Research on the Practice and Application of Modeling Ideas in Higher Vocational Mathematics Teaching

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Abstract. With the continuous deepening of educational reform, higher requirements have been put forward for higher vocational education. Higher vocational mathematics includes content such as advanced mathematics and linear algebra, which are highly abstract and difficult. Additionally, the teaching methods in higher vocational mathematics mainly focus on solving problems, which can easily lead students to mistakenly believe that the knowledge of vocational mathematics is only used to solve mathematical problems. As a result, students generally have a passive attitude towards learning subjects such as advanced mathematics and linear algebra. Vocational mathematics teaching should aim at cultivating students' core mathematical literacy and actively explore more scientific teaching models. Given the logical characteristics of mathematics, there are many commonalities with modeling ideas. Therefore, using this as a medium to help students develop modeling thinking can enhance the quality of vocational mathematics teaching. Thus, applying mathematical modeling ideas in vocational mathematics teaching plays a crucial role in promoting the reform of higher vocational mathematics teaching.

Keywords: Higher Vocational Mathematics; Teaching Reform; Mathematical Modeling Ideas.

1. Introduction

As a subject closely related to logical thinking and creativity, the importance of mathematics in higher vocational education is becoming increasingly prominent. Research on the teaching methods of mathematics in vocational colleges has entered a new phase. The application of mathematical modeling ideas in vocational mathematics teaching reform not only promotes sustainable development in teaching reform but also cultivates students' mathematical thinking. However, there are still some constraints on teachers using mathematical modeling ideas, coupled with students' limited learning abilities, leading to a lack of comprehensiveness and systematization in vocational mathematics teaching reform. Therefore, based on the current development, it is necessary to take targeted measures to infiltrate and apply modeling ideas in vocational mathematics teaching, helping students build a stronger framework of mathematical knowledge and break through superficial understanding, thus motivating them in their mathematical learning.

2. Current Status of Higher Vocational Mathematics Teaching

2.1 Lack of Student Interest in Learning

The poor initiative of vocational students in learning mathematics is the result of multiple intertwined factors. On one hand, in terms of student quality, the academic foundation and learning habits of vocational college students are generally lacking. These students often have poor performance in college entrance exams, with less rigorous study attitudes and poor learning habits. On the other hand, the abstract nature and difficulty of vocational mathematics itself contribute to students' low motivation. Even in undergraduate institutions, students tend to have a passive attitude toward learning advanced mathematics and linear algebra. For many vocational students, the difficulty of these subjects can cause frustration and fear, further affecting their motivation and enthusiasm for learning.

2.2 Traditional Teaching Models

While some progress has been made in the application of mathematical modeling ideas in vocational mathematics teaching, the methods remain traditional and fail to leverage the full potential of information technology. With the rise of the digital era, improving students' information literacy is an undeniable trend. Mastery of computer software, especially in mathematical modeling, has become an essential skill. Applying mathematical modeling ideas to vocational mathematics teaching reform requires the use of information and network technologies. However, some teachers have not thoroughly explored these technologies, and the application of mathematical modeling ideas remains conventional. Additionally, in the use of multimedia teaching, some teachers fail to integrate modeling processes into course design, limiting the effective application of modeling ideas in teaching reform.

3. The Importance of Applying Modeling Ideas in Vocational Mathematics Teaching

3.1 Highlighting the Key Points of Knowledge Structure

The primary objective of higher vocational colleges is to cultivate skilled, versatile professionals. To enhance students' logical thinking abilities, the subject of mathematics plays a crucial role, given its strong tool-like nature. Therefore, the knowledge structure of vocational mathematics textbooks exhibits distinct practical characteristics. Teachers can leverage modeling ideas to conduct teaching based on textbook content and students' understanding of the material. By adhering to the principle of learning for practical application, real-world problems or cases can be used as entry points, breaking away from the traditional generalized knowledge structure. This approach imbues the subject with both intellectual and distinctive qualities, increases the applicability of mathematical knowledge, and helps students quickly understand and master various key concepts.

3.2 Promoting Innovation in Teaching Models

Innovating teaching models is a key force in advancing educational progress in vocational mathematics teaching reform. Teachers, as guides and facilitators, must fully play their role while emphasizing students' central role in learning, encouraging them to explore and participate actively. The application of mathematical modeling ideas in vocational mathematics teaching provides significant support for promoting innovative teaching models. It changes traditional teaching approaches by actively involving students in the process, offering new teaching methods with diverse characteristics, and enriching the teaching content. This plays a crucial role in optimizing the teaching system and improving the quality of vocational mathematics education. (Refer to Table 1 for the significance of innovating teaching models.)

Table 1. The Significance of Innovating Higher Vocational Mathematics Teaching Models

Role	Meaning
Enhance Learning motivation	Through mathematical modeling, abstract mathematical concepts are combined with practical problems in real life or professional fields to stimulate students' interest and curiosity in mathematics
Cultivating comprehensive ability	Mathematical modeling requires students not only to master mathematical knowledge, but also to have the ability of problem analysis, logical reasoning, teamwork, data processing and so on
Promote thinking development	The modeling process encourages students to think outside the box and adopt innovative approaches to problem solving
Optimize Teaching Content	The idea of mathematical modeling was introduced to make the teaching content more rich and diverse, covering both basic theoretical knowledge and practical application cases

3.3 Improving Classroom Teaching Efficiency

To apply modeling ideas in classroom teaching, teachers should adopt diverse teaching modes that provide students with new learning experiences, thus stimulating their motivation. This not only

enhances students' learning efficiency but also improves teachers' teaching efficiency. Using modeling ideas to explain concepts and assign homework can make the course content more intuitive, aiding students in understanding. Furthermore, assigning homework based on modeling ideas can increase students' interest in after-class assignments, helping them complete tasks with a more positive attitude and reinforcing their knowledge. The application of modeling ideas also enhances students' ability to apply knowledge to solve real-world problems, fostering practical skills and supporting the educational goal of cultivating well-rounded, high-quality talents.

3.4 Enhancing Students' Overall Qualities

In the process of higher vocational education reform, cultivating students' comprehensive qualities has become a core goal. Mathematical modeling serves as a bridge between theory and practice, requiring students to possess both independent analytical and problem-solving abilities. Applying mathematical modeling ideas in vocational mathematics teaching reform is crucial for improving students' overall qualities. It can stimulate students' interest in learning, cultivate a rigorous and pragmatic attitude, and emphasize the importance of teamwork. The active participation of students can further enhance their enthusiasm, creativity, and initiative. Teachers must deeply understand the role of modeling ideas in fostering comprehensive qualities and actively integrate them into daily teaching to optimize strategies and encourage students to explore and innovate.

4. Application Principles of Modeling Ideas in Vocational Mathematics Teaching

4.1 Adhering to the Principle of Purposefulness

Incorporating mathematical modeling ideas into vocational mathematics teaching helps students gain a new understanding of the subject, spark their interest, and connect abstract concepts with real-world problems. This builds students' confidence in mastering the subject and forms a rich knowledge system and skill framework that lays a solid foundation for further studies and career development. Additionally, modeling ideas play an essential role in fostering students' social practice skills by teaching them to abstract complex phenomena into mathematical problems and solve them using mathematical tools.

4.2 Adhering to the Principle of Motivation

The motivational aspect of incorporating mathematical modeling ideas into teaching manifests at multiple levels, injecting strong momentum into teaching. The construction of the teaching organization should revolve around stimulating students' intrinsic motivation by fostering a strong learning atmosphere that ignites their curiosity and desire to explore. Teachers should adopt diverse methods such as case studies, group discussions, and hands-on activities to boost participation and encourage students' sense of achievement in problem-solving, enhancing their self-esteem and sense of accomplishment. Furthermore, teachers' active involvement and enthusiasm serve as a vital factor in motivating students, as their actions deeply influence students. Therefore, teachers should display a high level of engagement in the teaching process by meticulously preparing materials and thoughtfully designing questions to convey the importance of mathematical modeling to students.

5. Optimized Strategies for the Application of Mathematical Modeling Ideas in Higher Vocational Mathematics Teaching Reform

5.1 Building a Professional Team of Teachers

Higher vocational mathematics teachers, as the leaders of the classroom and the designers of the teaching process, play a crucial role in determining the quality of instruction. To apply mathematical modeling ideas effectively in vocational mathematics education, teachers must enhance their

"modeling" awareness and capabilities. Enhancing their awareness means that teachers must recognize the positive impact of modeling ideas on vocational mathematics teaching and consciously apply these ideas in their lessons. As shown in Figure 1, higher vocational institutions should strengthen moral and professional training for mathematics teachers, encouraging them to take responsibility for exploring new teaching methods and focusing on cultivating students' abilities. Schools can organize conferences for vocational mathematics teachers, emphasizing their teaching responsibilities and encouraging them to explore and practice the specific applications of modeling ideas. Moreover, schools should incorporate the use of modeling ideas and their effectiveness into performance evaluations to motivate teachers to implement these strategies in their teaching.

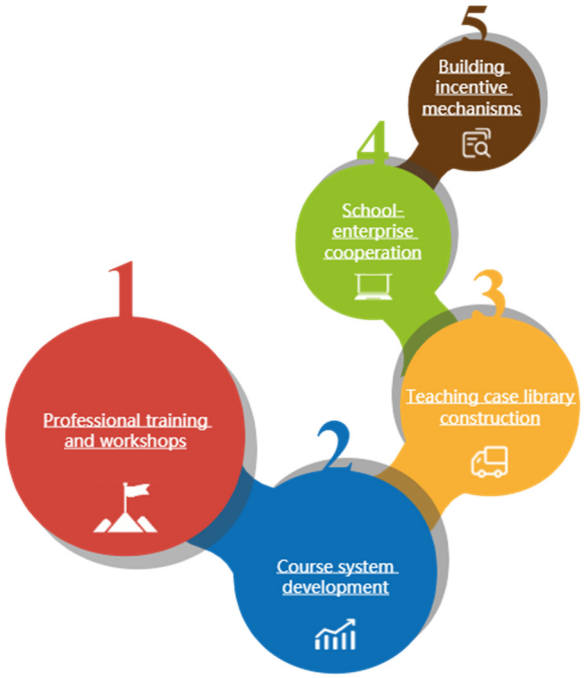

Figure 1. Ways to Build a Professional Team of Vocational Mathematics Teachers

5.2 Introducing Course Content

Due to certain objective factors, vocational mathematics textbooks often lack introductory sections, and teachers may be unaware of this gap. In daily teaching, adding course introductions can capture students' attention and reduce their unfamiliarity with the material. Teachers should design innovative course introductions based on students' current learning progress to create a positive classroom atmosphere. Vocational mathematics teachers should use course content as the "center" and students' knowledge base as the "radius" when designing these introductions, ensuring they do not introduce new material unfamiliar to students, as this could further alienate them from the subject. For example, when teaching the second major limit concept in advanced mathematics, a teacher could assign the following pre-class task: "Suppose you have 10,000 yuan to invest. You know that the annual interest rate for Yu'ebao is 2.90%, the three-month term investment rate is 2.90%, and the one-year bank deposit rate is 2.93%. To maximize your returns after three years, which investment option should you choose?" Using MATLAB software to calculate the final returns of these three investment options, as shown in Table 2, students can learn that total interest is influenced not only by the interest rate but also by the compounding frequency, thus gaining a deeper appreciation for the power of mathematics.

Table 2. Final Returns of Three Different Investment Options

	Principal	Annual interest rate	Compound interest method	Time	Toyal principal and interest
Yu'ebao	10000	2.90%	Day (n=365)	3 years	10909
Three-month fixed-term financial product	10000	2.90%	Quarter(n=4)	3 years	10906
One-year fixed-term deposit	10000	2.90%	Year(n=1)	3 years	10905

5.3 Perfecting the Teaching System

A well-designed teaching system is essential for the smooth implementation of teaching activities, and teachers play a critical role in selecting modeling content. In choosing modeling topics, teachers should conduct thorough research and analysis of students' actual learning situations to ensure the content is practical, interesting, simple, and suitable for students. Additionally, teachers should adhere to the principle of "quality over quantity" when selecting mathematical modeling examples. Each example should serve as a beacon, guiding and inspiring students in their exploration of mathematics, helping them enjoy problem-solving while fully experiencing the essence and beauty of mathematical modeling. This way, modeling ideas can be applied effectively to improve teaching outcomes.

5.4 Improving the Teaching Model

To fully harness the potential of mathematical modeling in vocational mathematics education, teachers must continually explore and optimize the implementation model, ensuring a balance between systematization and comprehensiveness. To achieve better results in applying mathematical modeling ideas, teachers should continuously refine these methods, with particular attention to ensuring their systemic and comprehensive application. For example, in developing mathematical modeling resources, teachers should thoroughly research mathematics textbooks, extracting content suitable for integration with modeling ideas while adapting them to students' actual learning levels. Broadly applying information technology in vocational mathematics teaching helps cultivate students' digital literacy, data awareness, and software application skills, such as proficiency in multimedia software. By integrating computers into mathematical modeling education, the interactivity and enjoyment of teaching are significantly enhanced, effectively fostering students' information literacy and problem-solving abilities, and laying a solid foundation for their future learning and work in the digital era.

6. Conclusion

In summary, vocational mathematics teaching reform should place greater emphasis on practical application, particularly on cultivating students' ability to solve real-world problems, apply mathematical methods scientifically, and improve their overall qualities. Integrating mathematical modeling ideas into vocational mathematics teaching reform systematically and scientifically can improve both teaching quality and outcomes. By incorporating modeling ideas into vocational mathematics education, the common problems of low student motivation and one-dimensional teaching methods can be addressed, fostering students' innovation awareness and enhancing teaching efficiency. In future development, teachers should be aware of their important role, break away from traditional thinking patterns, adopt diverse teaching approaches, and cultivate versatile, applied talents through mathematics education.

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