

# *Innovative Teaching Reform in the Division of Higher Mathematics in Colleges*

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**Abstract:** Advanced mathematics is the basic knowledge required for the development of science and technology in industry and agriculture, so it is the most important link in the basic curriculum framework of universities of science and technology. The level of students' mastery of it will affect the entire university period of study, later advanced studies, and the choice of graduate employment. Because of its large content and difficulty, teachers often spend a lot of energy, but students are not interested, and the overall teaching effect is not good. In particular, the usual large-class teaching leads to great differences in the degree of mastery of the learning content of students. Statistics show that the distribution of test scores is very different, which does not conform to the normal distribution. In response to this situation, our school has carried out analysis and research, proposed and implemented the teaching reform of unified teaching in large classes and reorganization of small classes in tutoring. This new teaching method has improved students' learning enthusiasm and mastery of knowledge, which is better than previous years. Significant improvement was made, and very positive feedback was obtained in the follow-up study of other courses.

## **1. Introduction**

Advanced mathematics is the basic knowledge required for the development of science and technology in industry and agriculture, so it is the most important link in the basic curriculum framework of universities of science and technology. This course is also the first mathematics course that college students come into contact with after entering the school. Compared with the mathematics learning in the middle school stage, it has a great change, which is reflected in the increase in content and the significant increase in difficulty. The mastery of this course will directly affect students' entire university study, as well as subsequent further studies (postgraduate entrance, postgraduate entrance examination) and employment choices. Take the mechanical and electrical engineering major of our school as an example. If you do not understand and have a firm grasp of basic calculus knowledge, it will be difficult to understand and learn the engineering mathematics of the following year, as well as the Fourier transform and system transfer function required by subsequent professional courses. Employment in this industry, let alone further education.

As a basic course, freshman students are required to study this course, and the course content is varied, and the class time lasts up to one year. Due to the limited number of teachers, in order to ensure progress, it is often necessary to teach in large classes, which is also a common practice in universities at home and abroad. Taking this school as an example, the classroom teaching of higher mathematics is usually arranged in a large classroom, including three small classes in the registration of students, with nearly 100 students. And mathematics learning usually needs to consolidate and understand the content through exercises, and each small class has a separate exercise class every week. Each time in order to complete the teaching progress, the large-class teaching has strict progress control, and the small-class exercises are analyzed and explained the same topics in each class for unified arrangement and easy management. Such large-class teaching can't take care of everyone's progress. Some students gradually lose interest because they don't understand. Even if teachers find that students have different levels of mastery, it is difficult for teachers to give targeted explanations and guidance to teach students in accordance with their aptitude.

Just as the distribution of one-dimensional random variables in the natural world is Gaussian normal, our teaching also hopes to use moderately difficult questions in the exam to make students' scores present a normal distribution, that is, "control the two ends and encourage the middle", so that students' scores are basic. They are all distributed around the average level. The statistics of our school's test scores in the past single year and over the past years show that the scores are basically stable, but the average score is still low compared to the teacher's expectations, mainly because some students' scores are obviously low, indicating that they have not mastered the basics. knowledge. In addition, the overall distribution does not obey the Gaussian normal distribution. Many low scores make the overall distribution close to the lognormal or Rayleigh distribution. This shows that the degree of mastery of students is very different, and some students are "left behind" seriously, which is obviously not in line with teaching. Expectations. In addition, through discussions and follow-up contacts with senior students and graduates, students generally feel that advanced mathematics courses are very difficult, have low interest in learning, and lack solid mastery, which has a great impact on subsequent learning. Some students feel that "the content is really too difficult for them, and they can't learn well even if they want to learn"; some students reflect on "occasionally there is a small run, but the big class does not stop, learning and learning will be pulled down"; many students It reflects that "every time I take exercises, some questions are not understood at all, so I get mixed up." In addition, the test score statistics show that the rankings have a certain consistency. The same student's ranking in the mid-term or early test of a semester is close to the final test score, but the overall average score will gradually decline as the content of the study increases, which shows that the student The decline in interest in learning and the "left behind" of some students.

In summary, higher mathematics plays an extremely important cornerstone role in university education; and because of the limitations of teaching resources and schedule requirements, the generally implemented large-class teaching is difficult to take into account the individual progress of students; performance statistics show that students have differences in their mastery of teaching content. It is very large, and many students have experienced a decline in interest, and eventually "left behind" phenomenon.

## **2. Teaching Reform: Teaching Reform for Unified Teaching of Large Classes and Reorganization of Small Classes for Guidance**

We have analyzed the higher mathematics teaching links in our school and tried to carry out some teaching reforms to improve the problems mentioned above. Different from research-oriented

and comprehensive universities, the school's school policy is “skills-based, based on employment, and cultivating all kinds of technical talents urgently needed for local economic construction.” Under this guiding ideology, in fact, the goals of freshmen after enrollment are also very clear. Basically, they want to learn some skills and find a good job in a few years. Some eager students gradually have the idea of further study. However, because students generally have a weak foundation in mathematics and lack of confidence, they feel that advanced mathematics courses are too difficult, which in turn leads to a decline in interest in learning. Therefore, the main purpose of the teaching reform is to cultivate students' confidence and interest, improve overall performance, and reduce significant differences in students' learning levels.

After the author's repeated thinking and discussions with other teachers, he believes that teaching students in accordance with their aptitude is the best way to achieve this goal. For example, the common primary and secondary school tutors are the most typical teaching students in accordance with their aptitude. However, for the large number of college students and strict teaching schedule arrangements, it is basically impossible to rely on teachers to achieve individualized teaching for each student, so we can only make some small teaching innovations and reforms based on the current school teaching system. After five years of attempts, the author's new teaching method has achieved some results and is gradually improving. The main contents are as follows:

## **2.1 Unified Teaching in Large Classes, Focusing on Student Interests**

In the unified teaching for nearly a hundred students in large classes, compared with traditional teaching, under the premise of ensuring the basic progress, the author focuses on improving students' interest, and the teaching content is gradual. In each chapter, a large number of outline descriptions will be made on the overall content, so that students can first have a general understanding, analyze the simple connection with the old knowledge in the past, and then start teaching the knowledge points. I have had many discussions with the teachers of the professional courses. In the classroom, the possible practical uses and examples of the knowledge will be briefly mentioned, so that students feel that “learning is useful”.

## **2.2 Small Class Reorganization Counseling**

The focus of teaching reform and innovation is to regroup students in small class tutoring classes. The school's establishment of classes is mainly to facilitate the unified management of students. Although they are of the same major, the actual knowledge of students in the same class varies greatly. In the past tutoring classes, the object of the class was the same professional small class. To learn the same topic, some students often find it too simple, and some students find it too difficult. This is contrary to the original intention of small-class tutoring. In response to this situation, after the first entrance exam, the author reorganized the advanced mathematics tutoring classes for students in one large class and three small classes, disrupting their student status and dividing them into math learning questions 1/2/3 (Fast, medium and slow) classes. And in consultation with the school's teaching office, the small-class tutoring time of the three classes does not conflict or overlap with other courses. In the fast class, briefly review the knowledge points, and focus on some improvement topics, such as the content of the junior college upgrade, so that students with better mastery can further stimulate their potential; in the middle class, the main textbook exercises will be given to students with medium mastery. Consolidate the foundation and achieve satisfactory results in the exam; in the slow class, it is mainly to review some of the content of the class, encourage students to ask questions about the most basic knowledge, and give a second lecture on some common problems to prevent the emergence of “left behind”. At the same time, the three classes maintain mobility, telling everyone that the division of classes is for students to learn

better knowledge. The teacher treats students equally, and hopes that students face their own situation and choose the class that suits them. For example, you can adjust the class based on the test results, and you can voluntarily choose to go to the other two exercise classes to audit.

### 2.3 Stimulate Students' Learning Initiative

Research and practice show that mutual discussions between students are often very valuable and creative, because the knowledge level between students is similar, there is no problem of confidence or lack of confidence, mutual discussions are also easy to understand each other, and the discussion will promote positive Thinking; and on the basis of student discussion, if the teacher can give guidance and analysis, very good results will be obtained. In the teaching reform, the author will assign some discussion tasks to the students in each exercise class, especially to encourage the students in the slow class to discuss more, let the students discuss first in each class, and finally the teacher will summarize and analyze. It turns out that with the emergence of students' interest, some of the students had discussions before class, and their understanding of the content of learning was obviously deepened. In addition, in order to improve students' enthusiasm and strengthen their understanding of students' mastery and feedback on teaching, the author requires every student to send emails a week or ask at least one question in the evening for self-study. It can be the simplest content or a certain exercise. . Then the author will reply and give a unified explanation of the more common content in class.

### 3. Teaching Results and Feedback

In this attempt of teaching innovation and reform, some problems also appeared in the early stage. For example, management confusion. Due to the difference in the arrangement of small classes with student status, students misremembered the time of the exercises and missed classes. This problem was solved after the establishment of the WeChat group for the tutoring small class and small class student representatives; in addition, some students were assigned When I arrived in the slow class, I felt "lost face" and did not cooperate with the teaching. The author continued to try and improve, strengthened the communication with the students, tried to motivate the students more and strengthen the mobility between the small classes. After exploration, the author's substitute class average score is higher than that under the traditional teaching model, longitudinally compared with previous years, and horizontally compared with other large classes of the same grade, the average score is higher than 6%, and the significance passes the 95% confidence regression hypothesis t-test. . In addition, it is obvious that students' interest in learning has increased and their confidence maintained, and there are more students who say that they want to participate in the undergraduate upgrade than in previous years. What is more important is that the phenomenon of low scores has been greatly reduced. phenomenon". In addition, the senior professional teacher also expressed in the follow-up communication that the mathematics foundation of the students after the teaching reform has been significantly improved.

### 4. Summary

In the teaching of higher mathematics in vocational schools and colleges, it is particularly important to cultivate students' interest and motivation in learning. In the current teaching management and arrangement, large-class teaching is a common mode, but it is difficult to teach students in accordance with their aptitude, resulting in unsatisfactory overall teaching results. Under this teaching framework, the appropriate reform of the small-class tutoring mode and the stimulation of individual attention and interest to the students have effectively improved the overall

performance of the students and maintained their individual confidence. This innovative reform has received strong support from the school, and will continue to make more attempts and improvements. It has been planned to be implemented in other classes, and to be promoted and experimented in other subjects.

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