

# *A Brief Analysis of the Teaching of Higher Mathematics*

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**Abstract:** The latest issue of the National Education Bulletin shows that 73.6% of students have some resistance to higher education. Because of its unique mathematical thinking mode, relatively abstract and highly logical theory, higher mathematics involves many axiomatic system formulas, so it is also the basic entry subject of science and technology, economics and management in Chinese higher teaching. With the rapid development of the society, how to help students complete the study of higher mathematics more efficiently in the limited classroom environment has become a problem for teachers in colleges and universities to think about.

## 1. Introduction

As a basic entry subject, higher mathematics generally appears in the teaching of science and technology, economics and management in colleges and universities. The main applied disciplines include computer, aerospace, economics, advanced physics, chemistry, clinical medicine, architecture, mechanics, civil engineering, pharmacy and other majors. At present, most of the textbooks selected by colleges and universities are based on the seventh Edition of Advanced Mathematics of Tongji University. In the teaching of colleges and universities, they generally appear in the form of two volumes. The length of schooling is one year, and the distribution of knowledge system is mainly divided into differential and integral. It is subdivided into 11 chapters, including limit and continuity of function, derivative and differential of unary function, mean value theorem of differential and application of derivative, indefinite integral, definite integral and its application, etc. The inspection method is closed book examination. The study of advanced mathematics has certain requirements for students' calculation ability and mastery of elementary mathematics knowledge points, and focuses on the cultivation of students' logical thinking ability and reasoning and analysis ability<sup>[1]</sup>.

## 2. Analysis of teaching status

### 2.1 Contradiction between expanding enrollment and current teaching model

In recent years, colleges and universities have started to implement enrollment expansion policy. From 2015 to now, students in colleges and universities have gradually increased. On the one hand, with the same teaching content and teaching requirements, the number of students increases but the mathematics foundation varies; On the other hand, with the increase of teaching individuals, teaching demands increase, but teaching means and teaching methods can not follow up, which also

goes against the principle of individualized teaching. Some students get excellent scores in the college entrance examination, while some students only get a few points without any basic knowledge of mathematics. As a result, some students have reached the point of mastery of knowledge, while some students just start their study.

## 2.2 Single teaching method

Advanced mathematics as a basic subject, most teachers adopt the teaching mode of "blackboard + chalk + multimedia" at the beginning of class, blindly "cramming" teaching of "teachers talk, students listen". In the communication with students, some students say that such advanced mathematics class makes them feel boring and boring. Students said that facing the blackboard + chalk, as if back to the middle school mechanical learning knowledge, no interest in learning higher mathematics, students' thinking mode is still in a rigid state, it can be seen that if blindly adopt the traditional teaching mode, without reflection and innovation, is not conducive to the cultivation of students' interest and ability.

## 3. Analysis of learning status

### 3.1 Course difficulty

In terms of learning thinking, advanced mathematics is a subject with abstract concepts and rich logical teaching content, which has certain requirements for students' logical thinking ability and abstract thinking ability. In terms of teaching content, higher mathematics mainly consists of differential and integral. It is studied on the theoretical basis of limit. It can be said that the mastery of the concept of limit is the cornerstone and bridge of learning calculus<sup>[2]</sup>. However, the students said that at the beginning of learning, there was a certain difficulty in understanding the concept of limit, which even reached the point of arduousness. As a result, the first impression of higher mathematics was difficult.

### 3.2 Transformation of students' thinking mode

From the perspective of thinking mode: middle school mathematics pays attention to students' problem-solving skills, teaching content, teaching methods, teaching difficulties are based on the college entrance examination, students who have just graduated can be said to be the product of the exam-oriented education mode, but the teaching content and thinking mode of higher mathematics are not on the same level with middle school mathematics. As a result, when students graduate from high school and enter the university, they do not form a complete system in terms of mathematical knowledge structure, thinking mode and problem-solving skills, and there are many loopholes. However, a lot of math knowledge that is omitted in high school is basic in college math. For example, in the chapter of derivative, students will find the derivative, but when it comes to the proof of the derivative, most students say it is difficult. As a result, many students cannot keep up with the progress of advanced mathematics teaching.

### 3.3 Differences between knowledge points

Middle school mathematics mainly focuses on mathematical problem solving skills and methods, for the basic concepts are not very clear, which limits the way of thinking of students. However, the content of higher mathematics is stronger than that of middle school mathematics in breadth and depth, so there are great differences between the teaching methods of higher mathematics and

middle school mathematics. In addition, the time of advanced mathematics is limited, so in college classes, teachers' teaching of knowledge points is relatively intensive and the teaching speed is fast. The change of thinking mode and the surge of knowledge points make students unable to quickly catch up with the teaching progress of college teachers<sup>[3]</sup>. In addition, higher mathematics teaching pays more attention to the understanding and mastery of basic concepts, and emphasizes the understanding and thinking of students on mathematical knowledge, which requires students to spend time thinking and discussing after class. In other words, it requires students to learn independently, and focuses on the cultivation of students' self-learning ability and hands-on problem-solving ability. However, students just from high school into the university, independent learning ability needs to be cultivated and improved.

### 3.4 Connection between knowledge points

There is some contradiction between middle school mathematics and university mathematics. For example, the inverse trigonometric function and related knowledge are deleted in the middle school curriculum, but students need to have a certain grasp of advanced mathematics and its beginning, which makes students confused at the beginning of advanced mathematics learning. Of course, after the reform of the new curriculum standard, there are also overlapping knowledge points in the learning of middle school mathematics and higher mathematics. For example, the concept of limit is put into the elective textbooks of middle school, and derivative is the important and difficult point in the learning of middle school mathematics. The imminence of knowledge makes students have a certain understanding of the concept of function limit and the application of derivative. However, the study of middle school mathematics is mainly oriented towards the college entrance examination, and focuses more on the cultivation of mathematical ability and skills. It emphasizes the calculation of limit and derivative, and the understanding of concepts is not very clear. However, advanced mathematics requires a higher level of knowledge points such as limit and derivative in the understanding and application of concepts, and the learning time is more compact, making students unable to keep up with the teaching progress of advanced mathematics.

## 4. Teaching improvement plan and analysis

### 4.1 Explanation of Basic concepts

The concept of advanced mathematics is highly abstract and continuous. In the communication with students, most of them said that they were confused in understanding the concepts of limit and derivative, which made it impossible to continue the follow-up study. In the explanation of basic concepts, teachers can properly introduce the history of mathematics, conclude relevant cases, and make animations to improve students' interest in learning and deepen their understanding of concepts.

For example, when explaining the concept of "derivative", we can properly explain the century debate between Newton and Leibniz in vivid language on the naming of the concept of derivative. The introduction of a history of mathematics not only allows students to understand the development of calculus and arouse students' learning interest, but also can better link up the classroom content.

### 4.2 Pay attention to the cultivation of mathematical thinking

Teaching a person to fish is better than teaching a person to fish. In advanced mathematics, the problems can be ever-changing, but the knowledge system is the same. Teachers should not only

explain the process of solving problems clearly, but also guide the problem solving ideas, guide the students how to use the knowledge to independently find solutions, and pay attention to the cultivation of logical thinking ability.

For example, the section of Mean Value Theorem mainly contains four theorems of Fermat theorem, Rohr theorem, Lagrange mean value theorem and Cauchy theorem. In the concept understanding of differential mean value theorem, the previous of the four theorems is followed by the last one. In addition, the exercises of differential mean value theorem are mostly variations of theorems, concept derivation process and relations between the four theorems. Especially the concept derivation of Lagrange's mean value theorem, most students said that they could not fully understand the origin of its concept. In the course of teaching, they tried to use the way of drawing mind maps to explain the relationship between theorems and help students complete relevant exercises, and students said that the class was acceptable.

### 4.3 Use of modern educational technology software

Modern educational technology is the most subversive technology to education in the future. It is the general trend to use modern educational technology to promote the development of education. The author learned that Dai Jinjun's linear algebra class in Central China Normal University adopted the "1+7" teaching mode to realize the sharing of high-quality teaching resources. In the process of offline teaching, teachers can intuitively contact students and timely understand their learning status and progress by walking in class and observing students' facial expressions and movements. However, due to limited offline teaching time, teachers can also use modern educational technology to assist teaching, such as establishing advanced mathematics question answering groups<sup>[4]</sup>. To solve the problems encountered by students in learning, students set up corresponding study groups in the group to discuss related knowledge points, so as to find problems and solve problems in time. At the same time, Dingding, Xuotong and other software are used to carry out online discussion and learning, analyze students' feedback and summarize students' problems in learning, help students answer their doubts through video teaching, summarize a series of knowledge points and teaching situations, timely adjust the next teaching plan, and help students learn higher mathematics faster and better.

### 4.4 Application of multiple teaching modes and learning theories

The concept of mathematics is a concise summary of the space form and logical relation of the real world. It is the starting point of deducing theorems, formulas and laws, the starting point of establishing theoretical system, and the core content of mathematics teaching. However, many students in the process of learning advanced mathematics reflect that they have some difficulties in understanding concepts. Meanwhile, the problem-solving ideas of advanced mathematics are more abstract than those of elementary mathematics. Due to the differences in students' foundation and sensitivity to mathematics, limited classroom explanation time cannot meet the needs of all students.

For example, we can try to use the flipped classroom teaching model in teaching, and divide students' learning into two stages: the imparting of pre-class knowledge and the internalization of classroom knowledge. The teaching stage of knowledge is completed before class, the internal and external time of class is adjusted, the corresponding teaching video is recorded before class, and the learning task list is prepared for students to preview. Students need to operate according to the task list given by the teacher, and complete the corresponding tasks such as self-study, knowledge point sorting and group discussion. In the internalization stage of knowledge, students start with problems, begin discussions under the guidance of teachers, integrate the key and difficult points of

knowledge, and finally achieve the purpose of knowledge integration.

## 5. Conclusion

The world we live in is constantly developing and changing, and the traditional education model cannot keep up with the trend of development. For teachers, the process of teaching is not only a process of helping students learn, but also a process of learning and reflection by teachers themselves. The Chinese civilization has lasted for five thousand years, and now the pace of progress has not stopped. Branch for the pen, now a variety of teaching mode bloom, is countless education teaching pioneers unremitting efforts, teachers as the development of the era, cultivate the future of the era, more need to improve themselves, teaching, history of education will lag behind, if we have been stagnant, we lag behind, "three times a day my body" is three thousand years ago educator Zeng Zi's expectations of us, As educators of the new era, we should pass on, but the discussion to the end of the paper feels shallow, also need to practice, so not overnight, when perseverance.

## References

- [1] Dai Wei, Yang Yang, E Chengguo, Chen Kun, Wang Qi. "Student-centered" Teaching Reform and Practice of Higher Mathematics [J/OL]. *Journal of hebei institute of environmental engineering*: 1-5 [2023-05-26]. DOI: 10.13358/j.i SSN. 2096-9309.2023.0111.01.
- [2] Li Jianlong, Guo Zhirong, Yao Xingtao. The application of Micro-course Teaching in the Reform of Higher Mathematics Teaching [J]. *Journal of Hubei Open Vocational College*, 2023, 36(07):167-169.
- [3] Li Han, Gao Yunfeng. Research on the Evaluation of "Online + Offline" Mixed Teaching Effect of Advanced Mathematics [J]. *Journal of Jilin Agricultural Science and Technology University*, 2023, 32(02):103-106.