

# Research on Teaching Reform of “Advanced Mathematics” Based on Micro-Course

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**ABSTRACT.** *As a traditional course of higher education, advanced mathematics has fallen behind the requirements of the development of times. The deep development of educational informatization has brought to the teaching of micro-courses. The resources of micro-courses are based on knowledge points and used teaching videos as the main carrier, having attracted much attention. The paper combines the actuality of the “Advanced Mathematics” course to analyze and study the necessity and feasibility of micro-course teaching. Besides, it gives specific implementation strategies to explore how to effectively conduct micro-course teaching and stimulate students’ interest and passion to learn advanced mathematics.*

**KEYWORDS:** *Advanced mathematics, Micro-course, Teaching reform*

## 1. Introduction

Advanced mathematics is a public compulsory course for all majors in universities, which is also the foundation of students’ follow-up studying. It is obvious to witness its foundation and importance. Therefore, the quality of the teaching effect of higher mathematics courses will directly affect the improvement of students’ basic quality. The content of advanced mathematics courses is rigorous and the logic of it is strong. Besides, it is abstract. However, traditional teaching methods can only use limited teaching hours to explain a variety of esoteric content. The teaching progress of tradition methods is fast and it is difficult to meet the personalized learning of students. Therefore, it is gradually cannot keep touch with the times. With the advent of the information age, the teaching model is increasingly updated under the background of the continuous popularization of the Internet, and it put forward new requirements for the teaching of advanced mathematics courses. Nowadays, most students are proficient in using information technology equipment

such as smartphones and tablets. The ways for students to access knowledge have greatly increased, which creates a good hardware environment and information network for the reform of “Advanced Mathematics” based on micro-courses platform. The emergence of micro-courses provides a new development model for the study of higher mathematics and provides feasible tools and approaches for exploring the transformation of teaching models. By using the characteristics of clear themes, simple production, easy dissemination and reusability of micro-courses, we will vigorously develop the higher mathematics teaching model based on micro-courses. It is an organic combination of teacher system teaching and fragmented teaching, to a certain extent. Besides, it provides the possibility for student to experience mobile learning. Therefore, teaching is no longer restricted to classrooms and textbooks and students can learn anytime and anywhere. The micro-curriculum designed and produced by teachers according to their academic conditions not only meets the cognitive level of students and meets the individual needs of students’ learning, but also becomes an important learning resource. It also forms the basis of the teaching reform of “Advanced Mathematics”.

## **2. The Necessity of Carrying out the Teaching Reform of “Advanced Mathematics” Based on Micro-Courses**

### ***2.1 Problems in Traditional Teaching Mode***

At present, “Advanced Mathematics” takes the way of teaching in our school. In this traditional teaching mode, students acquire knowledge through various teaching activities designed by teachers. In the classroom, students are only passively thinking about the problems raised by the teacher. Students who have not previewed do not even know what the teacher is going to do or what the examples are trying to illustrate. The teaching time of each lesson is long, and students are prone to fatigue, lack of attention and discipline. Therefore, the learning efficiency is low. The larger amount of course’ content will cause the learners to have blindness and frustration, and lose their interest in learning. Moreover, the phenomenon of large class sizes is widespread now, and the knowledge imparted by teachers in the classroom can hardly meet the individual needs of each student. In the long time, the differences between students will become greater and the polarization will become more serious. There are many problems of traditional teaching mode, for example, how to guide students to learn independently, how to study without being restricted by time and space and how to provide abundant learning resources.

### ***2.2 The Characteristics of Advanced Mathematics Courses***

Advanced mathematics courses mainly consist of concepts, theorems, rules, formulas and methods to form a logical system. Concepts and theorems are abstract and difficult to understand. The knowledge application cases are usually decoupled from life and profession and it is dull and tasteless. Advanced mathematics courses not only need to cultivate students’ image thinking, but also

emphasize the cultivation of students' abstract thinking and logical thinking ability. However, the limitation of class time limits the cultivation of students' thinking ability and each student's abilities and levels are various. This requires teachers to effectively expand their learning time and content and provide more high-quality supporting learning resources. Teachers should help students study before or after class. Through the design and construction of more intuitive and vivid higher mathematics micro-course resources, it can make up for the deficiencies of traditional higher mathematics teaching. It teaches students in accordance with their aptitude, improve the deficiencies of interactive teaching and individual guidance before, during and after class. Besides, it effectively stimulates students learning interest, makes students become the active learners and reverses the phenomenon of widespread failures in exams.

### ***2.3 Advantages of Micro-Course***

As the core of the micro-course, the micro-video time is shorter. It usually controlled within 5-15 minutes, which is in line with the cognitive characteristics of students. Therefore, students can be more concentrated and improve learning efficiency. The micro-video flexibly divides the longer chapter content into several small knowledge points, and builds a life or professional background in a certain situation. It uses various auxiliary means like videos, pictures, animations and texts and so on to make videos. The theme is clear and the content is highly accurate. Generally, it only teaches one knowledge point mainly, so that students can fully understand the content of knowledge. Under the guidance of the leading questions, the students can conduct targeted self-inquiry to complete the preliminary learning. Through the corresponding auxiliary teaching resources, one knowledge point corresponds to one exercise and one test. Students can choose the corresponding micro-course resources according to their needs. Therefore, it meets differentiated learning needs and it is conducive to the development of students' personality, which improves learning effects and increases learning confidence. Due to the small capacity of the micro-classes and the various forms of dissemination, students can reasonably and thoroughly determine the learning content, learning progress and learning time according to their own learning characteristics and acceptance, avoiding the waste of teaching resources. It makes up for the shortcomings of not understanding without teacher guidance, and achieves the ultimate goal of micro-video teaching content construction. Based on the above reasons, it is necessary to explore a higher mathematics teaching reform based on Micro-courses.

### **3. The Feasibility of Micro-Curriculum Construction to Promote the Teaching Reform of Advanced Mathematics**

In the era of rapid development of modern information technology, with the continuous popularization of the Internet and smart phones among teachers and students, it provides the necessary software and hardware guarantees for the application of micro-classes in the teaching of advanced mathematics.

For teachers, it is simple and easy to learn the technology required for micro-course production and application. The hardware equipment used in the production process is usually used frequently and the software can also be downloaded directly from the Internet. The micro-courses produced are all familiar and proficient. The content, through the use of a computer and a corresponding player, can make the entire micro-course present. Nowadays, teachers have a strong ability to apply information technology and have a certain foundation in resource search, courseware and video production. The production of micro-courses is fully competent for them.

For students, they have a strong ability to adapt and learn to accept new things and can skillfully use various network platforms for communication and learning. They are used to obtaining information, downloading, uploading and sharing learning materials from the Internet. Therefore, it is easy to accept the micro-class teaching mode.

In terms of the requirements of micro-class teaching equipment, the wide application of modern information technology in the education field provides the basis of information technology for the micro-class teaching mode. At present, the school has basically achieved full network coverage, and each classroom is a multimedia classroom. All teachers and students have computers and smartphones. These conditions make it possible to use micro-classes to carry out teaching. It provides information technology foundation and corresponding equipment guarantee for the application of micro-classes in advanced mathematics teaching.

In summary, the application of micro-courses to advanced mathematics teaching is completely feasible.

#### **4. The Implementation Strategy of “Advanced Mathematics” Course Teaching Reform Based on Micro-Course**

##### ***4.1 Pre-Class Teaching Preparation for Micro-Courses, Self-Inquiry Learning***

1) Teachers should carefully study the syllabus of advanced mathematics courses, fully analyze their teaching objectives and carefully analyze relevant textbooks and teaching content. Besides, they should follow the basic principles of curriculum design. Considering the students' characteristics include existing knowledge reserves, existing abilities and learning attitude, teachers decomposed the teaching content of advanced mathematics. They are no longer based on the units of existing textbooks, but based on the basis of knowledge points for overall planning. The setting of advanced mathematics teaching content is divided into the six modules, such as function and limit theory, the theory of calculus of one variable function, the theory of ordinary differential equations, the application of vector algebra and space analytic geometry, the theory of calculus of multivariate functions and infinite series. Then, teachers should make fragment of each module. For example, in the limit and continuity, teachers decomposed it into several units like the formation of the limit, the definition of the limit, the calculation of the

limit, the application of the limit and the continuity of the function. After selecting the teaching content, teachers conduct thorough treatment of it and carry out the micro-course design from the teaching objectives, teaching priorities, difficulties, and teaching duration, etc. Teachers divide complete knowledge content into a teaching process of different knowledge points. Teachers will consider the following aspects carefully: How to construct the situation and set the case according to the course content? What targeted problems do students need to solve in the process of autonomous learning? Which teaching activities are innovatively designed? How to connect these teaching activities with students' autonomous learning?

2) Teachers design pre-class self-study tasks or activities according to the teaching goals, make micro-class videos and ask thinking questions based on actual life. Teachers upload the pre-explanatory videos to the networked teaching platform to provide students with off-class previews and supervise students watching the video to think about the problem. The teaching method is no longer a mere lecture. The introduction of the teaching content is supplemented by interesting exercises closely related to life, as well as thinking questions for knowledge points. It highlights the main status of learners and inspires students' learning interest and enthusiasm. Cultivating student's learning enthusiasm can achieve the effect of independent learning and inquiry. In the micro-course learning, students can choose the time and place independently and decide whether to replay, pause, fast-forward or repeat the operation according to their actual learning situation. Through the networked teaching platform, students can learn micro-course resources, complete the self-learning tasks issued conducted by teacher, record the incomprehensible and unclear content and doubts. Moreover, students can use the networked teaching platform to consult the teacher.

3) Teacher should collect and sort out the relevant information that student feedback during the pre-class learning process. For the content that is not easy to understand, teachers can instruct students to solve by using the ways of returning visits, re-studying or researching. Besides, teachers can guide students to solve by consulting relevant materials for difficult problems and record them to prepare the relevant content of discussions and teaching activities in the targeted preparation class.

#### ***4.2 Appropriate Use of Micro-Classes in Class, Absorbing and Internalizing Knowledge***

The class is a stage where teachers implement mathematics teaching face to face. It is carried out on the basis of self-study before class. It is also a stage of knowledge internalization. Micro-curriculum and traditional teaching are integrated to maximize strengths and avoid weaknesses. In terms of link design, it must have introduction of context, the process of exploration, exercises of consolidation and the knowledge of summary. Necessarily, it must have sublime themes and diversify questions at the right time to effectively guide students learning in classroom. Due to the differences in students' autonomous learning

ability and self-awareness, some students may not fully grasp the knowledge points involved in the micro-videos and learning tasks issued before class. By providing appropriate discussion, students can think and solve problems actively and increase students' participation in advanced mathematics. In the class, teachers carefully produce corresponding micro-videos and practice test questions of knowledge points that students do not know. Teachers can give detailed explanations to help students strengthen their understanding of teaching content, so that students can maintain consistent learning progress and be flexible use the knowledge learned to solve practical problems. For students who have not yet mastered the knowledge, they can use micro-courses to study further after class.

#### ***4.3 Use Micro-Classes after Class to Expand Knowledge, Consolidating Learning Effects***

After class, the teacher corrects the assignments assigned to the students in the class. It can give feedback to the students in time and find students' deficiencies. Teachers can make micro-videos by collecting detailed problem solving processes or ideas for typical problems such as difficult, key and error-prone problems. This way can create conditions for studying after class. In the micro-class, you can also analyze and solve the problem from different angles and draw inferences about the problems. Therefore, students can learn by analogy and understand each other. According to the feedback information of students, teachers can adjust and modify the pre-class preview resource library in time. Through the network platform of micro-courses, the questions raised by students can be answered in time. They can be answered one by one, or they can be answered uniformly. Students can find and correct their mistakes in time. It can meet the needs of students of different levels to expand their learning after class and consolidate the learning effect.

### **5. Conclusion**

Advanced mathematics is a relatively dull, obscure, abstract and difficult course. By introduction of Micro-course teaching, knowledge resources are integrated, classified and delivered through pictures, animation, voice, text and other more lively information technologies. Those who are willing to learn can study without being restricted by time and place. Students with different basic levels can control their learning progress by themselves. It is a useful supplement to learning outside of the classroom. The learning method exerts the students' subjectivity. Moreover, it provides a more effective and scientific teaching method conforming to the curriculum teaching law, which serves for the development of advanced mathematics courses.

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