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Strategies for Improving the Teaching Quality of Higher Mathematics Course under the Background of New Engineering

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Abstract: *Based on the learning theory of constructivism and BOPPPS teaching model, this paper studies the strategies to improve the teaching quality of higher mathematics under the background of new engineering. According to the current teaching situation, the teaching content should be reconstructed, teaching methods should be innovated, curriculum assessment should be improved, curriculum ideology and politics should be integrated, student-centered and talent training goal-oriented, strategies to improve teaching quality should be explored from the perspective of students, so as to stimulate students' interest in learning, cultivate students' mathematical thinking, innovative ability and practical ability, and improve the teaching quality of higher mathematics course.*

Keywords: *New Engineering, Advanced Mathematics, BOPPPS Teaching Model, Teaching Quality*

1. Introduction

The new engineering construction adheres to the problem-oriented, student-centered, future-oriented and international advanced level as the goal, and cultivates students' practical ability and innovation ability through engineering projects and interdisciplinary integration. Under the background of new engineering, new requirements are put forward for the teaching contents, teaching methods and the cross-application of mathematical knowledge in higher mathematics course. Advanced mathematics is an important basic compulsory course for students majoring in science and engineering, which plays an extremely important role in cultivating students' ability to understand the relevant concepts and principles of the major by using mathematical knowledge and methods, the ability to transform practical problems into mathematical problems, and the ability to apply mathematical tools to solve mathematical problems. With the continuous expansion of colleges and universities, students in private colleges and universities have relatively low scores, weak mathematical foundation, uneven mathematical level, and generally low enthusiasm for learning higher mathematics, and unsatisfactory learning results. The quality of higher mathematics teaching is directly related to students' ability to understand and analyze problems in their later professional learning. Many scholars have conducted research on how to improve the teaching quality of higher mathematics. The traditional higher mathematics curriculum system, teaching content, training mode and teaching concept can not meet the new changes of the new engineering requirements for mathematical knowledge and ability. Therefore, the reform of higher mathematics teaching is particularly urgent and significant.

At present, the teaching reform of higher mathematics course in applied universities is mainly improved from the three dimensions of knowledge training, skill training and quality improvement, and a trinity teaching mode of "theory + practice modeling + online" is constructed, so as to promote college students to change their ideas, truly love mathematics and improve their interest in learning mathematics. In order to improve students' innovative ability and stimulate students' enthusiasm for learning, with the wide application of computer network, scholars have put forward a large number of teaching reform schemes based on network resources[1-4], such as Internet-based teaching mode, flipped classroom teaching mode, MOOC-based teaching mode and micro-lesson teaching mode. In the aspects of teaching content, teaching methods and evaluation methods, many suggestions are put forward. Most scholars put forward theoretical teaching methods, but neglect the students' acceptance and mastery of the content, thus affecting the teaching quality of the course. In a large number of studies on the teaching of higher mathematics course, there are few studies on the reform of the teaching content of higher mathematics course in private colleges, and few studies on interesting mathematical activities.

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This paper reforms the teaching content and teaching methods of higher mathematics course, reconstructs the teaching content of higher mathematics course under the background of new engineering, takes students as the center, carries out personalized teaching, and stimulates students' learning interest. Then improve the teaching quality of higher mathematics course in private colleges.

2. Teaching Situation of Higher Mathematics Course

Most of the students in our school are afraid of difficulties in mathematics courses, have an inactive learning attitude, no good learning habits, and lack of perseverance, so most of the students are in a passive state of learning. Even if some students have their own ideas, they lack self-confidence and courage, and do not solve difficult knowledge points in time. With the increase of the difficulty of the course content, students' learning initiative in the first two weeks is significantly higher than that after two weeks, and the polarization is more serious in the later period of learning.

By analyzing the achievement degree of higher mathematics course for engineering majors in our university, we can see the problems existing in the learning process from the students' overall and individual achievement. Students lack basic mathematical knowledge, the basic formulas that need to be memorized are vague, and they fail to master basic methods, such as: the derivative and differential of a function, the definite integral and the double integral, and the related concepts of series are confused. Most of the students are weak in operation ability, and lack the ability to analyze problems by using the thought and method of differentiation and integration. They are not proficient in the basic calculation methods of calculus of one variable function, so they have many problems in the calculation of partial derivatives, total differentiation, double integral and line Integral of binary functions. Most students have weak mathematical thinking and poor problem-solving ability, especially for more complex comprehensive problems. For example, the knowledge of total differentiation, double integral, line integral and series of binary implicit functions are relatively difficult. The students not only failed to fully understand the class, but also did not review and consolidate on time after class, and the phenomenon of plagiarism is serious.

Under the background of new engineering, the teaching of higher mathematics should not be limited to the understanding and operation of knowledge, but should pay more attention to the ability of using mathematical knowledge to express, analyze and solve problems. At present, the teaching content of higher mathematics course is relatively simple, the teaching method is more traditional, and the connection with the professional course and practical engineering problems is out of touch. The lack of practical cases and extended content in teaching reduces the enthusiasm and participation of students in learning, and it is difficult for students to feel the practical application value of mathematics. As there are more knowledge points in the course and less time for classroom practice, students only finish homework after class, and cannot reach the level of proficient calculation, and it is more difficult to understand and apply relevant knowledge to solve practical problems. Due to the large amount of teaching content, limited teaching time and heavy teaching tasks, teachers do not have enough time and energy to understand each student's learning situation, fail to design teaching content according to the individual needs of students, and fail to adjust teaching methods in time according to the real-time feedback of students, which seriously affects the curriculum teaching quality.

3. Teaching Strategies of Higher Mathematics Course

3.1. Reconstruct Teaching Content

Based on the constructivism learning theory and BOPPPS teaching model, this paper reconstructs the teaching content of higher mathematics course in view of the present teaching situation. Before class, in view of the content of the chapters studied, the weak knowledge points of students were understood according to the investigation, the content of pre-class review and preview was designed, the old and new knowledge points were effectively connected, and relevant practical problems were raised. According to the content of the Higher Mathematics course and students' learning situation, the teaching and learning objectives of the course are formulated. The educational team creates and integrates all kinds of online teaching resources at different levels, including courseware, videos, audio materials, exercises, and tests, so that students can choose knowledge modules to learn according to their needs. The instructors create problem situations with typical problems, connecting higher mathematics with professional courses, highlighting key contents, training the thinking required for difficult problems, and cultivating students' ability to analyze and solve comprehensive problems on the

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basis of mastering basic methods and skills. For example, the knowledge of sequence, function and limit in higher mathematics provides a powerful tool for the analysis and improvement of algorithms, and precisely analyzes the time complexity and space complexity of different sorting algorithms, so as to select the best algorithm. Teachers can explain the limit problem in combination with simple algorithm problems to help students understand and apply the limit idea.

3.2. Innovative Teaching Methods

In line with the principle of "student-centered", according to the training objectives of new engineering talents and the characteristics of higher mathematics curriculum, we should teach students according to their aptitude and specialty. Based on the BOPPPS teaching model, blended teaching [5] is conducted to guide students to think independently and explore independently, and personalized teaching is carried out through participatory learning. In order to improve students' interest in learning higher mathematics, cultivate students' learning habits, and enable each student to carry out personalized learning, the teaching means and methods before, during and after class are adjusted in teaching, so as to stimulate students' learning enthusiasm to the maximum extent, so that each student can learn something, lay a good foundation for the subsequent study of professional courses, and cultivate students' independent learning ability.

Before class, the teacher pushes the learning video of the next class and the hierarchical self-test questions by SuperStar Learn, and puts forward the learning requirements of various knowledge points to make students clear their learning goals. As the class teaching time of higher mathematics course is relatively tight, students are encouraged to share the harvest of pre-class review online and raise existing problems, so that teachers can give targeted explanations in class. In order to encourage students to participate in the discussion as much as possible, divide students into groups of five. Each group is made up of good and bad students. Each group should ask at least one question and share their personal learning experience.

In the class, the teacher adjusts the teaching content according to the effect of the pre-class preview, and strives to comprehensively solve the difficult problems of the students. Teachers guide students to study independently, explore actively, and cultivate students' ability to analyze and solve problems. Through interactive inquiry, question answering and discussion, students are guided and encouraged to take the initiative to participate in classroom learning. On the SuperStar Learn, students are encouraged to take the initiative to answer questions by setting up candidates, answering quickly and discussing in groups. Students are allowed to explain the topics within their reach and are given corresponding challenge points. Students are encouraged to summarize what they have learned. Increase the interest of mathematics in teaching, use multimedia to present mathematical functions, formulas and other content, and solve practical problems with mathematical knowledge with the help of cases. The information technology is deeply integrated into the teaching of higher mathematics, and the problem situation is created by using information technology to improve student participation in class.

After class, the teacher guides and urges the students to reflect and summarize, check the omissions and make up for the deficiencies, and the group leaders hand in the difficult problems learned this week every week, and conduct guidance and answer questions online. Assign assignments at levels A and B. Level A is the basic question, requires each student must complete. Level B in addition to the A question, which are more difficult challenge questions, students can choose to do. Each group recommends students to explain the problems in this week's homework in the evening study. Students who are good at learning help students who are poor at learning. We encourage each other and make progress together. Teachers publish the topic discussion of the learned content on the SuperStar Learn, hold regular learning exchange meetings to share their learning experience, record the number of discussions and sharing of students and give them extra points.

3.3. Improve Course Assessment

Improve the course assessment system, pay attention to students' process assessment, and carry out all-round assessment before, during and after class. The comprehensive score of higher mathematics course is composed of the process assessment score and the final score in proportion, and the process assessment is composed of the learning before, during and after class. Pre-class learning input includes the completion of learning videos, basic knowledge quizzes and preview sharing. Class performance includes the enthusiasm and quality of class exercises, participation in discussions, summaries and class notes, using online interactive tools such as voting and quick answer to record students'

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participation. After class review and development include homework, unit tests, summary reflection, learning communication and so on. The assessment system weighted by each link assessment index can understand students' learning situation more comprehensively and accurately, give feedback and guidance in time, and promote students' learning effect and ability.

We will increase the students' self-evaluation system and innovate the extra point system. Students regularly self-evaluate, monthly self-evaluation of their learning attitude, learning methods, learning results, and record in the learning log. At the end of the course, students conduct a comprehensive self-evaluation of their performance throughout the course, including knowledge mastery, ability improvement, teamwork ability, etc. Self-evaluation is combined with teacher evaluation. When evaluating students, teachers refer to students' self-evaluation and give appropriate bonus points to students who can objectively understand their shortcomings and put forward improvement measures. Students who put forward innovative ideas, methods or solutions in the course of learning will be awarded points after evaluation and approval. Extra points will be given to students who participate in contests, academic activities and social practices related to mathematics courses and achieve certain results. Bonus points will be given to students who have made significant progress in their course studies. Points will be deducted for students who arrive late, leave early, or absenteeism. Points will be deducted for students who play mobile phones in class, talk to each other, interfere with teaching, or disobey teachers' management. By enriching examination forms, adding student self-evaluation system and innovative extra points system, students' learning achievements and abilities can be evaluated more comprehensively, and students' learning enthusiasm and innovative spirit can be stimulated.

3.4. Integrate Curriculum Ideology and Politics

Excavate the ideological and political elements of the course, and integrate them into the course. Introduce the historical background behind theorems and formulas and the process of mathematicians' exploration. For example, when teaching calculus, the story of Newton and Leibniz can be told to let students understand how they persevered under difficult conditions and eventually pioneered calculus, an important branch of mathematics. Through historical stories, students are cultivated with a tenacious spirit and a heart of awe for science. Combined with practical application cases in real life, for example, through the analysis of mathematical principles used in the structural design of Bridges, students can realize the key role of mathematics in ensuring engineering safety and improving efficiency, so as to cultivate students' sense of responsibility and mission.

After class, students are encouraged to participate in mathematical contests in modeling. In the process of solving practical problems, students' teamwork spirit, innovation ability and problem-solving ability are cultivated. Through setbacks and challenges in competitions, students learn to face difficulties and persevere. The school holds lectures on mathematics culture, inviting experts and scholars to introduce the development of mathematics, its cross-integration with other disciplines, and the role of mathematics in promoting social progress. These activities broaden students' horizons, enhance their interest and love of mathematics, and cultivate their humanistic sentiments. The faculty organizes students to participate in math practice activities, such as field measurements and data analysis, allowing students to experience the practicality and rigor of mathematics firsthand and fostering their practical abilities and scientific attitudes.

In the teaching process, emphasis is placed on accuracy and repeated practice to cultivate students' craftsman spirit. In the process of mathematical operations and proofs, students are strictly required to be accurate. Every symbol, every step of derivation should be taken seriously to cultivate students' attitude of excellence. The teacher assigns an appropriate amount of repetitive exercises so that students can improve their proficiency and accuracy through continuous practice. At the same time, students are encouraged to constantly sum up experience in practice, seek better solutions, and cultivate students' patience and perseverance. When explaining exercises and assignments, students' mistakes are analyzed in depth, not only to let students know where they went wrong, but also to guide them to think about why they made mistakes and how to avoid similar mistakes. Through this kind of error analysis, students can realize the complexity and multi-faceted nature of things, and cultivate their rigorous and comprehensive thinking habits.

4. Conclusion

This paper is student-centered, talent training goal as the guidance. It explores strategies to improve teaching quality from the perspective of students under the background of new engineering. In view of

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the current teaching situation and problems in our school, the teaching content of higher mathematics course is reconstructed based on the BOPPPS teaching model, and the teaching reform is carried out before, during and after class, and the participatory teaching method and the content of the connection between higher mathematics course and professional courses are adopted. Through the practice of curriculum reform, students' learning initiative can be promoted, their mathematical thinking, practical ability and innovative ability can be cultivated. Finally, the teaching quality can be further improved.

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