Exploration of the Reform of Stratified Teaching Mode of Higher Mathematics in Higher Vocational Colleges

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ABSTRACT

This study examines higher mathematics education within vocational colleges. Through a comprehensive review of literature, rand the recent developments in differentiated instruction and mobile technology integration, the study underscores the challenges and opportunities facing teachers in developing effective learning among students. The findings reveal that cooperative education frameworks significantly enhance students' employability by aligning academic learning with practical experiences. Further, the application of instructional strategies shows that it improves mathematics learning outcomes. It also addresses the diverse needs of students in mixed-ability classrooms. This study shows the importance of innovative pedagogical approaches in higher education and provides recommendations for further research in the field of vocational education.

Keywords—Higher vocational colleges; higher mathematics; stratified teaching mode; teaching reform

INTRODUCTION

In recent decades, the development of internet and financial technologies has caused the demand for applied mathematics talents. Higher mathematics, as a part of modern mathematics, is widely applied in natural and social sciences. Its teaching status has increased dramatically, with the same standard and broad applicability across different disciplines. The demand for mathematical skills has prompted teachers to develop teaching models tailored to the unique characteristics of higher mathematics, especially in vocational settings.

One method is the **stratified teaching model**, which has gained popularity in responding to the different levels of mathematical proficiency among students in vocational education. This approach consistent with the concept of differentiated instruction, as explored by Tomlinson (2001). He emphasizes the importance of adapting teaching strategies to students' diverse needs. Stratified teaching allows teachers to modify the content, and difficulty of the lessons. The modification is aligned also with the students' existing knowledge, thus, facilitating a more inclusive learning environment. This model is effective in vocational education, where students often come from varied academic backgrounds and need tailored support to succeed (Gu, 2011).

Tomlinson (2001) argues that differentiated instruction is very important in addressing mixed-ability classrooms. Accordingly, it enhances student engagement and comprehension as it caters to individual learning needs. In the context of higher mathematics, stratified teaching supports students at different levels in improving their understanding of complex mathematical concepts. This method also makes teachers adjust instruction dynamically, making sure that each student is challenged appropriately without being overwhelmed.

According to Hodgson and Spours (2013), in vocational education, where applied mathematics is crucial for industry-related problem-solving, stratified teaching helps in developing the practical skills of the students. Training students to build their mathematical knowledge little by little, teachers can create deeper understanding of the subject. This makes students apply these skills in real-world settings. This approach also promotes the educational principle of “teaching students in accordance with their aptitude,” which is fundamental in Chinese educational philosophy (Gu, 2011).

These studies underscore that by applying the stratified teaching model, teachers achieve better outcomes in higher mathematics education. This model makes students with differing skill levels progress at their own pace.

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It develops confidence and improved their learning outcomes. With the growing demand for professionals skilled in applied mathematics, vocational colleges must explore the full potential of this model to prepare students for future challenges in the workforce.

Through the conduct a comprehensive literature review this paper examines the stratified teaching and its role in improving students' understanding of higher mathematics. This involves analyzing existing studies that demonstrate how stratified teaching addresses diverse student needs, accommodates different levels of mathematical proficiency, and fosters deeper conceptual understanding.

The Stratified Teaching Model

The stratified teaching model is associated with differentiated instruction. It is an educational approach designed to address the varying levels of proficiency and learning needs among students in a classroom. This model involves grouping students based on their abilities. Thus, the instruction is to meet their specific learning needs. It also aims to provide personalized experiences that develops engagement and comprehension. Carol Ann Tomlinson (2001) proposed the differentiated instruction. She emphasizes the significance of adapting teaching strategies to address the diverse student needs. Tomlinson argues that "effective differentiation involves modifying content, process, products, and the learning environment based on students' readiness, interests, and learning profiles." In this context, the stratified teaching model therefore a vital approach responsive to the diverse learning needs of students in higher mathematics education within vocational colleges. By Through the ideas from the proponents such as Tomlinson and others, teachers can develop instructional strategies that meet engagement and comprehension among students.

Analysis of the Development Status of Higher Mathematics Teaching in Higher Vocational Colleges

A. Challenges Faced by Higher Mathematics Teaching in Higher Vocational Colleges

In China, student enter higher vocational colleges with a weak foundational knowledge in subjects like mathematics. This is due to the nature of the college entrance examination system. For instance, first-year students display low mathematical abilities, lack of self-discipline, and even narrow learning scope. Higher mathematics with its rigor and abstraction, requires a high level of cognitive ability from students. According to Seng (2016), this challenge teaching because of the reliance on traditional teaching approaches. Traditional teaching methods, which consists of classroom lectures, assignments, and final exams, are still popular. These methods are structured in terms of learning. However, they emphasize theoretical content while offering less engagement and practical applications. The disconnection between theory and practical applications leads to student disinterest according to Cai et al. (2017).

Internet technologies caused some vocational institutions to adopt multimedia tools, such as video presentations. This is to replace traditional teaching. These tools may increase engagement and bring difference into the classroom instruction, they may also distract students from mathematical concepts. Students therefore may struggle to understand difficult topics presented via multimedia. Hwang, et al. (2018) said that this may further diminish teaching effectiveness. Further, the evaluation system for higher mathematics that relies on final exams, focuses on theoretical knowledge and therefore fails to assess students' practical skills, according to Liu (2020).

B. The Significance of Implementing Stratified Teaching of Higher Mathematics in Higher Vocational Colleges

Stratified teaching emerged as a response to the evolving demands of modern education. This approach accepts individual differences and the student learning abilities. This enables teachers to divide students into different levels based on their abilities. According to Tomlinson (2001) stratified teaching makes instruction meet the needs of each group, providing a more personalized and effective educational experience.

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In higher mathematics teaching, the stratified teaching model offers several key benefits. Firstly, it allows students to learn at a level that matches their abilities, making the content more accessible and manageable. This personalized approach enables students to make steady progress, fostering a sense of achievement and promoting active engagement in their learning (Ding & Zhang, 2021).

Secondly, stratified teaching helps alleviate the pressure that students with weaker mathematical foundations may feel. Some students in vocational colleges have extensive learning requirements across multiple subjects, which can create pressure with the challenges of higher mathematics. According to Zhang and Zhang (2020), stratified approach lessens this burden by making students have the ability to tackle mathematics at a pace suited to their individual skills.

Thus, the stratified teaching model provides a flexible and personalized solution for higher mathematics instruction in vocational colleges. Addressing diverse needs of students and promoting engagement, it enhances the effectiveness of mathematics education and prepare them for academic and professional success.

Implementation of Higher Mathematics Teaching Activities in Higher Vocational Colleges Based on Hierarchical Teaching Mode

A. Independent Standards Consideration for Professional Standards and Effective Stratified Guidance

In higher vocational colleges, implementing hierarchical teaching mode for higher mathematics needs teachers that establish strong guidance. This entails making specific teaching stratification that is consistent with the developmental needs of higher mathematics education. Cai et al. (2017) believes that the focus must be on students, because they are the primary agents in the classroom. Meanwhile the teachers should facilitate and guide the students through independent standards. This is to promote successful implementation of the hierarchical teaching framework.

In the implementation of higher mathematics teaching activities, an important aspect is to guide students to recognize the varying levels of difficulty. Therefore, teachers must help students understand the complexities and stages of mathematics, making sure that they have a basic understanding of the stratified teaching mode. Higher mathematics may be categorized into three modules based on learning difficulty:

Basic Teaching Module- This covers basic theoretical knowledge. This also covers problem-solving skills, which serves as the essential groundwork for students' higher mathematics learning.

Deep Learning Module- Here, students engage in deeper exploration and analysis of mathematical concepts, making them transfer knowledge across disciplines and strengthen the application of mathematical ideas.

Expansion and Testing Module- Here, teachers create opportunities for students to engage in practical mathematics. This enhances their application skills and reinforcing learned concepts (Liu, 2020).

The stratified teaching approach must address the different learning interests and requirements of students. Student interest is an important factor. It serves as a motivating factor for engagement in learning. Ding and Zhang (2021) notes that some college students possess some mathematical background. Thus, stimulating their enthusiasm may lead to more proactive self-directed learning and deeper engagement with mathematical concepts.

Further, it is vital to recognize that as the students develop, their mathematical skills needs will also evolve. To facilitate effective management of the hierarchical teaching mode, there should be a conduct of an assessment each semester. Factors such as student performance, learning expectations, and evaluations are important in determining students' appropriate levels. Within the context of higher vocational colleges, stratified teaching guidance makes students' understand and accept the hierarchical teaching mode. It positively impact its application and overall effectiveness (Zhang & Zhang, 2020).

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B. Specific Stratified Implementation Based on Varied Standards

Higher mathematics teaching activities in vocational colleges have challenges that are influenced by students' learning abilities, attitudes, as well as teachers' instructional methods. These areas may serve as barrier in the achievement of educational objectives. The application of a stratified teaching mode in higher mathematics, however, can facilitate development by having targeted teaching activities that are aligned to the different learning levels (Tomlinson, 2001).

In order to have an effective stratified teaching, teachers must conduct thorough research in the characteristics of various majors, the requirements for higher mathematics. They should also know the actual teaching conditions, and professional training objectives. According to Hwang et al. (2018), based on this information, students can be classified into four categories: A, B, C, and D.

Category A- Students majoring in fields such as computer science and electronics who have higher mathematics requirements.

Category B- Students majoring in biology and chemistry, whose professional knowledge closely correlates with mathematics.

Category C- Students in economics, e-commerce, and accounting, who needs a different level of mathematical application.

Category D- Students in political science and law, where mathematics is less central to their studies.

By knowing the different learning needs of these categories, teachers may develop mathematics courses that are apt for such areas as Economic Mathematics, University Mathematics (for liberal arts), and Higher Mathematics (for sciences).

Adhering to a student-centered teaching philosophy allows for hierarchical teaching activities. In this model, teachers categorize students based on their basic knowledge and interest in mathematics. Category A for instance has strong foundation and advanced logical skills appropriate for challenging teaching objectives that have modeling concepts. Category B on the other hand, are with students that possess moderate understanding. This necessitates focused teaching in order to consolidate their mathematical knowledge. In Category C, these are students with weaker foundations that require strategies to have effective learning methods. This stimulates their interest and encourage participation in mathematical studies (Liu, 2020).

CONCLUSIONS

The stratified teaching mode as discussed in this study presents a solution to the challenges faced in higher mathematics education within vocational colleges. By accepting the diverse mathematical backgrounds and proficiency levels of students, this model gives a personalized learning environment that allows response to individual student needs. This approach makes flexible instruction, which enable students to progress at their own pace while developing important mathematical skills that are important to their fields of study.

Through an analysis of students' different capabilities and interests, educators can design learning experiences that enhance engagement and comprehension. As underscored in the literature, stratified teaching not only alleviates the pressures associated with mathematical concepts but also promotes participation and self-directed learning. This shift is important in preparing students for the demands of the 21st century workforce, where applied mathematical skills are necessary.

With stratified teaching model in higher mathematics education, there is greater chances of improved academic outcomes and students are better equipped with the skills necessary for success. As we continue to explore and refine this approach, it is necessary for teachers to be adaptable, to ensure that teaching practices develop with the changing methods applicable for different types of students.

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