Teaching Reform and Practice of "Engineering Structure" Course Based on OBE Concept

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Abstract: In order to further improve the teaching level and learning effectiveness of the engineering structure course, this article analyzes the current teaching status and characteristics of the course under the guidance of the OBE concept, summarizes the research ideas and methods of other school-based courses, and explores measures for curriculum reform based on the specific characteristics of our school and puts them into practice. This reform is guided by achievement goals and proposes five reform measures, including restructuring teaching modules, reforming teaching methods, improving the ideological and political system of the curriculum, reforming curriculum design, and strengthening evaluation mechanisms. Guided by teaching goals, the focus is on analyzing the reform of teaching methods in this course. Through the practice of curriculum reform, the effectiveness of classroom teaching has been further improved, and students' learning enthusiasm has been enhanced, providing certain reference opinions for the reform of other similar courses in this major.

Keywords: Engineering Structure; Course Ideology and Politics; Teaching Reform

1. Introduction

The OBE educational philosophy is a result oriented, student-centered, and reverse thinking approach to curriculum system construction, ultimately evaluated based on the achievement of students' learning goals. To achieve the ultimate goal of outcome oriented education, teachers' teaching methods must constantly change to meet curriculum needs [1]. The course of "Engineering Structures" not only involves a lot of knowledge related to structural design principles, but also requires students to correctly read structural construction drawings, master the design and verification methods and construction requirements of basic components, and be able to carry out design verification work for simple structural components such as beams and slabs in order to achieve talent cultivation goals. It is closely related to previous courses such as engineering mechanics and building architecture, and also serves as the foundation for subsequent courses such as civil engineering construction, Guanglian Da software application, and building engineering measurement and pricing. However, the foundation of our school's students is average, and some high school humanities students have certain difficulties in learning theoretical courses, so the learning effect is average.

In response to the existing problems in this course, relevant majors in various universities have successively carried out teaching reforms and practices of this course, which have achieved certain results [2]. Liang and others conducted a case study on concrete structure design engineering based on the OBE concept, aiming to match learning objectives with actual needs and professional requirements [3]. Xiang and others conducted teaching research on the principles of concrete structure design to meet the requirements of modern engineering education [4]. Li and others introduced the CDIO concept into the teaching reform of engineering structure courses, which improved students' comprehensive quality and practical ability [5]. Niu Jingxing, & Kang Xiaofang and others analyzed the methods of integrating ideological and political education into the course of concrete structure design principles, and achieved certain results [6,7]. Zhu Mingqiao, & Zhang Yu and others have studied the methods and measures of curriculum practice teaching reform, enriched the content of practice teaching, and improved the quality of practice teaching[8,9].Through analysis, various universities have mainly carried out teaching reforms in teaching methods, ideological and political courses, and practical teaching, and have achieved certain results. In order to further improve the teaching quality of our school, based on the OBE concept, this article takes the

engineering structure course as the research object, analyzes the current problems of this course in our school, draws on the teaching reform methods of other universities for this course, combines with the actual situation of our students, proposes specific teaching reform methods suitable for our students, and puts them into practice.

2. The Current Teaching Status of Engineering Structure Course

2.1 The Teaching Content Is Highly Theoretical, But Students Lack Interest in Learning

The content of this course is diverse and highly theoretical, with some connections to prerequisite courses such as engineering mechanics, building architecture, and engineering materials. In addition, it is constrained by current regulations and many formulas have empirical characteristics, which makes many students feel that the learning difficulty of this course is high. During the learning process, they will gradually develop a sense of frustration and lose interest in active learning. This is also the main reason for the unsatisfactory learning effect of this course.

2.2 Insufficient Class Hours and Poor Classroom Teaching Effectiveness

One of the prominent issues is the insufficient teaching hours arranged for this course. In the reform of the training program, the total class hours and the hours of professional courses are constantly decreasing, resulting in less classroom teaching time. Teachers mainly focus on whether the course content can be taught, while neglecting whether the students' learning outcomes are good or not.

2.3 Slow Textbook Update Speed, Insufficient Knowledge Update Speed

Textbooks are mainly written by university teachers, lacking the participation of engineering and technical personnel, and lacking in architectural design and construction

The lack of skills in various aspects, insufficient integration of theory with practice, and insufficient updating of textbooks to keep up with the pace of professional development, as well as a lack of tracking of research trends in the field of engineering and technology, have deviated from the original intention of cultivating applied talents. In recent years, the construction industry has developed rapidly, and the updating speed of knowledge is relatively fast. However, the updating speed of textbooks often lags behind the updating speed of knowledge, resulting in students having little understanding of new technologies, new materials, etc.

2.4 Practical Teaching Cannot Achieve the Expected Effect

The traditional practical teaching of this course is also to complete the course design content of one-way slab ribbed beam floor with a lifelong question, complete the writing of calculation sheets and the drawing of related construction drawings; However, most students use the example problems explained by the teacher as templates for mechanized completion, which does not truly achieve the purpose of practical teaching. The effectiveness of practical teaching is average, especially for the drawing of construction drawings, which cannot be completed with their own calculated data.

3. Teaching Reform Measures for Engineering Structure Course Based on OBE Concept

In response to the current problems and deficiencies in the course, a research group composed of dual qualified teachers was formed based on the learning situation of our school students to explore specific measures for curriculum reform. The final discussion mainly focused on the following aspects for reform.

3.1 Determine the Course Objectives for Ability Development and Reconstruct Modular Teaching Content

The revised training plan for the course "Engineering Structures" includes 48 class hours. After discussion by the course team, the content of reinforced concrete structures, masonry structures, and steel structures in engineering structures has been reduced. Based on students' future career needs, reinforced concrete structures, masonry structures, and steel structures have been retained as self-study content. The reinforced concrete structure is divided into three modules, including basic knowledge, design principles and concrete structure design; The design principles section consists of three learning units: multiple hours of learning about the calculation of the normal

section bearing capacity of bending and compression members with ultimate bearing capacity, and fewer hours of learning about the calculation of the bearing capacity of tension members; Provide a solid foundation for the design of future beam and slab components; The main focus of the concrete structure design section is to learn the design methods of one-way slab ribbed beam floor and complete the course design training of one-way slab ribbed beam floor, in order to enhance students' future learning and professional abilities [10].

The course objectives have been redefined from three aspects: knowledge, ability, and quality. The knowledge objectives include mastering the mechanical properties of reinforced concrete materials, basic design principles of concrete structures, calculation methods for reinforced concrete bending, compression, tension, and other components, as well as the basic principles of reinforced concrete beam and slab structure design; Ability objective: To cultivate students' ability to design unidirectional ribbed beam floor slabs, draw corresponding construction drawings for beams and slabs, and perform reinforcement calculations for general compression and tension components. Emotional goal: Through the study of the course and the completion of practical training, to understand the professional ethics of structural engineers and gradually cultivate good professional ethics in students.

3.2 Guided by Teaching Objectives, Reform Teaching Methods

Analyze the drawbacks of traditional cramming teaching, develop a blended learning method of online and offline, enhance students' learning interest and self-learning ability, and improve the learning effectiveness of the course. Constructing teaching resources based on the Chaoxing teaching platform, forming paper and electronic teaching resources such as teaching videos, teaching designs, teaching cases, teaching courseware, assignments, etc., and continuously updating the platform resources, providing necessary conditions for online and offline teaching. For online content, it mainly focuses on basic concepts and theories, such as the performance of steel bars and concrete materials, beam and slab construction, and classification of floor systems. Online resources are mainly used for post class review and preview.

After the reform, classroom teaching emphasizes practice, understands theory, and combines blackboard writing and multimedia. In formula derivation and calculation diagram drawing, students are required to record and supplement corresponding knowledge points in the form of blackboard writing. For example, in previous studies, students were prone to confuse the formulas for single and double reinforcement sections. Therefore, in classroom teaching, students are required to follow the teacher to draw calculation diagrams and derive formulas, which can better understand the formulas correctly; When it comes to cross-sectional design and composite problems, it is easy to use the wrong two methods, requiring students to solve them by searching for unknown variables; In addition, different formulas are taught using different methods of understanding and memorization, making it easier for students to understand the application of formulas and memorize different types of problem-solving ideas and methods, achieving good results. When explaining exercises after class, a flipped classroom approach is adopted, where students explain, discuss with each other, and receive feedback from the teacher. Students are organized to discuss key and difficult points, allowing them to participate more in classroom learning and increasing their enthusiasm for learning and collaboration, thus improving the effectiveness of classroom teaching.

The four stages of understanding, memorizing, and retelling different knowledge have been achieved through teacher classroom lectures, student exercises and homework, and student exercises after class, leaving a deeper impression.

3.3 Improve the Ideological and Political System of the Curriculum

This course is based on the design specifications used by structural engineers, in order to enable students to learn. During the process of learning, I gained a deeper understanding of the professional qualities and ethics required for structural engineers. In the corresponding chapters, I condensed the content of ideological and political education in the course, such as adding the unity of opposites in reinforced concrete structures in the introduction, adding the "green eye care" of new concrete materials in reinforced concrete materials, and introducing different teaching cases such as the standard tragedy of Beijing Daxing Mingyue Bay

residential reconstruction in the design basic principles as ideological and political content. At the end of the cases, I extended the relevant cases to enable students to understand the new technologies, methods, and important events worth learning and paying attention to in the development of the construction industry, and to marvel at the efforts made by engineering and technical personnel for the development of society, as well as the responsibilities and obligations that engineers should undertake in the engineering field. To evoke a sense of national pride and social responsibility, Establish a sense of responsibility for safety in advance, firmly adhere to the concept of safety development, and be able to take it as a warning in future learning and work.

3.4 Guided by Students' Practical Abilities, Carry out Curriculum Design

Traditional practical teaching is about completing course design tasks. Although it also achieves a lifelong goal and ultimately submits the results of the course design, the effect on improving students' abilities is not ideal, such as insufficient ability to recognize and draw structural construction drawings, and insufficient understanding of the application of data in calculation sheets. After the reform, the curriculum design is based on groups, with 2-3 students per group according to their actual learning situation and their own abilities. Each group has one question, and the team members work together to complete the design of the slab, secondary beam, and main beam in the design of the one-way ribbed beam floor system, as well as the drawing of the structural construction drawings. After the course design is completed, each group member will report separately, including but not limited to the division of labor, completion status, and the ideas and methods of drawing the construction drawings; And use self-evaluation by teachers and students, peer evaluation by team members, etc. to score, and calculate the practical training score by weighted average. Through the presentation of course design, students were prevented from plagiarizing and mechanically calculating each other. Instead, they truly understood the entire process and methods of course design, and gained a deeper understanding and mastery of the reading and drawing of structural construction drawings. In the future, they will have a more solid foundation in professional courses such as measurement and pricing, and Guanglian Da.

3.5 Adopt Process Assessment and Increase Evaluation Mechanism

Adopting a process based assessment method, adding regular assessments, with a comprehensive assessment of 50% for regular assessments and 50% for final closed papers Grades; Regular grades include attendance, homework, notes, classroom interaction, course design, and other comprehensive components. Attendance is checked in and checked out for each class, while homework mainly refers to the completion of practice questions in class. Failure to complete or plagiarism in class will result in deduction of regular grades, ensuring that students can think independently and complete their homework on their own. Classroom interaction mainly tests students' answers to classroom questions, and points will be deducted for doing things unrelated to the classroom. Course design will be scored according to the implementation method of the curriculum design reform after implementation. The final exam is mainly conducted in a closed book format based on students' learning situation, with content including multiple-choice, fill in the blank, noun explanation, simple answer, calculation and other question types. In the assessment, reference is made to the national registered structural engineer examination method, and basic formulas are given in the calculation, mainly assessing students' application of formulas rather than memorizing them; The final closed book assessment not only tests students' mastery of basic knowledge, but also their ability to comprehensively analyze and apply the knowledge they have learned, achieving the purpose of course learning, achieving a process oriented assessment, and improving students' classroom participation and teaching effectiveness.

3.6 Encourage Students to Participate in Extracurricular Activities and Apply what They Have Learned to Practical Situations

Students are actively encouraged to participate in practical activities related to the course or activities integrated with other courses, and to carry out enterprise internships in the construction industry in winter and summer, such as large-scale innovation projects, Internet plus competitions, discipline competitions, and

writing academic papers, so as to exercise students' practical and cognitive abilities. Through the school level image recognition competition participated by students, it can be seen that after the curriculum reform, students' image recognition ability has been significantly improved, and the curriculum reform has achieved preliminary results.

4. Conclusion

As the core course of engineering management majors, the course reform of engineering structure is an inevitable requirement of the development of the times. This study adopts reform measures such as updating course content, improving teaching methods, strengthening practical activities, and optimizing evaluation mechanisms to effectively enhance the quality of engineering structure education and teaching, improve students' knowledge, abilities, and qualities, and cultivate high-quality professional talents that meet the needs of modern engineering. In the evaluation of the course organized by the Quality Office of our school, we have achieved good results and formed a relatively complete teaching resource, including teaching design, teaching videos, teaching cases, course ideological and political education, etc. In the future, we will constantly reflect on the problems and shortcomings in classroom teaching, accept students' feedback on course learning, adjust classroom teaching in a timely manner, strengthen school enterprise cooperation, combine modern teaching tools and resources, improve the knowledge graph, further improve teaching, and enable students to better master the learning methods of the course, providing good guarantees for future learning and work. In response to this, teachers will continuously deepen their reflection on the problems in curriculum teaching based on new technologies and materials in the construction industry, and continue to deepen the reform of the teaching process.

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