

# A Study on the Effective and Innovative Teaching Model of College Mathematics

Yabin Tao

Jiangxi Vocational Technical College of Industry & Trade, Nanchang, 330046, Jiangxi, China

yuyang-770@sohu.com

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**Abstract:** College mathematics is a compulsory and most extensive public basic course for college students majoring in various fields during the college education stage. Mastering this course can gradually cultivate students' ability to form good logical thinking and transform their perspectives on problem-solving and thinking. In recent years, with the innovative progress of science and technology in China, the role of mathematics in various fields has become increasingly significant. People have become more and more aware that various modern high-tech, after all, belong to mathematical technology in essence. Colleges bear the essential responsibility and mission of cultivating talents for various sectors of society, and it is necessary and crucial to reform and innovate the teaching mode of college mathematics. In this regard, this article first discusses the connotation and requirements of innovative teaching models, then analyzes the problems in current college mathematics teaching, and finally proposes innovative strategies for college mathematics teaching models, hoping to provide reference for relevant colleges and mathematics teachers.

## 1. Introduction

With the continuous deepening of education reform in China, ordinary higher education institutions have actively responded to the requirements of education reform and the demand for market talents, offered a series of mathematics courses for non-mathematics majors, which are collectively known as "college mathematics courses" [1], roughly including advanced mathematics, linear algebra, probability theory, mathematical statistics, etc., aiming to lay a solid foundation for students to learn professional courses well and strengthen their mathematical cultural literacy by imparting mathematical thinking, professional mathematical knowledge, and mathematical problem-solving methods. The traditional mathematics teaching model mainly focuses on explaining theoretical knowledge, with teachers in a dominant position and students in a passive position of receiving knowledge, which undermines their learning enthusiasm and initiative. This requires colleges and mathematics teachers to analyze and follow the "student-centered principle" to innovate effective teaching models in mathematics, in order to foster a group of high-quality mathematics talents.

## 2. Connotation and Requirements of Innovative Teaching Models

The college classroom is the main battlefield for cultivating and developing talents. In the past, colleges focused on explaining and imparting theoretical knowledge in organizing mathematical teaching activities, which was manifested as a single knowledge dissemination process. Under this teaching model, the main task of college mathematics teachers is to extract and summarize knowledge from books, and then "copy" it into the students' brains. Various types of knowledge have not yet been repeatedly studied and refined, so students have poor mathematical knowledge application abilities. The reform and innovation of college mathematics teaching mode mainly refers to the reform of teaching concepts, teaching content, and teaching methods, aiming to cultivate students' innovative spirit and ability [2].

The specific requirements for innovative teaching models are as followed. Firstly, it is crucial to strengthen the student's subjectivity, and college mathematics teaching activities should be closely carried out around students' learning abilities and needs. Secondly, teachers are the organizers of

college mathematics teaching activities and the guides for students to understand and apply mathematical knowledge. Thirdly, teachers should engage in equal dialogue with students in promoting mathematics teaching activities, strengthen classroom interaction, and create a good teaching atmosphere. Fourthly, students need to strengthen self-directed learning and fully recognize that textbooks are not the only way to acquire knowledge.

In summary, teachers should start from the aspects of teaching philosophy, teaching content, and teaching process design when innovating college teaching models. They should use teaching theoretical knowledge that can stimulate students' innovative consciousness and creative behavior to innovate teaching models, promote students to truly understand the essence of mathematics, master the essence of mathematics, and continuously improve their mathematical cultural literacy.

### **3. Problems in Current college Mathematics Teaching**

#### **3.1 “Theoretical Indoctrination” Teaching Model is Difficult to Stimulate Students’ Interest in Learning**

Analyzing the current situation of college mathematics teaching, it can be found that due to the long-term influence of traditional teaching concepts, some teachers still use the “theoretical indoctrination teaching model” to promote college mathematics teaching activities. In this traditional teaching model, teachers are in a dominant position, while students are in a passive position to receive knowledge<sup>[3]</sup>. Specifically, it manifests as what the teacher says, what the students learn, and the students’ learning initiative, thinking initiative, independent thinking ability, etc. are constrained. Especially for humanities students, under the influence of traditional mathematics teaching models, learning mathematical knowledge has evolved into “rote memorization”, which greatly stifles students’ innovative thinking. In college mathematics teaching activities, only a large amount of fragmented theoretical knowledge is accumulated, which cannot be transformed into practical motivation.

#### **3.2 Lagging Content of Textbooks Cannot Meet the Knowledge Acquisition Needs of Students**

The essence of various modern information technologies is mathematical technology. In recent years, with the innovative progress of science and technology in China, mathematical technology has also been continuously optimized and updated. Various sectors of society have put forward higher requirements for the mathematical skills and literacy of mathematical talents and fresh graduates. However, at present, some colleges still use mathematics textbooks from over a decade ago and have not kept up with the pace of development. It can be said that contemporary college students are still struggling to learn basic mathematical knowledge and have not timely grasped and mastered the latest mathematical knowledge. In fact, it is possible to supplement the lack of textbook knowledge through studying extracurricular materials. However, some teachers currently assign extracurricular learning activities that mainly focus on training exercises and strengthening the knowledge required by students in this lesson, rather than cultivating mathematical learning interests and expanding learning horizons, which restricts the effective improvement of students’ mathematical abilities.

#### **3.3 Schools Prioritize Scientific Research over Teaching, Restricting Teaching Quality**

The level and quality of scientific research to a certain extent affect the ranking and status of colleges. Therefore, at present, most colleges regard the number of scientific research projects and teaching papers as important indicators for evaluating teacher performance. This leads to some teachers placing too much emphasis on scientific research work, thereby reducing the quality of teaching work. In recent years, some college teachers have shown a decrease in their enthusiasm and sense of responsibility for teaching work, resulting in careless lesson preparation, careless teaching attitudes, and a lack of enthusiasm for teaching. If current teaching methods and models are not reformed and innovated in a timely manner, it will inevitably reduce teaching effectiveness and quality, and bring adverse effects to talent cultivation work. Domestic colleges generally

provide guidance for teachers to apply for scientific research projects, while foreign colleges pay more attention to training teachers in teaching abilities and methods, which requires colleges to learn from and draw inspiration from [4].

#### **4. Innovative Strategies for Effective Teaching Models in College Mathematics**

##### **4.1 Innovate Teaching Models to Enhance Students' Learning Initiative**

Students are the main body of college mathematics teaching activities. In the current college mathematics teaching, students are in a passive state of receiving knowledge. For some courses that are not interesting or important, some students cannot even count as participants, and their learning efficiency and quality cannot be significantly improved. Therefore, teachers can use innovative teaching methods to stimulate students' learning enthusiasm when organizing college mathematics teaching activities.

Firstly, a discussion-based teaching model can be adopted to promote college mathematics teaching activities. The biggest feature of the discussion-based teaching model is that the content discussed is not clearly discussed inside and outside the textbook, and the answers are not unique. This includes a discussion on the connection between new and old knowledge, a summary of problem-solving methods, updating the knowledge system, and expanding the knowledge currently mastered. In using discussion-based teaching methods to carry out college mathematics teaching activities, teachers can guide students to think deeply through inspiring and inducing questions, thereby ensuring that students quickly grasp the knowledge they have learned in a short period of time and form a structured knowledge system.

For example, in higher mathematics teaching, to find  $\int_L (e^x \sin y - 2y) dx + (e^x \cos y - 2) dy$ , where  $L$  is the upper half circumference of  $(x - a)^2 + y^2 = a^2$ , in a counterclockwise direction, teachers can gradually guide students to recall the methods for calculating the integration of the second type of curve and use these methods to attempt to solve it. If using Green's formula, it is necessary to add auxiliary lines. During adding auxiliary lines, teachers can set questions for students, whether to add curves or straight lines as auxiliary lines? Which one is more convenient? Finally, teachers guide students to engage in discussions and stimulate their interest in learning [5].

Secondly, carry out online teaching activities. Teachers can use MOOC network teaching and multimedia online teaching to innovate teaching forms, break the limitations of traditional college mathematics teaching models in terms of time and space, provide online Q&A for students and utilize abundant online teaching resources and innovative teaching modes to stimulate their interest in learning.

##### **4.2 Enrich Teaching Materials and Improve Teaching Quality**

Firstly, teaching materials do not equal teaching content, and mathematics teaching activities require the flexible use of textbooks. The scope of teaching content can be flexibly adjusted based on the actual learning ability and needs of students. It can be content from textbooks or extracurricular learning materials. As long as the selected teaching materials conform to the cognitive patterns of students and are in line with their actual situations, they can be used as teaching content to explain. Secondly, the new curriculum standards require teachers to make use of textbooks creatively and innovatively. Teachers need to integrate their professional knowledge into the process of using textbooks, extract key and difficult points from teaching materials, form teaching knowledge with teacher personality, and improve teaching effectiveness [6].

##### **4.3 Strengthen the Construction of the Teaching Staff and Improve the Comprehensive Literacy of Teachers**

The professional ability and comprehensive literacy of teachers have a direct impact on the level and ultimate effectiveness of college mathematics teaching. Therefore, colleges should timely transform their concept of emphasizing scientific research and neglecting teaching, and strengthen the construction of the teaching staff. For example, improving the selection criteria for college

mathematics teachers, regularly conducting professional training activities for in-service teachers, and providing opportunities for teachers to study abroad can comprehensively enhance their teaching abilities and lay a solid foundation for the smooth development of teaching and research work.

## 5. Conclusion

In summary, reforming and innovating the teaching mode of college mathematics has strong practical significance. This is not only an inevitable measure for major colleges to actively respond to the requirements of education reform, but also an effective path to improve the quality of college mathematics teaching, strengthen teaching effectiveness, and enhance students' mathematical cultural literacy. In this regard, major colleges and mathematics teachers should deeply interpret the connotation and requirements of innovative teaching models in education reform, and face and analyze the limitations and problems in the current mathematics teaching process. By adopting a cooperative teaching model, enriching teaching materials, strengthening the construction of the teaching team, and utilizing multimedia technology to assist teaching activities, the quality and efficiency of teaching can be comprehensively improved, gradually cultivating good thinking and logical abilities among college students, strengthening their mathematical cultural literacy, and laying a solid foundation for their professional knowledge and subsequent personal progress.

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