling contest and other forms, mathematical modeling has been familiar to more and more teachers and students in the field of university. Generally speaking, the mathematical treatment of mathematical modeling is helpful to students' mathematical ability as follows [4]:

(1) Cultivate students' mathematical application ability. By abstracting and simplifying practical problems, students' mathematical induction and summary ability can be greatly improved.

(2) By transforming and solving practical problems into simplified mathematical models, students' mathematical language expression ability and scientific analysis ability can be improved.

(3) Mathematical modeling often involves a lot of deep-level mathematical knowledge, which

can only be solved through a large amount of information retrieval and knowledge learning. Therefore, students' ability of resource retrieval can be greatly improved.

(4) Mathematical modeling is mostly for team participation, which requires task allocation and coordination between team members. Therefore, students' teamwork and team tacit understanding will be greatly improved.

Therefore, we can see that the role of mathematical modeling is mainly reflected in the following aspects. For schools, mathematical modeling is an innovative attempt of new teaching model and teaching assessment model. For teachers, mathematical modeling is a better teaching mode of interactive communication outside classroom teaching. For students, mathematical modeling will show their mathematical interests and help them tap their scientific research potential as well as career development direction.

3. The Application of Mathematical Modeling Thought in College Mathematics Teaching

3.1 Introducing Mathematical Modeling Cases into Teaching.

In linear algebra, we can introduce the following cases: input-output mathematical model, animal reproduction law, commodity market share, autosomal genetic problem, traffic flow problem, closed economy problem, production plan arrangement, world population prediction problem, the balance of chemical equation, the calculation of resistance circuit, the matrix segmentation and connection of network, the secret coding and decoding using inverse matrix, the realization of weight loss formula, the network and graph, price balance model, macroeconomic model, signal flow graph model, population migration model, product cost calculation, information retrieval model and so on [5].

In probability statistics, we can introduce the following models: ball problem, encounter problem, same birthday problem, diagnosis rate, test serum problem, application background problem of various probability distribution, reasonable allocation problem, queuing theory, random storage problem, airline reservation strategy, organizing the source of goods to maximize revenue, insurance company income problem, car overload problem, calculation error problem, estimation of fish quantity in the lake, estimation of the average performance, whether the machine works normally, whether the products produced are qualified, whether a striker is a first-class striker, the relationship between the price and the sales volume, forecasts the sales of the products and so on.

Many of the mathematical modeling cases listed above are also interesting. What needs to be explained is that our teaching reform is not to introduce mathematical modeling into mathematics classroom teaching, but to improve the quality of classroom teaching. Therefore, it is not necessary to integrate each model into the classroom teaching, but to select the appropriate model into the teaching according to the actual situation of the students and the needs of the content in the classroom teaching [6].

3.2 Introducing Mathematical Experiment into Teaching.

Compared with the fact that there were basically no mathematical experiments in the past, now some textbooks also have mathematical experiments. However, since there is no mathematical experiment in the syllabus, the teacher does not attach importance to the experiment. With the continuous progress of science and the development of various emerging disciplines, the requirements for mathematics education are getting higher and higher，especially the emergence of computers has further promoted the application of mathematics in all aspects of society. Through computer mathematics, it can be directly related to social production and get nutrition, thus the influence of mathematics on production continues to exceed that of any other subject [7]. Therefore, mathematics experiment must be introduced into university mathematics teaching. Only by strengthening the teaching of mathematics experiment can students really realize the importance of mathematics and be interested in mathematics.

3.3 Introducing Mathematical Modeling Problem into Homework.

Students' extracurricular homework is an important link to further understand, digest and consolidate the classroom teaching content. However, most of the exercises in the traditional college mathematics textbooks are arranged for students to consolidate their basic knowledge and operation skills. Due to the few practical application problems, students' applied mathematics ability and innovation ability can not be improved at all. Only by applying theory to practice and solving practical problems can we understand, deepen and consolidate the effect of the theory we have learned. Therefore, mathematical modeling problem can be introduced into extracurricular homework. Considering the openness of practical problems, each chapter can arrange a carefully selected practical problem as students' homework, which requires students to use what they have learned to solve problem according to the idea of mathematical modeling. Basically, the mathematical experiment is one chapter at a time, so this practical problem can also be regarded as homework of the mathematical experiment. In order to give full play to students' creativity, we can put forward the homework at the beginning of each chapter of teaching, so that students can learn knowledge with questions. In this way, students can not only learn to use knowledge, but also cultivate students' self-study ability.

3.4 Offering Elective Courses or Lectures on Mathematical Modeling.

Due to few class hours in the mathematics classroom teaching in the college, too many mathematical modeling cases or the teaching experiments may lead to an incomplete teaching task, thus some other ways should be taken to achieve the teaching purpose [8]. Our approach is to offer elective courses and lectures on mathematical modeling for students. In addition, in order to improve students' interest in mathematics and to serve the needs of mathematical modeling competitions, mathematical culture festivals are held every year. During this period, my college invited some mathematical experts to talk about the application of mathematics. On the one hand, these lectures enhance students' interest, on the other hand, they popularize the ideas and methods of mathematical modeling.

3.5 Integration of Mathematical Modeling in Exams.

The traditional mathematics examination can test the students' mastery of the mathematical concepts, conclusions and methods. However, it can not test the students' mathematical application ability and innovative ability, so it should be integrated into the mathematical modeling in the examination. Because of the particularity of mathematical modeling, it needs to be carried out in the laboratory and takes a long time to complete, so a midterm exam can be arranged in the middle of the semester. Midterm exams are similar to mathematical modeling competitions, allowing students to form teams and choose from a variety of questions [9]. The final exam still adopts the traditional examination method, which can not only test the students' mastery of theoretical knowledge, but also test their application ability and innovation ability. It is critical to integrate mathematical modeling into the exam, without which other teaching reforms may become formalistic. In addition, the proposition of examination must be chosen well in order to improve students' writing level and teamwork spirit.

4. Summary

The integration of mathematical modeling into the reform of university mathematics teaching content is a complex system engineering, which needs to be constantly summarized and improved in teaching practice. Colleges should actively carry out the compilation of relevant teaching materials. In order to achieve the training goal, the reform of teaching content is the foundation, and at the same time, the reform of teaching methods and teaching means is also needed to adapt to it. Only in this way can we really improve the quality of college mathematics teaching and lay a solid foundation for the cultivation of innovative talents.

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