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Case Study of Flipped Classroom Teaching Mode in Advanced Mathematics

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Abstract

Advanced mathematics plays an important role in higher education teaching, and is one of the required professional basic courses for undergraduate science and engineering students. In this paper, case teaching method is adopted to study the specific application of flipped classroom in higher mathematics teaching from the aspects of education concept, teaching objectives, teaching framework, teaching process and teaching implementation, so as to promote the continuous reform of higher mathematics teaching methods and teaching models and deepen the concept of flipped classroom.

Keywords

Higher Mathematics; Flipped Classroom; Constructivism.

1. Education Philosophy

This paper takes "Advanced Mathematics" chapter 1 section 2 - the limit of sequence as an example, adopts the teaching mode of flipped classroom, so that students can fully digest and absorb the content of this lesson, and apply what they learn to improve the teaching effect.

The educational concept of flipped classroom mainly comes from the constructivism learning theory of Piaget in Switzerland. According to constructivism, the individual learning process is that learners construct the meaning of things in their own way, and it is also influenced by the social interaction between students and the environment. Constructivism emphasizes student-centered teaching and requires students to be respected as subjects in the teaching process, constantly improve their subject consciousness and creativity, and finally make students become social individuals capable of self-education.

2. The Teaching Goal

(1)Introduce the concept of limit with the famous mathematician Liu Hui's "circle cutting technique". Through the idea of using polygon area to approach circle area infinitely close, let the students feel the "limit". Understand the definition of limit of sequence, master the properties of convergent sequence.

(2)Cultivate students' ability to analyze and solve problems and improve their mathematical literacy; Be able to use mathematics and professional knowledge to model, analyze, demonstrate and solve problems in the professional field.

(3)Limit refers to the infinite approach to a fixed value. According to the philosophy contained in limit, teachers encourage students to never forget their original aspiration once they set a goal (limit value), strive to move forward, and finally get infinitely close to the target.

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3. The Teaching Framework

(1)Teaching Content: The Limit of Sequence

(2)Credit hours: 2 credit hours

(3)Teaching key and difficult points: the definition of sequence limit and the properties of convergent sequence

(4)Teaching method: Different from traditional classroom teaching, flipped classroom teaching is adopted in this class, which adopts the mode of self-study before class + classroom inquiry + after-class development , transform the traditional teacher-centered classroom into student-centered classroom.

4. The Teaching Process

According to the requirements of the constructivism theory on flipped classroom, combined with the teaching content of this lesson, this lesson consists of three links: self-study before class, classroom inquiry and after-class development.

(1)Pre-class self-study - in this link, students are the main body of learning activities, and teachers are the organizers, planners, participants and promoters of students' learning activities. Teachers will record the teaching video of this class in advance, distribute the teaching plan, lecture notes, PPT presentations and other teaching resources to students, and organize students to conduct self-study in after-class time. Of course, the teacher needs to clarify the teaching objective of this lesson - the concept of sequence limit and the properties of convergent sequence. In order to understand the concept of sequence limit and master the nature of convergent sequence, students will actively study and independently explore the learning videos released by teachers. Students can also communicate and discuss with each other through QQ groups, wechat groups and discussion groups of learning pass, etc., to explore each other and answer difficult questions, so as to realize interactive communication. Through self-study before class, students have basically mastered the main content of this class, which lays a foundation for the internalization and application of knowledge in class.

(2)Classroom inquiry - in this link, fully reflects the subject status of students, with students' teaching and interactive communication as the main, to realize the internalization of knowledge absorption and application. In flipped classroom, teachers fully embody the role of promoters and collaborators, respect students' independence throughout the whole teaching process, and pay attention to cultivating students' independent learning ability. Specific steps include:

Answer questions and solve puzzles - guide students to actively explore the answers to the questions they don't understand and can't solve in the process of self-study.

Group discussion, interactive learning, completion of learning tasks

① How did the ancients find the area of a circle? Liu Hui, an ancient Chinese mathematician, used a method of calculating the area of a circle by connecting regular polygons inside the circle -- circle cutting: when the circle is cut thin, it will lose little. When the circle is cut again and again, it can't be cut, and then it will fit with the circle without loss

② Problem discussion: How does the area of a polygon approximate the area of a circle? What philosophy does "circle cutting" imply?

③quotes： Zhuang Zi once said in the Tianxia chapter, "A hammer of one foot can be taken in half every day, which will last forever."

④Discuss the key and difficult content of this lesson: the definition of sequence limit; Properties of convergent sequence: uniqueness, boundedness, sign-preserving property.

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In the interaction of students, students can not only complete the learning task through progressive training, but also not limited to the learning task, can independently construct their own knowledge system, realize the internalization of knowledge.

Evaluation reflection - a process in which students review and reflect on their own learning. In this link, students summarize and sort out the whole learning content and learning process, effectively promote the internalization and mastery of knowledge, and consolidate the learning effect.

(3) After-school development - In this section, teachers provide students with some knowledge beyond the content of this section, broaden students' horizons, improve students' ability of personalized thinking, analysis and problem solving. The extension link after class leads the teaching content to the depth, leads the teaching problem to the practice, the theory connects the practice, realizes the knowledge application.

5. Implementation of Teaching

The Ten-year Development Plan of Educational informatization points out that the development of educational informatization should be guided by the innovation of educational concepts, based on the construction of high-quality educational resources and information-based learning environment, and centered on the innovation of learning methods and education modes. Flipped classroom is not only a breakthrough and innovation in education mode, but also in learning mode. Especially for China's current education reform, vigorously developing flipped classroom will become an important focus and start a new journey of education. Flipped classroom, as a new teaching form in the information age, takes information technology as the carrier and brings great impact and turnover to the traditional classroom.

Our school also attaches great importance to flipped classroom. Although the mathematics courses I teach are theoretical, it is difficult to implement flipped classroom. However, our teaching and Research Office has been constantly groping and making efforts. Combined with the National Mathematical Contest in Modeling for College Students, our teaching and Research Office has successfully explored a mathematical modeling-oriented flipped classroom teaching mode of higher Mathematics, which has been promoted in the whole school.

6. The Advantages and Disadvantages

(1)Advantages: The teaching form has changed from the traditional classroom teaching + homework to pre-class self-study + classroom inquiry + after-class development. Students have changed from passive recipients of knowledge to subjects of learning and independent constructors of knowledge, which stimulates students' interest in learning. For example, in this class, students collected and sorted out materials, cooperated with each other to make PPT, and shared these classic cases in class. The teaching mode of flipped classroom breaks the disadvantages of the traditional teaching mode, emphasizes students' personalized learning and their dominant position in learning, and cultivates students' self-learning ability and the ability to analyze and solve problems.

(2)Disadvantages: Due to the different nature of the subject and the specific situation of students, the design of flipped classroom teaching mode, including the setting of specific teaching links, is not perfect enough. At present, in many schools or teachers, flipped classroom is just a concept and has not realized the real flip. In the future teaching and practice, flipped classroom needs to be constantly modified and improved to make it more perfect.

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