

# *Research and Practice on the Construction of High-Quality Courses in Higher Mathematics*

Bai Xiuqin<sup>1</sup>, Yang Nan<sup>2</sup>

<sup>1</sup>Pingdingshan University, Pingdingshan, Henan Province, 467000, China

<sup>2</sup>Henan College of Transportation, Zhengzhou, Henan Province, 450000, China

**Keywords:** Advanced mathematics, Excellent courses, Practical research

**Abstract:** In recent years, with the full support and advocacy of the Ministry of education, colleges and universities pay more attention to the construction of high-quality courses. The so-called quality course refers to the essence course in the school, which belongs to the main content of improving teaching quality in Colleges and universities. The construction purpose of such courses is mainly to clarify the teaching objectives and improve the course content on the premise of the current development of science and technology. Through the full use of modern teaching equipment, the teaching methods and modes are significantly innovated. At the same time, the construction of high-quality courses should also design and adjust the syllabus and scheme around the teaching object, and make every effort to create a teacher led a new educational model with students as the main body and modern technology as the tool. Based on this, this paper mainly studies the construction of high-quality teaching courses on the premise of higher mathematics.

## 1. Introduction

In essence, the construction of excellent courses can be regarded as the optimization and reform of traditional courses. It is the optimization of a course for the realization of modern educational objectives. Higher mathematics has always been one of the important courses in college teaching, and it is also the necessary content for students to participate in the examination. The study of this course can not only effectively train students' group reasoning ability and logical thinking ability, but also promote their ability of problem analysis and solution. Therefore, colleges and universities should attach great importance to the construction of high-quality courses in higher mathematics. In recent years, with the continuous growth of the number of students in higher education, the overall ability and learning level of students have decreased. In the face of this situation, colleges and universities should further strengthen the curriculum construction in combination with the new educational situation, so as to promote the deepening of educational reform and significantly improve the quality of higher mathematics education.

## 2. Optimize the Guiding Ideology of Curriculum Construction

According to the spirit of the documents related to the construction of high-quality courses issued by the education department, such courses are required to have first-class teaching content,

teacher team, teaching management, teaching methods and teaching materials, which should fully include the characteristics of exemplary courses. Higher education institutions should clarify the importance of spiritual curriculum construction and regard it as an important part of the two requirements of deepening teaching reform and improving teaching quality. For the content of higher mathematics, when constructing high-quality courses, college leaders and teachers regard the fundamental needs of teaching as the premise basis, and in the selection of course content, we should not only fully consider the professional characteristics and applicability of talent training, but also comprehensively measure the sustainable development of student groups [1]. In addition, the teaching link should actively implement the application as the purpose, and always emphasize the necessary and sufficient teaching principles, and focus the teaching of higher mathematics on “concept mastery, strengthening application, improving quality and ability training”. Through the course teaching, we should fully realize the teaching objectives of ability development and knowledge transfer, and put the ability training through the whole process of teaching. In teaching, teachers should also be based on the characteristics of students and scientifically choose teaching means and methods around the teaching content. In this way, they can not only highlight the teaching focus, but also help students resolve learning difficulties, promote them to consciously and actively participate in learning activities and improve their comprehensive ability. The cultivation of students' ability can be mainly reflected in the following aspects: strengthening students' knowledge application ability, basic operation ability, problem analysis ability, solution ability, mathematical modeling ability, abstract problem generalization ability, logical reasoning ability and autonomous learning ability.

### **3. Strengthen the in-Depth Construction of Teaching Echelon**

In the construction of high-quality courses, the construction of teaching echelon is the core. From a certain level, the teaching level of teachers is the key to the improvement of teaching quality. As one of the compulsory contents of various majors, higher mathematics has strong theoretical knowledge content, too many class hours, a wide range of students and a large number of people. Therefore, it is far from just a few teachers to undertake the teaching of this course, but a whole teaching echelon. It can be seen that the guarantee of higher mathematics teaching quality should be directly related to the professional quality and teaching level of the teaching echelon, that is, if there is no first-class teaching echelon in college education, the curriculum quality is difficult to be effectively guaranteed. In view of this, colleges and universities should always take building a first-class teacher echelon and improving teaching level as the focus of the construction of high-quality mathematics courses. The specific implementation can be started from the following aspects. First, formulate the system of curriculum director. The curriculum director should choose professors with excellent teaching effect, advanced ideas, strong teaching and research ability, excellent coordination ability and organization ability. At the same time, the responsibilities of the person in charge should be clarified in the system, that is, the teaching methods, curriculum organization, teaching means reform, textbook construction, teaching effect and curriculum evaluation of higher mathematics. Second, we should regularly organize students' teaching evaluation system. By organizing students' teaching evaluation activities every semester, we can comprehensively collect and master the teaching opinions of students on mathematics teachers. After teachers sort out various feedback opinions, we can start to rectify teaching measures, so that teachers can improve the deficiencies in traditional teaching [2]. Third, young teachers' class assistance activities are carried out. Due to the needs of high-quality curriculum construction, colleges and universities will have a certain number of higher mathematics teachers every year. In order to make the group of young teachers familiar with the teaching links as soon as possible and

get the recognition of the students, each school should strictly stipulate that young teachers need to help the class for at least three years. After the task of helping the class is completed, they can officially serve as the lecturer of higher mathematics through the trial lecture of the teaching and Research Office in the school. Fourth, teaching and research activities should be carried out for a long time. Before the beginning of each semester, the person in charge of the course should formulate a specific plan around the teaching and research activities. At the same time, specific time for collective teaching and research activities can also be set. The main contents of the activity should include teaching observation, class evaluation, collective lesson preparation, discussion on the construction of auxiliary teaching materials, trial lectures by young teachers, multimedia courseware production, etc. By adhering to this series of teaching systems and measures for a long time, higher mathematics teachers can better combine the teaching needs of the new era, update teaching ideas, optimize teaching contents, deal with teaching difficulties, innovate teaching methods and improve teaching level.

In addition, in order to ensure the overall improvement of the academic level and research ability of the senior teaching echelon, colleges and universities also continue to organize and implement various scientific research activities. Professors, doctors and other groups can take the lead to form a variety of research directions and establish a professional senior scientific research echelon.

#### **4. Integrate the Curriculum Structure System and Content**

The Ministry of education has clearly stipulated the content of the excellent course content, which should not only be scientific and advanced, but also be able to fully reflect the latest technological achievements in this field. Although higher mathematics is very classic in content, there are still many problems worthy of in-depth thinking and discussion at the level of content establishment. According to the current teaching principles of higher education, the development trend of higher education and the characteristics of higher mathematics courses, it can be found that the cultivation of students should start with four abilities. First, use mathematical concepts, ideas and methods to help students further absorb engineering principles and related concepts. This part of teachers should pay attention to the teaching of conceptual knowledge in higher mathematics; Second, to transform practical problems into mathematical modeling ability, at this time, teachers should increase mathematical modeling training opportunities in daily teaching and increase the proportion of this part of teaching; Third, the ability to solve mathematical models, which trains teachers to make use of all kinds of mathematical software and computer functions; Fourth, creative thinking ability. In this part, teachers should make it clear that mathematics is the best thinking gymnastics. In the teaching link, they should consciously guide students' analogical thinking, logical thinking, associative thinking and divergent thinking around the teaching content, so as to help them fully understand the beauty of mathematics and improve their innovation ability [3]. In addition, the curriculum system and content of higher mathematics should also be reformed. First, the descriptive definition can be used in the teaching of limit concept; Second, the chapter of MATLAB calculus and derivative application can be integrated; Third, when explaining the application of definite integral, you can try to only talk about the area of plane graphics; Fourth, the function differential method determined by implicit function and parametric equation can be deleted; Fifth, the knowledge related to mathematical modeling can be fully introduced, so as to increase the teaching examples of modeling; Sixth, introduce the mathematical software package and reasonably integrate the basic introduction of MATLAB knowledge into the high-quality mathematics courses; Seventh, highlight the content of mathematical experiment and make full use of MATLAB software; Eighth, according to the teaching requirements of different majors in the school, the original teaching cycle of higher mathematics courses will be shortened to provide students with more

professional skills, school time and opportunities.

## 5. Adopt Advanced Teaching Methods and Means

The ultimate purpose of the construction of high-quality courses is to make full use of modern educational means and teaching methods, and to stimulate students' learning enthusiasm and initiative to the greatest extent, so as to further broaden students' subject knowledge level, cultivate their innovation ability and exploration spirit. The construction of high-quality courses in higher mathematics should abandon the previous single teaching mode, and combine a series of teaching means and methods such as teaching syllabus, teaching materials, multimedia courseware, exercises, network teaching and electronic teaching plan, so as to provide high-quality services and guarantee to meet the needs of students' individualized development. For example, teachers can use the “problem driven method” to explain the course content; Teaching mathematical concepts with “case teaching method”; Organize students to carry out exercise training with “discussion method”; Fully introduce mathematical operations and concepts with “comparison method”, and help students master knowledge and concepts more skillfully through intuitive teaching; At the same time, it can also promote students to consciously complete their learning tasks by means of “special assignments”. The application of diversified teaching methods not only effectively alleviates the originally boring classroom atmosphere, but also helps to re-establish the relationship between teachers and students. In order to improve the teaching quality, higher mathematics teachers should constantly innovate teaching methods around the construction requirements of high-quality courses. First, the combination of blackboard writing and multimedia courseware can be adopted. The implementation of teaching in this way is not only conducive to the improvement of teaching efficiency, but also very helpful for teachers to control the rhythm of the classroom. The application of blackboard writing can enable students to have a deeper understanding of teachers' thinking and knowledge analysis process, which can greatly promote the improvement of their creativity. Second, fully combine online Q & A and face-to-face counseling, and carry out offline teaching through this method. After providing students with relevant knowledge learning materials, teachers can check students' learning progress in the way of face-to-face guidance, and can also use the online Q & a function to answer students' after-school questions; Third, students' motivation to learn advanced mathematics can be stimulated through mathematics competition. This method is mainly aimed at the characteristics of students' competitive heart, and stimulate their motivation to explore mathematics by means of individual or group competition. This can not only make students experience the joy of competition, but also create a good learning atmosphere in the school. Finally, the in-depth application of layered teaching method. Before the application of this method, teachers can divide the class students into two different levels: A and B. the principle of level division should be based on multiple factors such as students' mathematical test, personal voluntariness and professional type. The two groups of students should be relatively fixed, but after half a semester, teachers can make appropriate adjustments according to the wishes of students. In order to ensure the smooth implementation of layered teaching method in higher mathematics teaching and meet the requirements of high-quality course construction, teachers should pay attention to the following aspects. First of all, the syllabus should be formulated. This link should fully reflect the differences of students' needs at all levels on the premise of ensuring the basic requirements of the course. We must teach students according to their aptitude in combination with students' ability. Secondly, different teaching requirements should be set during course explanation. Level a students are a group with high basic ability. Therefore, when designing teaching requirements, teachers can expand and deepen the penetration of theoretical knowledge around the content of teaching materials, so as to lay a solid foundation for the follow-up development of students at this level. At

the same time, they can also set up elective master courses for level A students, such as mathematical modeling, problem solving, thinking training and fuzzy mathematics. For B-level students, because their basic ability and learning ability are relatively weak, they can focus on explaining basic knowledge in teaching. At the same time, they should practice more and speak more carefully, and appropriately increase the teaching proportion of exercise class and summary class. Thirdly, in terms of teaching means, for level A students, due to their excellent basic ability and strong understanding ability, the application times of multimedia courseware can be appropriately increased to expand the amount of teaching information. On the contrary, for level B students, teachers can prefer the application of traditional teaching means, which is more conducive to knowledge understanding and control of teaching progress. Finally, in the Q & A counseling session, senior teachers can adopt two different forms: online Q & A and open Q & A. For level A students, teachers can mainly conduct online interactive communication, supplemented by open Q & A, while for level B students, it is just the opposite. Through the above methods, we can not only ensure the smooth development of layered teaching method, but also fully realize the purpose of teaching students according to their aptitude.

## 6. Strengthen the Infiltration of Mathematical Modeling Ideas

The education department clearly requires colleges and universities to upload the teaching plan, syllabus, teaching video, electronic teaching plan, experimental guidance and relevant exercises of high-quality courses to the network. This change can not only improve the online learning environment, but also provide students with more diversified quality services. Therefore, the construction of teaching resources for high quality courses is very important. Colleges should share their best teaching methods, contents and curriculum essence in the network teaching platform, so as to ensure that the college students can understand many educational resources. Meanwhile, resource sharing can also help teachers learn from each other, innovate teaching methods and update the knowledge system. In view of this, colleges and universities should speed up the construction of high-quality mathematics courseware and strengthen the development of software and hardware resources. In addition, colleges and universities should also pay attention to higher mathematics experiments, making it clear that the teaching experiments in this link are mainly related to mathematical modeling and mathematical software operation. At the same time, at present, the symbolic computer systems closely related to higher numbers mainly include Mathematica, and MATLAB. For such courses, the construction of high-quality courses should ensure that the school has professional experimental teaching materials, laboratories, experimental instructors and teachers. In daily teaching, students should be actively encouraged to participate in mathematical modeling competitions and other activities, so that students can improve their comprehensive ability under multiple competition training.

The experimental contents of advanced mathematics courses usually include mathematical model problems in the application of ordinary differential equations, the application of integrals, the application of series and other knowledge, as well as relevant modeling experiments with mathematical software as the basic tool. In experimental teaching, special attention should be paid to the in-depth practice of mathematical model methods and mathematical software operation. At the same time, it is also necessary to clearly require students to be more on the computer, more hands-on and more training, guide them to actively participate in practical activities, and transform the high mathematics experiment process into basic teaching activities, so as to cultivate students' ability of mathematical software application and mathematical modeling. In addition, teachers of advanced mathematics should attach great importance to the infiltration of mathematical modeling thought. They should know that mathematical modeling thought is one of the best ways to improve

students' comprehensive ability. Based on the analysis of teaching objects, the higher mathematics courses usually face freshmen, so the teaching purpose at this time is to make them fully master the theory and basic knowledge of the course, and also to effectively train students' computing ability, logical reasoning ability and spatial imagination. However, in the past teaching, the cultivation of students' mathematical thinking and problem-solving methods was ignored, As a result, some students' mathematical application ability is poor. The deep combination of mathematical modeling thought and teaching content can properly solve this problem. Taking the numerical solution of definite differential equation and numerical calculation of integral as an example, teachers can design mathematical experiment projects, and let students complete basic experimental tasks through the use of corresponding mathematical software. Or we can combine various types of mathematical modeling competition questions to design mathematical experiment questions around teaching needs and students' ability. Through the curriculum guidance of senior mathematics teachers, we can assist teachers to complete experimental training within the specified time. Finally, in addition to encouraging students to participate in competitions held by the outside world, schools can also jointly hold large-scale mathematical modeling competitions. After many times of practice, it can be found that the integration of mathematical modeling ideas can not only deepen students' understanding of mathematical knowledge, but also help to cultivate their innovative consciousness and ability.

## **7. Develop Multimedia Teaching Courseware for Exercise Class**

Based on the position and teaching purpose of Higher Mathematics in higher education, colleges and universities should first understand the auxiliary functions of multimedia courseware. In classroom teaching, teachers should be able to reasonably introduce multimedia courseware in combination with teaching content and students' characteristics, so as to comprehensively improve the shortcomings of traditional teaching mode and overcome more important and difficult points of higher mathematics teaching, At the same time, multimedia courseware application teachers should avoid using multimedia courseware at will regardless of the nature and type of the course. If they use it blindly in the teaching process, it will not only fail to effectively build high-quality courses, but also seriously affect the improvement of course quality. Secondly, exercise class has always been the main part of higher mathematics curriculum. Because it plays a great role in promoting the improvement of students' ability, this part accounts for a large proportion in the curriculum. In view of this characteristic, teachers should focus on this part of content to design and develop multimedia courseware of exercise class, and clearly require teachers to deal with its reasonable application. The use of this kind of courseware during the explanation of exercise class can better help senior teachers summarize, summarize and analyze the content of exercise class, so as to enrich the teaching materials. After the teaching, the teacher can also upload the exercise courseware on the online teaching platform. Once a student has doubts about the knowledge learned, he can review it again through the network platform. Finally, with the increase of enrollment in Higher Education in recent years, if teachers still use the traditional face-to-face Q & a method, there will be a shortage of teachers' resources. In view of this situation, schools can develop an online Q & a system by combining their own facts and using the campus network. Through this system, students and teachers can provide sufficient interactive opportunities to help students answer all kinds of doubts.

## **8. Conclusion**

To sum up, in view of the fact that the construction of high-quality courses in higher mathematics can not be completed in a short time, all schools should stand up and develop and construct the truth, strengthen the construction of teaching echelon, integrate the curriculum

structure system and content, adopt advanced teaching methods and means, and strengthen the infiltration of mathematical modeling ideas, Making multimedia teaching courseware and many other ways can significantly improve the effectiveness of higher mathematics teaching.

## Acknowledgment

Fund Project: Research on the Hybrid Teaching of “Applied Mathematics for Engineering” under the “Internet + Projectization” Teaching Mode of Pingdingshan College School-level Teaching Reform Project, (HLW202022)

Pingdingshan College Excellent Online Open Course “Advanced Mathematics (Part 1)”

## References

- [1] Li Jing, Guo qianghui. Curriculum reform of “higher mathematics” based on modern information technology -- Taking the curriculum construction of “higher mathematics” in Binhai College of Nankai University as an example [J]. Education and teaching forum, 2021, 27: 4-5.
- [2] Yuan Jianhua. Thoughts on the ideological and political construction of higher mathematics courses in Agricultural Higher Vocational Colleges [J]. Journal of Taizhou vocational and technical college, 2021, 21 (1): 3-5.
- [3] Deng Tingyong, Zhang Fuyu, Zhang Hong. Research and Practice on the construction of “golden course” in Higher Mathematics in the new era [J]. Daqing Social Sciences, 2021, 2: 4-6.