

Research on the Construction of First Class Higher Mathematics Curriculum Based on OBE Concept

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Abstract: In higher education teaching in our country, higher mathematics courses are very important foundational courses. Higher mathematics has the characteristics of high abstraction, rigorous logic, and wide applicability, which can cultivate college students' ability to analyze and solve problems. OBE is a results oriented educational philosophy. Including student-centered approach—emphasizing the subject status of students in the learning process, paying attention to students' learning needs, interests, and individual differences, and cultivating students' self-exploration and self-learning abilities; Outcome oriented— all teaching activities should aim at students' learning outcomes, including knowledge, abilities, qualities, and other aspects. Teachers need to clarify students' learning outcomes and design courses, teaching methods, and evaluation systems based on this; Reverse design—starting from the final learning outcomes, reverse design the curriculum system and teaching content. Determine the knowledge, abilities, and qualities that students should possess upon graduation, and then design corresponding courses and teaching activities; Continuous improvement—continuously improving teaching activities and learning outcomes through evaluation and feedback. The OBE philosophy emphasizes that evaluation is not only about assessing students, but also about improving the teaching process and enhancing the quality of education. This article is guided by the OBE educational philosophy and combines the connotation of the OBE educational philosophy to explore the construction path of first-class higher mathematics courses under the OBE educational philosophy from the aspects of clarifying teaching objectives, reconstructing teaching content, integrating ideological and political education into the curriculum, constructing a blended teaching mode deeply integrated with information technology, and establishing a diversified evaluation system.

1. Introduction

Advanced mathematics is a compulsory basic course for science and engineering majors and management majors in higher education institutions. It is a course that serves and supports the construction of majors. Improving the quality of professional construction cannot be achieved without high-level advanced mathematics curriculum construction. The OBE concept is result oriented and focuses on the output of results. Based on the OBE concept, the construction of

first-class courses in higher mathematics can promote the construction of first-class courses and better achieve the construction goals.

2. Overview of OBE concept

The Outcome Based Education (OBE) educational philosophy, also known as outcome oriented education, competency oriented education, goal oriented education, or demand-oriented education, is a student-centered outcome oriented educational philosophy [1]. This educational philosophy emphasizes the goal oriented approach of results and adopts reverse thinking to construct the curriculum system, which is an advanced educational concept. OBE first appeared in the basic education reforms in the United States and Australia, with its core being an outcomes based education (OBE) model that emphasizes that what students learn and whether they succeed are far more important than how and when they learn [2].

In the OBE education model, student output rather than textbooks or teacher experience becomes the driving force behind the operation of the education system, which is in sharp contrast to traditional content driven and investment oriented education. OBE emphasizes what students have learned rather than what teachers have taught, the output of the teaching process rather than its input, research-based teaching mode rather than indoctrination based teaching mode, and personalized teaching. Personalized teaching requires teachers to accurately grasp each student's learning trajectory, timely grasp each person's goals, foundations, and progress, develop different teaching plans according to different requirements, and provide different learning opportunities.

The implementation of OBE educational philosophy includes steps such as building a curriculum system, determining teaching strategies, self referencing and evaluation, and reaching the peak step by step. Learning outcomes represent a structure of abilities that are primarily achieved through curriculum teaching. Therefore, the construction of a curriculum system is particularly important for achieving learning outcomes. OBE's teaching evaluation focuses on learning outcomes, using diverse and hierarchical evaluation criteria. The evaluation emphasizes the connotation of achieving learning outcomes and personal learning progress, without emphasizing comparison between students.

3. Research on the Construction of First Class Higher Mathematics Curriculum under the OBE Concept

Curriculum is the core element of talent cultivation, and the quality of curriculum directly determines the quality of talent cultivation. According to the spirit of the National Education Conference, the achievements of education and teaching reform must be implemented in curriculum construction. OBE is a student-centered educational model, with an educational philosophy of "outcome oriented" or "learning output oriented". Firstly, based on the requirements of the major (such as software engineering) for students upon graduation and the societal demand for knowledge, skills, abilities, and qualities in advanced mathematics courses, the teaching objectives are determined. Then, the teaching content, design, process, and evaluation are determined. It not only depends on whether the teacher has completed the teaching task, but also on what has been learned at the end of the teaching! Therefore, based on the OBE concept and our school's educational positioning, the construction of provincial-level first-class courses in higher mathematics for science and engineering majors can be reformed and explored from the following aspects [3].

3.1. Based on the OBE concept, clarify the connotation of first-class courses and determine the teaching objectives of higher mathematics courses

The Ministry of Education has put forward specific requirements for the construction of first-class undergraduate courses in its implementation opinions: highlighting goal orientation, student centeredness, continuous improvement, emphasis on ability cultivation, and effectively enhancing the high-level, innovative, and challenging nature of the courses. The traditional teaching objectives of higher mathematics courses are difficult to meet the requirements of building provincial-level first-class courses. Therefore, by clarifying the connotation of first-class courses and based on the OBE concept, we need to redefine the teaching objectives of higher mathematics courses for science and engineering majors [4]. The new teaching objectives include knowledge objectives, ability objectives, and quality objectives. The knowledge objective is to master the basic concepts of limits, differentiation, integration, etc., and be able to apply these concepts to solve fundamental mathematical problems. For complex mathematical problems, one can unravel the essence through phenomena, unfold layer by layer, and solve them. The ability goal focuses on cultivating students' abstract thinking ability and logical reasoning ability. By organically combining professional applications, mathematical software, mathematical modeling, and teaching content, students are able to establish mathematical models to solve practical problems. The quality goal is to cultivate students' rigorous and pragmatic scientific spirit and professional ethics through ideological and political education in the curriculum; Guide students to understand the national conditions and inspire patriotic enthusiasm.

3.2. Based on the OBE concept, reconstruct the teaching content of higher mathematics courses

The course content is the core of the course, and the design of the course content should reflect the systematic nature of knowledge and experience. The construction of first-class courses should closely follow the needs of national development, rely on the latest developments in disciplinary research, new changes in social demands, and the requirements for talent cultivation to update the knowledge system and reconstruct course content.

The content is scientifically rigorous, cutting-edge and contemporary, with moderate capacity and clear structure, and can be effectively integrated into ideological and political education in combination with reality. Based on the OBE concept, first-class courses in higher mathematics need to sort out and reconstruct their teaching content. The organized content should enable students to fundamentally understand the essential connotation of the knowledge they have learned; At the same time, we should also pay attention to practical applications, concretize abstract and logically strong mathematical knowledge points, so that students can see and touch them, understand and digest the knowledge more easily, and feel the application value of knowledge in the process of analyzing and solving problems; The new content should incorporate ideological and political education into the curriculum, while imparting knowledge and educating people, to support the higher mathematics curriculum in achieving its educational function.

3.3. Integrating ideological and political education into higher mathematics teaching, achieving the goal of cultivating morality, nurturing people, and nurturing things silently

The fundamental task of education is to cultivate virtue and nurture people. The priority of "educating people" is to "cultivate morality", which is a problem that current university teachers need to study and solve. Course ideological and political education is advocated by General Secretary: cultivating students' moral character is the foundation of university teaching, and various

courses and ideological and political theory courses are in the same direction and form a synergistic effect, achieving the organic connection and integration of ideological and political education and professional education. Therefore, based on the OBE educational philosophy, while restructuring the teaching content, ideological and political content should be organically integrated into the content of higher mathematics courses, and some current news cases and cutting-edge scientific research achievements should be combined with ideological and political elements in higher mathematics teaching to provide students with positive incentives and guidance, and achieve the goal of nurturing students silently. For example, Wei Dongyi and Wei Shen from the Department of Mathematics at Peking University have made a series of advances in the regularity problems of Navier Stokes equations and linear damping problems of two-dimensional incompressible Euler equations; At the end of February 2021, Chen Gao, a 26 year old young professor at the University of Science and Technology of China, solved a world problem in the field of complex differential geometry; In October 2022, Professor Zhang Yitang made significant progress on the zero point conjecture problem... This series of achievements by Chinese mathematicians has greatly inspired us, aroused students' national pride, and motivated young people to study hard, climb the technological peak, and strive to make their own contributions to solving the "bottleneck" problem in China's science and technology as soon as possible. In recent years, China's aerospace industry has developed rapidly. On October 31, 2022, the Mengtian experimental module was successfully launched and docked with the forward port of the Tianhe core module at 4:27 am on November 1, 2022. At 9:32 am on November 3, 2022, the Mengtian experimental module successfully completed its transposition, marking the completion of the in orbit assembly of the "T" basic configuration of China's space station, and thus the construction of China's space station has been completed. At the same time as the construction of the space station, from the successful launch of Shenzhou-12 on June 17, 2021 to the launch of Shenzhou-16 on May 30, 2023, manned spacecraft will send batches of astronauts into the Chinese space station for various scientific research and experiments. The establishment of space stations and the launch of manned spacecraft are inseparable from the rocket, a major national tool! The birth and launch of rockets are closely related to mathematics. Mathematics, with its ubiquitous charm, influences our lives.

3.4. Building a blended learning model guided by learning outcomes and deeply integrated with information technology

Guided by learning outcomes, it clarifies the expected output that students should achieve at the end of the course, which can effectively measure what students can do through learning rather than what they know, and greatly improve students' initiative in participating in learning. Under the student-centered teaching model, online teaching has become an integral part of offline teaching and plays a crucial role in teaching. This project utilizes the Chaoxing Learning Platform to build a learning outcome oriented teaching model that deeply integrates with information technology, achieving a blended learning approach that combines online and offline learning. The specific implementation is as follows:

① Refactoring the student learning process, shifting from a teaching centered approach to a learning centered approach to achieve expected outcomes. The acquisition of students' basic knowledge is completed online. Before class, teachers post learning tasks on the Learning Platform for students to independently learn online resources or form teams to conduct exploratory learning of online resources in groups.

② The classroom learning process is completed offline, and teaching methods such as case-based teaching, problem driven teaching, discussion, and situational teaching are introduced accordingly based on the knowledge points in the classroom to achieve a change in teaching

methods, stimulate students' learning interest and potential, and make students busy and teaching lively. Reveal the essence of problems and provide solutions through classroom teaching activities. Deep learning in the classroom facilitates students' absorption and internalization of learned knowledge, enhancing learning outcomes.

③ Complete post class knowledge extension and practical application by assigning challenging tasks online. Teachers use the Chaoxing Learning Platform to release tasks, guide students to actively answer questions, provide feedback based on their answers, and provide timely feedback to students, thereby vertically extending the depth of teaching and achieving or even exceeding expected output.

3.5. Establish a diversified assessment and evaluation system

A comprehensive course assessment and evaluation system is an important outcome oriented evaluation indicator. The evaluation system for teaching effectiveness has the characteristics of development, objectivity, comprehensiveness, and diversification, and can run through the entire teaching process. Establish a diversified assessment and evaluation system:

① In the pre class preview stage, students' online learning performance, learning participation, pre class exercises, and case analysis are mainly assessed based on their online time, the number of posts and comments in the discussion area, and the accuracy of their answers.

② During the in class learning stage, the performance of team members is mainly assessed based on their completion of pre class tasks, peer evaluation among group members, and the effectiveness of demonstration cases.

③ In the post class task stage, the assessment of learning effectiveness is mainly based on students' task completion and peer evaluation among group members.

The assessment of the three stages of pre class preparation, in class learning, and post class tasks is a process assessment, and the final assessment is the result assessment of course learning. Teachers can use a combination of paper-based paper assessment and small papers for assessment.

4. Summary

Through the above channels, the OBE concept provides new ideas and methods for the reform of higher mathematics, which helps to improve teaching quality and students' learning outcomes. By utilizing the output oriented characteristics of the OBE concept, we aim to increase students' learning investment, scientifically "increase their burden", and enable them to experience the learning challenges that can only be obtained by "taking a leap". Cultivate students' comprehensive ability and advanced thinking to solve complex problems. Develop students' application skills. Our school is an applied university, and only by strengthening the cultivation of students' application abilities can they become competitive in society.

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