

Analysis of the Effectiveness of Higher Mathematics Course in University Teaching

Zongguo Zhang, Hong Wang, Wenrui Qu*

*School of Mathematics and Statistics, Qilu University of Technology (Shandong Academy of Sciences),
Ji'nan Shandong, China*

**Corresponding Author*

Abstract: In the university curriculum system, higher mathematics is a basic course, which is of great significance to the improvement of students' comprehensive ability. Especially for individual students, the study of advanced mathematics courses will directly affect their future career development, which is of great significance to them. However, under the traditional educational concept, the efficiency of higher mathematics teaching in colleges and universities is low, and the students' enthusiasm for learning is insufficient. As a result, many students do not have basic mathematical thinking and ability, which makes them unable to adapt to the development of society. To this end, this paper has made some analysis on how to improve the teaching effectiveness of higher mathematics courses in colleges and universities for reference.

Keywords: Higher Mathematics; Curriculum Teaching; Effectiveness; Reform

1. Introduction

In the context of ongoing educational reform, improving the effectiveness of higher mathematics course teaching is a crucial task in university education. With the continuous expansion of university enrollment, the number of students has increased, and the differences among students have become more pronounced. Higher mathematics is a subject that students find challenging, so improving the effectiveness of teaching higher mathematics to ensure that every student can enhance their abilities is an important topic that educators need to focus on and research.

2. The Current Background and Basic Approaches to Higher Mathematics

Teaching Reform

2.1 The Current Background of Higher Mathematics Teaching Reform

2.1.1 Confusion in Higher Mathematics Teaching

According to research, many universities face confusion regarding the reform of higher mathematics teaching. The main issues include a lack of student interest, evident fear and resistance toward the subject, which hinder the improvement of teaching effectiveness. Additionally, the heavy teaching workload and limited class hours exacerbate the problem. Taking engineering majors as an example, the contents of advanced mathematics courses include multivariate calculus, unary calculus, spatial analytic geometry, differential equations and vector algebra. However, the limited class hours make it difficult to ensure the quality of teaching.

2.1.2 Cause Analysis

Based on the current situation, the primary reason for the aforementioned confusion lies in the changing environment of higher mathematics courses, while the teaching philosophy, methods, and students' learning thoughts have not adjusted in time. First, universities have different educational orientations. Some universities are research-oriented, while others focus on applied education. These different types of institutions exhibit variations in their teaching philosophy, content, and methods for higher mathematics courses. Second, the role of higher mathematics has shifted. The educational goals of many universities now focus on cultivating more outstanding applied talents, driven by societal needs, making higher mathematics, like other courses, an essential part of achieving this objective. Finally, there has been a shift in the teaching model. In traditional higher mathematics

courses, instruction mainly focused on theoretical knowledge. However, under the concept of applied talent development, higher mathematics teaching now needs to be connected to real-world applications, emphasizing the enhancement of students' practical skills.

2.2 Basic Approaches to Higher Mathematics Teaching Reform

In the process of reform, the fundamental approach to reform should be clearly defined, which includes: achieving one goal, shifting two orientations, adhering to three integrations, opening up four areas, and cultivating five student abilities. The "one goal" refers to improving the teaching quality of higher mathematics courses to meet the needs of cultivating applied talents. This requires universities to combine local realities and establish a scientifically sound system for higher mathematics teaching, laying a solid foundation for developing high-quality applied talents. The "two orientations" primarily concern the functional positioning of higher mathematics courses, focusing on both the orientation toward societal needs and the complete structure of the discipline. From the perspective of course evaluation standards, this means emphasizing both mathematical application skills and exam performance. The "three integrations" refer to addressing the relationship between professional courses and higher mathematics courses to meet the needs of different majors, ensuring a balance between diversity and uniformity. When managing the relationship between teaching content and the course system, it is necessary to integrate both practical application and foundational knowledge, emphasizing the resolution of real-world problems. Regarding the relationship between students' learning abilities and course assessment standards, flexibility and principles should be combined, respecting individual student differences and strengthening the training and development of key student abilities.

3. The Importance of Emphasizing Learning Interest in Teaching

For most university students, higher mathematics is one of the more challenging courses, and many lack interest in learning it. In this context, Curriculum reform of advanced

mathematics must focus on stimulating students' learning interest. Without this, it is difficult to awaken students' motivation and enthusiasm, and thus, the effectiveness of higher mathematics course teaching will remain low. Therefore, university mathematics teachers should prioritize fostering interest. The reality is that higher mathematics courses often have fewer hours and more content. For freshmen, it is difficult to adapt to the learning pace in a short time, and the content is challenging. Under the traditional educational concept, most students rely on teacher and parent supervision in high school, while in university, learning requires more self-discipline and self-directed learning abilities, which often leads to decreased interest. In response, teachers need to fully understand the characteristics of higher mathematics and the needs of students at different stages and majors. This will enable teachers to develop targeted teaching strategies that stimulate students' interest and build their confidence in learning higher mathematics.

4. Emphasizing the Cultivation of Innovative Thinking in Teaching

4.1 Insufficient Cultivation of Innovative Thinking in Current Higher Mathematics Teaching

Innovation is a popular term in today's educational context. In the reform and development of higher education in China, cultivating more innovative talents is an important goal. In particular, some universities of science and engineering should attach importance to the cultivation of innovative talents. Higher mathematics courses, as an integral part of university education, bear the important responsibility of cultivating innovative talents. However, from the actual teaching situation, there are still some problems in cultivating students' innovative thinking in higher mathematics courses in colleges and universities, which are mainly reflected in the following points.

4.1.1 Outdated Teaching Models

Many universities still follow traditional teaching models for higher mathematics, which typically follow a "concept-example-exercise-summary" format. This spoon-feeding approach may ensure students can pass exams and complete the

course load but does little to develop innovative thinking. One prominent issue is the lack of interaction between teachers and students. Innovative questions are rarely posed, and students' thinking skills are not sufficiently exercised, leading to a passive learning experience where students do not fully engage.

4.1.2 Outdated Teaching Content

At present, the textbooks of higher mathematics courses are mainly based on the deductive nature of mathematical logic system and the rigor of theory, and teachers also take textbooks as the main basis in teaching. However, the essence of mathematics teaching is the process of discovering, analyzing, and solving problems. In this process, students need to have certain thinking ability, especially innovative thinking ability, so as to improve the teaching effect. Yet, However, the current content of higher mathematics teaching does not elaborate the original research background of the concepts and theorems of relevant knowledge, and only pays attention to students' skills, ignoring the cultivation of students' innovative thinking.

4.1.3 Single Evaluation Methods

A reasonable evaluation system not only improves teaching effectiveness but also helps students identify their shortcomings. However, under the "results-over-process" approach to evaluation, many teachers focus solely on final exam scores, ignoring the learning process, including class participation, homework completion, and group discussions.

4.2 Strategies for Cultivating Innovative Thinking in Higher Mathematics Teaching

4.2.1 Optimizing and Innovating the Teaching Model

In traditional teaching models, higher mathematics is taught in a spoon-feeding manner, limiting students' initiative and creativity. Cultivating innovative thinking is a crucial way to enhance the effectiveness of higher mathematics teaching. Therefore, college teachers should pay attention to it, not take it as a slogan, but put the cultivation of students' innovative thinking ability into practice. This requires optimizing and innovating teaching models, such as incorporating case-based teaching and MOOCs, to help students better understand and learn. This way, students can feel the charm of higher mathematics and be willing to actively explore

relevant knowledge, thereby unleashing students' initiative and fostering more active thinking.

4.2.2 Improving the Evaluation System and Introducing Open-Ended Questions

In higher mathematics course teaching, teaching assessment is a very important part and a means to strengthen teaching effect. In a rational teaching evaluation framework, teachers can assess students' innovative thinking abilities and evaluate the effectiveness of their cultivation. At the same time, it allows students to clearly recognize their shortcomings, enabling them to autonomously explore and enhance their innovative capabilities during actual learning processes. Therefore, the assessment mechanism should be improved. Firstly, there needs to be a change in the assessment methods used in higher mathematics courses at universities. It's not sufficient to determine students' learning outcomes solely based on final exam scores; attention should also be given to students' learning processes. To achieve this, methods such as adding unit quizzes, book reports, and assignments can be implemented to assess students' regular learning progress. These assessments should serve as important criteria for the final assessment grades. Secondly, it's crucial to fully utilize the guiding role of exams. Historically, exams for higher mathematics have predominantly focused on basic and memorization-based questions, which do not necessarily promote divergent thinking among students. Therefore, in assessing higher mathematics courses, it would be beneficial to introduce some open-ended questions. Open-ended questions do not have a single approach or answer, thus stimulating students' innovative awareness and effectively cultivating their creative thinking skills.

5. Key Considerations for Higher Mathematics Teaching under New Circumstances

1. Recognize the central role of students. Under the background of education and teaching reform, students' subjectivity should be reflected in the higher mathematics course teaching, so as to enhance students' enthusiasm for learning and devote themselves to learning.
2. Clarify the teacher's leading role. Teachers are the implementers of educational activities, and their qualifications and teaching skills

directly affect the outcome of higher mathematics teaching. Therefore, in this context, universities should clarify the dominant position of teachers, strengthen the training and education of teachers, and improve the quality of personnel training.

3. Classification of the development of the curriculum to adapt to the professional. For different majors, colleges and universities should take different higher mathematics teaching content.

4. Actively promote the use of case-based teaching. Case-based teaching not only helps students improve learning efficiency but also connects professional knowledge with higher mathematics, enhancing students' ability to apply mathematical knowledge.

5. Optimize the assessment methods for higher mathematics courses. As society's requirements for talent increase, universities should actively adjust their educational concepts to improve the quality of talent cultivation.

6. Conclusion:

In conclusion, improving the effectiveness of higher mathematics teaching is not only a fundamental requirement of educational reform but also essential for enhancing the quality of talent cultivation in universities. Therefore, universities should attach importance to the promotion of teaching reform of higher mathematics courses, and take appropriate measures to improve the quality of teaching and help students' future development in light of their own actual situation.

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