

The Analysis of Teaching Methods' Reformation Based on Mathematical Modeling

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Abstract. As a basic course, the higher mathematics is very important, but there are a lot of difficulties and problems of mathematics teaching in the higher vocational colleges now. In this paper, the author put forward a teaching reform based on the coalition of mathematical modeling and mathematics' teaching. Then, we analyze the way of their mutual penetration between mathematical modeling and reformation of teaching. At last, expanding the advantages and disadvantages of this binding pattern, and giving some reasonable suggestions on future development direction.

1. Teaching Situation in Higher Vocational Colleges

Higher vocational education must cultivate applied talents to adapt to the needs of society. Therefore, the curriculum models should take the cultivation of application ability as the main line in higher vocational education, and enhance the practicability and pertinence. Higher vocational mathematics is a public basic course, how to combined with cultivate talents and the requirement is an urgent problem^[1]. Along with the national vocational education in the new location, our professional set up more and more flexible, this put forward new requirements in all aspects, such as teaching organization form, teaching content, teaching method and so on.

Our students are from higher schools or primary technical schools, their mathematical basis is very different, so mathematics teaching has been facing many difficulties for many years. The most important reason is their basic ability is not strong, in addition to the traditional mathematics teaching content are too theoretical, too much emphasis on integrity, rigor mathematics itself. In many students' impression, mathematics is a highly theoretical course, not practical, therefore they lack of interest to learn this course. In the classroom of mathematics, students' participation is not high, and effect of teaching is greatly reduced.

2. The Introduction of Mathematical Modeling

Mathematical modeling, in simple terms is to use mathematical knowledge and methods to solve practical problems. In the process of modeling, at first we should transform the practical problems into mathematical problem, and then analyzing these problems, so as to obtain the corresponding solution. the answer of mathematical modeling is not sole, there is not right or wrong, only good or better.

Mathematical modeling contest began in America, China's national college modeling contest is founded in 1992, this contest is currently the largest discipline competition in universities. In 1999, the contest for the colleges' students is established, in this 10 years, higher vocational college students have been actively participating in the competition, the enthusiasm of this contest has been rising always. Because the mathematical modeling can connect mathematical knowledge and many unsolved frontier problems, this let students understand the value of higher mathematics in life, and let students feel complacent and successful, so as to stimulate their interest in learning.

Northern Beijing Vocational Education Institute has been participating in the national college mathematical modeling contest since 2008, we obtained very good achievement. The students feel benefit, but the race is minority after all. How to let more students can better understand, accept, apply higher mathematics is a new question. How to mobilize the enthusiasm of students through the "Mathematical Modeling Contest", how to let all students can be harvested in the learning process become the main problem in front of us.

3.The advances of the idea of modeling for mathematics teaching in schools

Mathematical modeling covers the applications in much aspects of knowledge, such as: problem analysis, higher mathematics, probability, decision analysis, various software and paper writing, and it trains the students' comprehensive ability. It is the comprehensive test for the students to master the professional knowledge of mathematics' theory and method、 the ability to analyze and solve problems and the computer knowledge and operation ability, it is also an effective measure to cultivate practical ability and teamwork ability. To train the students interested in science and technology activities, improved the comprehensive quality, expanded knowledge, and fostered innovation and teamwork spirit, while making more students know the mathematics application in many fields, we think it is a direct and effective method that apply the idea of mathematical modeling into the mathematics teaching.

We introduce the simple mathematical model case which is related with the teaching content in the teaching process. Mathematics model cases are from the different fields of the real life. By these specific examples, not only can make the students master the mathematical concepts and principles, but also greatly enhance the ability to solve the practical problems with using the knowledge and can add the students' confidence and interest in learning mathematics.

The mathematical modeling into mathematics teaching in collages, could be a breakthrough in the teaching reform of higher vocational mathematics, this approach is very feasible and effective. At present, many higher vocational collages all over the country participated in the mathematical modeling competitions, while many students had the experience in analyzing and solving practical problems from this activity, so how to expand the benefit wide is the new direction of the exploration.

Some colleges have had a lot of useful attempts, such as introduce mathematical modeling classes and optional mathematical experiment Class and so on, but it didn't fundamentally solve the problems in learning higher mathematics .How to improve the students' interest in learning, and improve teaching effect is also need further exploration.

4. The Way of Combination between Mathematical Modeling and Teaching Methods in Higher Vocational Colleges

In order to integrate mathematical modeling into mathematics education, we did a lot of word. First, we draw lessons from the reform achievements of other university, then we try to integrate the teaching content of higher mathematics, preliminary explore a suitable teaching mode on the basis of investigating and studying. In this teaching content, the higher mathematics content will be divided into "Mathematical Culture" ,"Mathematical Concepts"," Mathematical Computation" and "Mathematical Operation" four parts.

In Mathematical Culture, letting students learn features of mathematics and mathematics civilization, in order to improve the students' interest and literacy. In Mathematics Concept part, we should introduce a large number of actual cases to introduce basic concepts of mathematics and its background. In this way, we can train the student how to analyze the question, and construct the basis for the application of mathematics in the back. Mathematical Calculation can improve the students' ability of solving problem. In this part, we relate mathematical calculations with modern achievements of science and technology. There are a lot of computer mathematics software, such as Mathematicas, Spss and so on. In Mathematical Operation, we guide students to build mathematical model on the specific cases, so as to cultivate the students' way of thinking, enhance the training of application ability of math.

Combined with the actual situation of our school, in first semester we have 64 hours, to explain the "Mathematical Culture" and "Mathematical Concepts", In second semester, we have 64 hours too, explaining mathematics software to perform mathematical calculations. In this part, we guide students to build mathematical model based on number theory and specific case, such as "four-legged animals' weight ", "ghost cross the river" and so on.

Through the exploration of more than one year, we have a conclusion that, formulating the

structure and content and teaching course reasonably based on the requirement of each specialty, taking “guidance of employment is more important than books” as principle, reforming methods of teaching and assessment, fixing the problems in the process of teaching are important in establishing reasonable mathematical system with the feature of higher vocational education. We need to do the following:

(1)The teacher must observe students’ individual differences carefully, respect and admit differences. Starting from students’ actual conditions, we have to break the traditional teaching concept, attach importance to overall and individual, adopt hierarchical teaching. We must emphasize the utility and application, try to avoid logical reasoning process, and focus on the practical significance in the process of solving problems.

(2)We have to strengthen computer software teaching, pay more attention to practical application instead of theory. As traditional blackboard-teaching is very boring and not good at encouraging students’ enthusiasm, we could improve visual and application of mathematical teaching by using software like excel, mathematicas, SPSS and matlab, etc.

(3)We should emphasize the interest and popularity of higher mathematics based on some mathematical models, so as to improve the students' interest in learning. We Increase the link of mathematical modeling and mathematical experiment, and introduce the application of mathematics in real life with the modern education technology (such as multimedia, 3D effect appears).

(4)Teachers should strengthen the coordination of higher mathematics and different professionals. In the higher occupation colleges, "higher mathematics" is a basic course that is general to each discipline. But for different disciplines, we should distinguish. Only with the relevant professional knowledge, students can learn more guidance, and mathematics can provide better services for the professional. For example, for the building professional, statistics and decision cannot lack, how to design the architecture model is a decision problem; and for electronic professional, wave theory, Fourier series, Laplace transform, solution of partial differential equations is a necessary basic knowledge, these need appropriate emphasis; for automobile manufacture and repair professional, vector and space analytic geometry is the key, how to train the space imagination of students is very important.

(5) The teacher must guide students to the elicitation method. In different teaching module, we should guide students by the language it is easy to understand, we should encourage exchanges and discussions among students, let them find problems, promote the thinking ability.

(6) We should change the form of examination. According to the actual situation of different professional, we can refer to the mode that is combination of formative assessment and math exam. So then we can change the traditional mathematics learning process. We can keep an account of students' attendance, class activity, the operation completed of work. These usual performance decide 30% of the grade, and then we ask students to write the feasibility study report using mathematical knowledge, the paper decide 70% of the grade. This kind of mode cultivate the usual basic skills, it has achieved good effect. In some classes, but this method is not applicable to all professional, specific ways will depend on the circumstances.

5. The Results of Modeling and the Higher Vocational Mathematical teaching combining

For more than one year, we achieved some results in the practice exploration of introducing mathematical modeling into higher vocational mathematics teaching :

(1)To improve the students' interest in learning and enhance the students' autonomous learning, we introduced mathematical modeling into higher vocational mathematics teaching for enhancing the consciousness in applying mathematics and forming good learning habits. This method is welcomed by the students. Our new teaching model in the three-dimensional space of knowledge, quality and ability, construct a new model of teaching and learning as a whole, the theory and practice as a whole. Through this model the abilities of the students' analyzing and solving the problems had improved .It also enhance their ability of interpersonal communication and team cooperation.

(2)Strengthen the construction of teachers. Through more than a year of practice, we changed the teachers' teaching idea, teaching method, and teaching mode, so as to improve the teaching efficiency. Also we made some achievements in the aspects of teaching and research : we published " the Exploration and Practice of Teaching Method in Higher Vocational Mathematics" on the national academic journal "Teachers" ; we managed materials for the publishment of "mathematics and SPSS training manual" to the students who attended the calculation software training so that to lay a good foundation for the publishment of the new textbook "Applied Mathematics"; we completed the project "the research and exploration of the combination of mathematical modeling and mathematics teaching in Higher Vocational Colleges" and project "the Exploration of the Mathematical modeling to the promotion of mathematics reform in Higher Vocational Education".

The continuous development of society and the new demands for talented people provides an opportunity for our reform in mathematics teaching. The next step, the teachers of our research group will make further explore in practice, research the different teaching requirement model, accumulate the experience and data, improve the project implementation plan, so we can continue to carry out the effective research work. Eventually we finish the teaching material which is Suitable for the new situation, and summarize the teaching methods which are more interested, then we put it in practice in the future.

6. Summary and Outlook

So far, reforming of higher mathematics teaching is the need of the development of higher vocational colleges. In mathematical class, in order to arouse the students' interest in studying and make mathematical class become energetic and funny, teachers can only give students learning initiative. Innovation is not only depends on accumulation of knowledge, but also depends on the transformation of teachers' teaching methods and model. In the teaching process, a teacher is transformed as an initiator of knowledge into a designer, organizer, and instructor of teaching activity. As for the content of class, we can adopt method like "more qualitative than quantitative, more practice than derivation, more self-study than explanation", so as to arouse students' interest in studying, give students room and time to discuss, study, think, and make them study on their own instead of studying passively ,to adapt to the new social situation.

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