The Reformation in The Course Design of "Steel Structure" Based on "Outcome Based Education" Mode

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***Abstract*—Facing the arrival of a new round industrial revolution, advanced engineering education of our country is reforming gradually, the traditional education model can no longer meet the requirements of social and ecnomic development. Based on the OBE (Outcome Based Education) mode, this paper analyzes the current situation of the course "Steel Structure" and discusses the shortcomings in the curriculum design. And then, the results-oriented education concept is applied to specific projects, the learning is drived by projects, the student achievement is the teaching goal. Through the reform of the curriculum model, the purpose of combining theory with practice is achieved.**

Keywords—OBE, steel structure, the curriculum reform

With the high development of society and economy, The structure of higher engineering education is not consistent with the economic and industrial structure of the country, the traditional engineering education is divorced from engineering practice [1]. In June 2014, the document "Decision on Accelerating the Development of Modern Vocational Education" promulgated by the State Council clearly propose to guide some colleges and universities to transform from academic to applied technology universities [2]. In order to respond to the country's goal of cultivating applied technical talents, Xi'an Peihua University transforms the traditional talent training model into an applied university.

The OBE model can be considered as an innovation in the educational paradigm. OBE education concept is a result-oriented curriculum teaching model, emphasizing the students' expected results as the core, students play a major role in the learning process, and teachers are only managers of the teaching process[3].The introduction of the OBE education model plays an important role in the cultivation of applied technical talents.In the OBE education model, what students learn and whether they succeed is far more important than how to learn and when to learn.

I. CURRENT STATUS OF THE COURSE "STEEL STRUCTURE"

"Steel Structure" is a compulsory course for civil engineering majors. It mainly studies the basic design theories and methods of steel structure connections and components, so that students have the initial ability to design steel structures. But the reality is that students are working very hard during the learning process, but when they arrive at the design institute, they find that they will not do anything. Moreover, many students do not know what kind of work they can do after studying this course, The purpose of learning is not clear. The root of this phenomenon is the emergence of problems in the talent education model.

A. Lack of Engineering Practice

In the traditional teaching process, we pay more attention to the explanation of the theoretical knowledge of steel structure, and only arrange a course design after the theoretical course is over. The teaching mode of the course is single, lack of innovation, and weak practical ability. As a result, students cannot be immediately put into work after graduation.

B. Lack of the Systematization of Knowledge

Traditional education emphasizes the curriculum system and divides the knowledge of steel structure into small knowledge points, These knowledge points are relatively independent, and the relationship between them is weakened [4], what appears in students' mind is some fragmented theoretical knowledge points after the course. Such teaching effects simply cannot meet the goal of talent cultivation.

C. Lack of Learning Objectives

Students lack the goal as a driving force in the process of learning, and strictly follow the process prescribed by the teacher to learn. The focus of education is on the process and not on the results of the students, which leads the students to not know what they are learning and what is the use of learning.

D. Lack of Student Subjectivity

Traditional education pays attention to the main position of teachers, What does the teacher teach the students to learn. The rigid teaching brings only the unchanging scientific laws, lacks the ability to solve practical problems, lacks the ability to

innovate, and gets only the same work, which can not meet the social requirements for talents.

In response to the above situation, the OBE education concept was introduced. On the basis of inheriting the traditional excellent education model, the design of the "steel structure" curriculum is reformed, the results are oriented, the actual project is the content, and the students are the main body to realize the diversified assessment of the students' learning outcomes.

II. THE REFORM OF THE "STEEL STRUCTURE" COURSE

Based on the above situation, change the traditional whole-process teaching of the teacher as staged teaching and avoid students not participating in the study. The staged teaching is divided into three steps: the introduction of the basic knowledge of "steel structure" in the first two weeks of the semester; the students are guided to complete three course designs of steel structures during the semester; the students will visit the design institute two weeks after the semester to understand the relevant design process. The phased learning realizes the organic combination of theory and practice, and the training goal is changed from training engineering scientists to training engineers [1], which reflects the training requirements of applied talents.

In order to cultivate students' ability to solve general steel structure design problems, the three steel structure design projects completed by students in the semester are based on three real projects of the design institute, including: steel platform structure design project, light steel structure portal frame design project, ordinary steel roof truss design project, the course is organized around the three goals. So as to achieve the results-oriented, project-driven learning, learing by doing, doing by learing.

TABLE 1 OBE TEACHING MODE

Actual project/outcome	Teaching content	Teaching method	Completed assignment	Feedback and continuity
Steel platform structure design	Arrangement of platform structure, slab design, platform beam design, platform column design, Column head and column foot, railings and stairs	Teacher guides, students discuss in groups, and do as they learn	a calculation book for the design of the platform structure	Continuously improve teaching methods according to the actual effect of teaching
Light steel structure portal frame design	Structural layout, rigid frame design, purlin design, wall beam and support design	Teacher guides, students discuss in groups, and do as they learn	a calculation book of light steel structure portal frame design	Continuously improve teaching methods according to the actual effect of teaching
Ordinary steel roof truss design	Load and internal force calculation, roof truss design, joint design, construction drawing of steel toof truss	Teacher guides, students discuss in groups, and do as they learn	a calculation book for the steel roof truss design and a copy of the construction drawings.	Continuously improve teaching methods according to the actual effect of teaching

The OBE teaching model emphasizes the ability of the students, that is, after learning this course, they can adapt to future life and be able to engage in related work rather than something on paper. Therefore, the design of the course is very important. According to the OBE reverse design concept, the curriculum knowledge is reconstructed in the above table, the difficulty level of the project is progressed step by step, and more challenging projects are formulated to promote the students' more successful learning. In this process, teachers only play the role of helping students and guiding students. The process of teaching implementation keeps improving according to the actual teaching effect after the end of each project, so as to develop more reasonable teaching methods for students.

In the process of teaching, we need to pay attention to a few points: First, students are required to know that the goal of learning this course is to become a qualified steel structure designer; second, the subjectivity of the students is emphasized during the teaching period, and the teachers only provide design ideas, after discovering problems, the group will discuss together, this reflects cooperative learning; and then, teachers will provide students with a real engineering practice environment, and the projects provided should be the real projects of the design institute.

At the end of the semester, the class will be teamed by 5 to 6 students in each group, and in turn will go to the design unit for internship according to the time and place specified by the teacher to understand the relevant design process and the application of related drawing software. The work and study performance in the design institute are recorded in the final assessment results.

The theoretical knowledge objectives that should be achieved through the study of this course: familiar with relevant norms in china: "Steel Structure Design Code", "Building Structure Load Specification", etc., master the design method of the basic components and connections of steel structures. Skills to be achieved: master the design method of simple steel structure and understand the application of related drawing software, such as CAD, PKPM, Tianzheng, etc.

III. EVALUATION OF THE COURSE "STEEL STRUCTURE"

Assessing the output of learning is an important part of the OBE education concept [5]. Traditional teaching assessments tend to be simplistic, emphasizing choice and grading, and students with poor grades are getting worse. The OBE education

concept emphasizes inclusive success, that is, everyone can succeed, assessment and learning results echo each other, and it advocates attainment evaluation and diversified evaluation methods [4].

The evaluation of this course is based on the OBE education concept and comprehensive evaluation of students. The evaluation contents include: 1. Mastery of theoretical knowledge, through the final exam; 2. Team collaboration ability, determined by the interaction and discussion between the students and the students; 3. The design result, determined by the completion of the work; 4. Internship performance, based on the student's situation in the design institute. The final scores are superimposed on the above four items according to a certain proportion, the total score of more than 60 points is classified as qualified, and the total score of less than 60 points is considered unqualified and needs to be retaken.

This kind of evaluation has changed the traditional shortcomings of focusing only on the final exams, organically combining all aspects of students, and achieving the all-round development of students, in line with the requirements of applied talent training.

IV. CONCLUSIONS

The promotion and application of the OBE education model raises traditional education to a higher level, focusing on students' innovative ability and comprehensive development, focusing on the systematization of knowledge and the importance of practice, and returning education to engineering practice. Through the OBE teaching mode, students can master the knowledge of steel structure design skillfully and be able to engage in simple steel structure design. However, when learning this course, we should also pay attention to the connection with other courses, such as: architectural CAD, structural mechanics, material mechanics, etc. Only by systematically mastering all the contents, can we learn this course well and continue to improve during the learning process.

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