

Discussion on the Reform of Higher Mathematics Teaching Curriculum under the Background of New Engineering Education

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Abstract: With the rise and development of the new engineering education, higher mathematics teaching faces new challenges and demands in cultivating students' mathematical abilities and solving practical problems. By exploring the direction and strategies of the reform of higher mathematics teaching curriculum under the background of new engineering education, this paper provides a new approach and method to adapt to the needs of engineering education. It aims to promote the integration of higher mathematics teaching and engineering education, provide more practical and innovative mathematical education for engineering students, and further promote the development of the new engineering education.

Keywords: New engineering education background; Higher education; Higher mathematics; Curriculum reform

Introduction:

The reform of higher mathematics teaching curriculum under the background of new engineering education has become an important topic. The changes in the new engineering education environment and the problems existing in current higher mathematics teaching have made us realize the urgency of innovating and reforming teaching methods and content. This paper aims to explore the needs, plans, and strategies of the reform of higher mathematics teaching curriculum under the background of new engineering education. By reforming the teaching content, teaching methods, and teaching evaluation, we can better meet the needs of new engineering education, cultivate engineering talents with practical abilities and innovative spirit. This research has theoretical and practical significance for the improvement of higher mathematics education, helps to improve teaching quality and student learning outcomes, and promotes the continuous development and innovation of higher mathematics teaching under the background of new engineering education.

1. Research background

1.1 Higher education environment under the background of new engineering

Higher education in the context of new engineering education emphasizes interdisciplinary collaboration. The boundaries between traditional disciplines are gradually blurring, and the cross-fusion between engineering and other disciplines becomes more important. Engineering projects require collaboration among engineers, scientists, designers, economists, and experts from different fields to solve complex problems together. Therefore, higher education institutions need to provide interdisciplinary educational resources and platforms to cultivate students' teamwork and communication skills in order to adapt to the collaborative environment in engineering practice.

In the context of new engineering education, higher education also places greater emphasis on fostering innovative thinking and practical abilities. Pure theoretical knowledge alone is no longer sufficient to meet real-world demands; students need to possess the ability to solve practical problems. Higher education institutions should cultivate students' innovative thinking, problem-solving skills, and practical operational skills through project-driven and experiential teaching. This practice-oriented educational model can enhance students' motivation to learn and their practical application capabilities, making them more competitive in the workplace.

1.2 Issues with the current (engineering) higher mathematics teaching

There are several issues worth considering in the current higher mathematics teaching in engineering. Firstly, there is a widespread disconnect between theory and practice in engineering higher mathematics education. Traditional mathematics teaching focuses on theoretical derivation and the learning of abstract concepts, but students often find it difficult to apply the learned mathematical knowledge to practical problems, lacking specific application abilities of mathematics in engineering practice. Secondly, the content of engineering higher mathematics teaching is too abstract and theoretical. Traditional mathematics curriculum heavily emphasizes pure mathematical theory, lacking examples and case studies that are integrated with engineering practice, which makes it difficult to stimulate students' interest in learning and their practical application abilities. Students may feel a gap between mathematics and engineering practice, unable to connect the learned mathematical knowledge with practical problems, resulting in insufficient motivation to learn. Additionally, the teaching methods in engineering higher mathematics are relatively traditional and lack innovation and diversity. Teachers mainly adopt traditional lecture and demonstration modes, lacking interactivity and student engagement, which makes it difficult to stimulate students' active learning and creativity. The lack of personalized teaching methods tailored to different student characteristics and needs hinders the development of differentiated and individualized learning outcomes for students.

2. The demand for teaching reform under the background of new engineering

2.1 The new demand of new engineering for mathematics ability

Traditional mathematics education focuses on students' grasp of abstract concepts and theories. However, in the practical application of new engineering, mathematics plays a more important role, requiring students to have stronger mathematical and applied abilities. The demand for mathematical modeling ability in new engineering is constantly increasing, and mathematical modeling is the key to solving practical problems in the field of engineering. Engineering talents cultivated in the new engineering field need to be able to transform practical problems into mathematical models and use mathematical methods for analysis and solutions.^[1] Therefore, teaching reforms need to focus on cultivating students' mathematical modeling thinking. Through practical cases and problem-driven teaching, students can proficiently apply mathematical knowledge to solve practical problems. At the same time, the demand for data analysis and statistical abilities in the new engineering field is also increasing. With the advent of the era of big data, engineering practice involves a large amount of data collection and analysis. Students need skills in data processing, statistical analysis, and data visualization to effectively utilize mathematical tools and methods for data analysis and decision support. Therefore, teaching reforms should strengthen the teaching of data analysis and statistical methods to cultivate students' data thinking and data-driven abilities.

2.2 Innovation and reform direction of higher mathematics teaching in engineering education system

The new engineering education system requires the integration of engineering education and practical application, emphasizing the cultivation of students' practical abilities and innovative spirit. Therefore, higher mathematics teaching in engineering needs to be guided by the cultivation of engineering practical abilities, emphasizing the updating and adjustment of course content, the reform of teaching methods, and the reform of teaching evaluation. In terms of updating and adjusting course content, higher mathematics teaching in engineering should adopt a curriculum design oriented towards actual engineering problems. By combining mathematical knowledge with engineering practice, introducing practical engineering cases and problems, students can apply the learned mathematical knowledge to solve practical problems. Through the analysis and discussion of specific examples, students' mathematical modeling and problem-solving abilities are cultivated. In addition, the part of the course content related to skills and ability development should be enhanced, emphasizing the practical application of mathematical methods and tools, enabling students to independently solve practical engineering problems. In terms of the reform of teaching methods, higher mathematics teaching in engineering needs to introduce innovative teaching methods and approaches. The traditional lecture mode should be combined with practical teaching, using project-driven, case analysis, and experimental practices to enhance students' interest in learning and participation. Teachers can take on the role of mentors, guiding students to actively explore and solve problems, cultivating students' self-directed learning abilities and teamwork spirit. Additionally, the introduction of online teaching and blended learning models, utilizing modern technological means and online platforms, can expand students' learning resources and communication channels, and improve teaching effectiveness.^[2]

3. Programs and strategies for the reform of higher mathematics teaching courses

3.1 Update and adjustment of teaching content

In the context of new engineering, higher mathematics teaching needs to update and adjust its teaching content to meet the demands of practical problem-oriented engineering and enhance the content of skill and ability development. The updating and

adjusting of teaching content need to incorporate the orientation of actual engineering problems into curriculum design. Traditional mathematics education often focuses on abstract theories and concepts, making it difficult to integrate with practical engineering problems. Therefore, teaching reforms should introduce practical engineering cases and problems, integrating mathematical knowledge with engineering practice. Through specific case analysis and problem-solving, students' interest in mathematics and their application abilities are stimulated. This problem-oriented curriculum design can help students better understand the application of mathematics in practical engineering and cultivate their problem-solving abilities. Furthermore, updating and adjusting teaching content also need to enhance the content of skill and ability development. Engineering education emphasizes students' practical and innovative abilities. Therefore, mathematics teaching should focus on cultivating students' skills and abilities. Traditional mathematics teaching often stays at the level of theoretical derivation and computational methods, lacking the cultivation of practical engineering application skills. Teaching reforms should introduce commonly used mathematical methods and tools in engineering practice, such as numerical computation, data analysis, and modeling techniques. Through practical operations and experiments, students can master the ability to apply mathematical tools to solve practical engineering problems. Such enhanced teaching content can help students better address the challenges in engineering practice and improve their practical application abilities and innovative abilities.^[3]

To achieve the updating and adjusting of teaching content, teachers need to constantly update their knowledge and teaching methods, keeping up with the forefront of engineering development. They should actively explore practical teaching methods, introduce teaching activities such as case analysis, project-driven approaches, and experimental practices to stimulate students' interest in learning and practical abilities. Additionally, teachers should maintain close cooperation with industry enterprises, understand the latest developments and demands in engineering practice, incorporate practical problems into teaching content, and enhance students' practical application abilities.

3.2 Reform of teaching methods for higher mathematics courses in engineering majors

Teaching methods for higher mathematics courses in engineering majors need to be reformed to meet students' learning needs and improve teaching effectiveness. Innovative teaching methods and approaches are crucial for higher mathematics courses in engineering majors. Traditional mathematics teaching often relies on lectures and demonstrations, lacking interactivity and student participation. To enhance students' active learning and creativity, teaching methods can incorporate case analysis, problem-solving, and discussions.^[4] By introducing practical engineering cases and mathematical problems, students' thinking and exploration can be stimulated, promoting their understanding and application of mathematical concepts and methods.

The introduction of online teaching and blended learning models can bring more teaching opportunities and flexibility to higher mathematics courses in engineering majors. Online teaching can provide teaching resources and learning materials through online platforms, enabling students to learn anytime and anywhere. Through online discussions and exchanges, students can share learning experiences, solve problems, and interact with teachers and classmates. Blended learning combines the advantages of traditional classroom teaching and online learning. Teachers can use face-to-face class time for in-depth explanations and interactions, while basic knowledge and learning materials are made available for self-learning online.

4. Discussion

Higher mathematics teaching in the context of new engineering education faces the need for reform. The teaching content should focus on practical engineering problems and skill development to enhance students' application abilities. Teaching methods should be innovative and incorporate online and blended learning modes to stimulate students' active learning and collaboration skills. These reforms will cultivate engineering talents that meet the needs of engineering practice and promote the development and innovation of higher mathematics education.

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