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Exploration and Practice of Stratified Teaching Mode of Mathematics in Colleges and Universities under OBE Orientation

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Abstract: Mathematics is a compulsory course for many majors in colleges and universities, emphasizing the cultivation of students' innovative thinking and logical reasoning abilities. In the work of teaching reform, teachers can carry out mathematics teaching reform based on the OBE teaching concept and the stratified teaching method to improve the quality of mathematics teaching and implement the teaching requirements of teaching students in accordance with their aptitude. Based on this, this paper explores the stratified teaching of mathematics in colleges and universities under the OBE orientation, analyzes the overview of the stratified teaching model under the OBE orientation and its application value in mathematics teaching in colleges and universities, expounds the current situation of mathematics teaching, and puts forward corresponding implementation strategies, aiming to improve the teaching orientation and students' learning effect. This paper provides new ideas and practical references for the reform of mathematics teaching in colleges and universities.

Keywords: OBE; Colleges; Mathematics; Stratified teaching mode; Practice

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1. Introduction

Mathematics, as an important basic discipline in colleges and universities, its teaching effect directly affects students' subsequent professional course learning and the development of thinking ability. However, in traditional college mathematics teaching, the large class teaching mode makes it difficult for teachers to take into account the learning progress and characteristics of each student, and the uniform teaching materials are not suitable for students with different foundations and learning abilities, resulting in uneven teaching effects and dampened learning enthusiasm of some students [1]. The OBE educational concept emphasizes designing teaching based on students' final learning outcomes, while stratified teaching can tailor teaching according to students' differences. The combination of the two in college mathematics teaching is expected to effectively improve the current

teaching situation, enhance teaching quality, and meet the individualized development needs of students, which has important research and practical significance.

2. Overview of the stratified teaching mode under OBE orientation and its application value in college mathematics teaching

2.1. An overview of the OBE-oriented stratified teaching model

OBE (Outcome-based Education) is an educational model. Based on learning outcomes, which emphasizes focusing on the learning outcomes that students can ultimately achieve and designing the teaching process in reverse around those outcomes [2]. From the perspective of cognitive development theory, there are differences in students' cognitive levels, and different students have different starting points and speeds in learning mathematics [3]. Under the OBE-oriented stratified teaching model, emphasis is placed on dividing students into levels based on their knowledge base, learning ability, etc. Students are divided into the basic level, the advanced level and the extended level, and targeted teaching activities are carried out for them, and teaching objectives and teaching contents are selected to match them [4].

2.2. The application value of the OBE-based stratified teaching model in college mathematics teaching

Introducing the stratified teaching method based on the OBE concept into mathematics teaching is of great value, mainly reflected in the following aspects: First, it is conducive to clarifying the teaching objectives. OBE-oriented stratified teaching can prompt teachers to set clear, specific and measurable teaching goals based on the characteristics of students at each level. For example, for students at the basic level, the goal is to master the basic function differentiation formula and be able to apply it accurately. This goal is clear and feasible [5]. In line with the goals, teachers can design and organize teaching activities, select appropriate teaching content and methods, and students can also clarify their learning tasks and subsequent efforts, thereby promoting the effective implementation of teaching goals and enhancing the pertinence and effectiveness of teaching activities.

Second, it is beneficial to meet the needs of students. There are significant differences in students' mathematical foundations and learning abilities. Stratified teaching fully respects individual differences and can provide personalized teaching services for students of different levels. For example, students at the basic level can have more opportunities to consolidate their basic knowledge and practice their basic skills, avoiding losing confidence in learning because they can't keep up with the teaching pace; Students at the advanced and extended levels can be exposed to more challenging content, satisfying their pursuit of depth and breadth of knowledge and stimulating their learning potential. Students at all levels can find their learning paths in stratified teaching, meet their learning needs, and enhance their enthusiasm and initiative for learning [6].

Third, it is conducive to teaching students according to their aptitude. The OBE-oriented stratified teaching emphasizes the practice of teaching students according to their aptitude. There are differences among students at different levels in terms of cognitive level, learning style, learning speed, etc. In the process of stratified teaching, teachers can adjust the pace, methods and content of teaching according to the characteristics of students at each level, adopt individualized teaching methods, make teaching better adapt to the individual differences of students, help each student develop on the original basis, improve the quality of teaching and promote the all-round growth of students [7].

3. The current situation of mathematics teaching in colleges and universities

3.1. Adopt a large-class teaching mode

At present, most colleges and universities adopt the large-class teaching model and conduct teaching in the form of open classes. A large number of students are gathered in the same classroom for mathematics teaching. The large class teaching model poses many challenges for teachers in the teaching process, such as insufficient teaching interaction, difficulty in taking into account the learning status and feedback of each student, only a very small number of students can get the opportunity to speak in class questions, and most students lack the opportunity to interact effectively with teachers, resulting in low class participation and easy inhibition of students' learning enthusiasm. For instance, it is difficult for teachers to implement individualized teaching based on the differences in each student's knowledge base and learning ability. Instead, they tend to explain mathematical concepts at a uniform pace and practice exercises, which may cause students with weak foundations to fall behind due to their inability to keep up with the pace, while students with solid foundations have difficulty getting more challenging learning content, thus greatly reducing the effectiveness of teaching.

3.2. Use uniform teaching materials

Most colleges and universities use the same textbook for mathematics teaching, and students of all majors use the same textbook. While this approach can promote the unification of teaching management and curriculum standards, it also has many problems. For instance, there are significant differences in the demands and application directions of mathematical knowledge among students of different majors. Students of science and engineering need to learn more about engineering practice, model building and other related knowledge, and need to design relevant cases and content in the teaching materials; Students majoring in liberal arts have relatively lower requirements for the depth of mathematical theory and prefer easy-to-understand mathematics textbooks that are in line with the actual situation of the liberal arts major. From this, it can be seen that a uniform textbook is difficult to meet the diverse needs of students of different majors at the same time.

4. Practical strategies for the stratified teaching model of mathematics in colleges and universities under the OBE orientation

4.1. Scientific stratified teaching based on different teaching contents

The knowledge of mathematics in colleges and universities is rather difficult and involves a wide range of knowledge points. Under the OBE orientation, when implementing the stratified teaching model in college mathematics, emphasis should be placed on scientifically stratified teaching in combination with different teaching contents, scientifically and reasonably arranging learning tasks, and conducting targeted teaching in combination with the specific situation of students [8]. Take the teaching of "The Concept of Sets" in the chapter "Functions and Limits" as an example. The teacher first stratifies the students and divides them into the basic level, the advanced level, and the extended level based on their mathematical foundation, learning ability, and learning goals. Different teaching contents are set for students at different levels. For students at the basic level, the teaching content mainly focuses on the basic concepts and simple operations of sets, such as determining whether an element belongs to a given set, to help them master the basic knowledge and lay a solid foundation for subsequent learning. For advanced-level students, while helping them master the basic content, emphasis is placed on explaining the relationships between sets, such as subsets and proper subsets, and they are required to complete medium-difficulty operations, such as the intersection, union, and complement operations of sets.

For students at the extension level, they should not only be proficient in the above content but also explore extended knowledge related to sets, such as the application of set theory in other branches of mathematics. They can also tutor students at other levels to promote the transfer and sharing of knowledge and create a good learning atmosphere of mutual assistance [9]. In the implementation of teaching, for students at the basic level, teachers should adopt intuitive and detailed lecture methods, accompanied by rich examples and demonstrations, and assign a large number of basic exercises to help students understand abstract concepts and strengthen their mastery of knowledge. For students at the advanced level, teachers can adopt the problem-based teaching method by posing thought-provoking questions, such as real-life cases, to guide students to think independently, find solutions, and explore the application of collective knowledge. For students at the extension level, teachers can adopt the project-based learning approach, allowing them to independently design research projects related to sets to cultivate their innovative thinking and comprehensive application of knowledge [10].

4.2. Implement the result-oriented concept to guide teaching practice

In line with the OBE concept, teachers should, following the requirements of the curriculum, define teaching objectives that are in line with teaching principles and social development requirements, and guide teaching practice based on the results of the objectives to enhance teaching effectiveness. Taking the teaching of the chapter "Differential Calculus of Multivariate Functions" as an example, teachers should optimize the teaching process. Before class, implement precise guidance. Teachers should use a course management platform or learning APP to release to students a detailed framework of the knowledge content of the class, clearly mark key preview points, and attach relevant preview materials such as micro-lesson videos, basic concept explanation documents, etc. For example, inform students that they need to focus on previewing the definition of multivariate functions, the concept of partial derivatives, etc., guide students to initially construct the knowledge framework, enter the classroom with questions, and enhance the initiative and pertinence of learning. In class, lead students to overcome difficult points [11]. The teacher systematically reviews the key and difficult points of the students' feedback during the preview stage, and uses case analysis teaching methods to guide students to understand and master them in depth. For example, for the difficult point of derivative calculation, the teacher can introduce real-life cases involving the rate of change of multivariate functions, organize students to discuss in groups how to transform practical problems into mathematical models, and then introduce the method of partial derivative calculation. Through group reports and teacher comments, deepen students' understanding and application of the knowledge, and ensure that students can effectively solve the confusion they encounter during the preview in class, and achieve the goal of understanding and applying the knowledge. After class, guide students to consolidate and expand. After the class is over, the teacher assigns chapter exercises to the students and adds the special task of "one practice per lesson" [12]. For students at the basic level, "One practice per section" focuses on consolidating basic knowledge, such as setting simple problems of function differentiation and integral operation to strengthen basic operation skills; For students at the advanced level, there are more types of questions that integrate knowledge, such as extremum problems of multivariate functions combined with geometric figures, to train their analytical and problem-solving skills. Students at the extension level are assigned open-ended and exploratory tasks, such as asking them to independently explore the application of a certain mathematical theory in emerging disciplines and write short reports to cultivate their innovative thinking and knowledge expansion abilities [13]. Through stratified exercises, the learning needs of students at different levels can be met, promoting the improvement of learning outcomes within their respective capabilities.

4.3. Assign stratified homework and guide learning methods

Under the OBE orientation, teachers should flexibly set the amount and difficulty of homework based on the characteristics and needs of different levels to meet the learning needs of students at different levels. Take the design of the "Derivatives and differentials" homework as an example. Teachers should design homework of different levels of difficulty. For instance, the amount of homework for students at the basic level should not be too large. Emphasis should be placed on consolidating what has been learned in class. Simple derivative problems can be assigned, and students should be required to complete them based on understanding the rules of function differentiation, such as basic elementary function differentiation operations. Through repeated practice, basic operation skills can be strengthened. To lay a solid foundation for learning in subsequent courses. For students in the advanced level, the amount and difficulty of homework can be appropriately increased. In addition to regular derivative operations, more difficult derivative problems can be assigned, such as complex types of problems like composite function differentiation and implicit function differentiation, and extension exercises such as comprehensive application problems such as using derivatives to analyze the monotonicity and extremum of functions can be required to train their knowledge transfer and problem analysis skills [14]. The homework for students in the extension level should focus on innovation and autonomy. Teachers can assign open-ended and exploratory assignments, such as asking students to independently design mathematical models related to "derivatives and differentials" and apply them to real-life scenarios or emerging disciplines, and submit their results in the form of small papers. Teachers should provide individualized guidance on learning methods for students at different levels. For example, students at the basic level should focus on error correction and concept review, students at the advanced level should be guided to summarize problem-solving ideas, methods, and skills, and students at the extended level should be encouraged to read cutting-edge literature to enhance their academic vision and innovative thinking.

4.4. Build a diversified evaluation system to promote the development of abilities

Based on the OBE educational concept, mathematics teaching in colleges and universities should abandon the traditional single evaluation model and focus on the final learning outcomes of students, thereby building a multi-evaluation system to promote the development of students' mathematical abilities. The evaluation system covers various evaluation methods, emphasizing the comprehensive assessment of students' performance and achievements in mathematics learning. It is mainly divided into formative evaluation and summative evaluation, which complement each other and jointly reflect the process of students' mathematics learning. Formative assessment runs through the entire teaching process, and teachers should focus on observing students' participation in class, emotions in answering questions, etc., to evaluate students' immediate understanding of knowledge points; Understand the completion of students' homework after class, and focus on commenting on students' problem-solving ideas and methods of conclusion, rather than right or wrong [15]. Take the exploration of the "Mathematical modeling" project as an example. Teachers can evaluate students' model-building ideas, data processing methods, etc., and use the evaluation to guide students to continuously optimize their learning strategies during the learning process. Summative evaluation should emphasize feedback on phased learning outcomes. Teachers can conduct it through unit tests, mid-term and final exams, etc., and set different evaluation criteria for students of different levels. For example, for students at the basic level, emphasis can be placed on their mastery of basic knowledge and application of basic skills to ensure that they have a solid grasp of the core content of mathematics; For students at the advanced level, increase the proportion of questions on comprehensive application of knowledge to test their knowledge transfer and problem-solving abilities; For

advanced-level students, open-ended and innovative questions can be set, such as asking them to independently design math experiments and write reports to evaluate their innovative thinking and knowledge expansion ability. Through stratified evaluation, teachers can understand the learning outcomes of different students and encourage them to develop in their respective areas of competence.

5. Conclusion

To sum up, the OBE-oriented stratified teaching model of mathematics in colleges and universities has shown many advantages in practice, which can improve students' learning outcomes and promote the development of students' comprehensive qualities. In practical application, teachers should scientifically divide the teaching levels, implement the outcome-oriented theory, set up stratified assignments, build a multi-evaluation system, make the teaching objectives clearer, the teaching process more in line with the needs of different students, and implement the requirements of teaching students in accordance with their aptitude. Teaching reform is a continuous process, and teachers should constantly conduct in-depth research to optimize teaching models and lay a solid mathematical foundation for cultivating high-quality talents.

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