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Original Paper

Research on Blended Teaching Mode of Engineering Economy Based On OBE Concept

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Abstract

The blended learning model focuses on the organic combination of online and offline teaching overcoming the drawbacks of traditional teaching models that only focus on teaching. This paper explains the blended learning models based on the goal of efficient classroom and student-centered teaching. Based on the OBE concept, this paper elaborates on the ideas and measures of curriculum construction from the aspects of setting teaching objectives, optimizing teaching content, innovating teaching modes, and improving evaluation methods. This research can be applied to other professional courses in universities, providing reference for university teachers to carry out blended teaching reform.

Keywords

Blended teaching mode, Outcome-Based Education (OBE) concept, Engineering economy

1. Introduction

Engineering economy is an interdisciplinary course that combines engineering technology and economics. It includes conducting economic analysis and evaluation of engineering construction or technical activities. Its main purpose is to correctly evaluate the effectiveness of engineering projects in order to seek the best combination of technology and economy. Its principles can be combined with various engineering disciplines to form various branches of engineering economics. This course is gradually formed with the development of science and technology and the construction engineering industry. It is a course that conducts economic evaluation and analysis of construction engineering policies and technical solutions, emphasizing the application of basic principles and methods in engineering economics to construction and management decision-making. It is closely related to national development strategies, economic and social development policies, and major project decision-making. There are many connotation elements related to value guidance and ideological and

moral education. Many engineering majors in universities offer this course, which is a core course for the Engineering Cost and Engineering Management majors at the School of Civil Engineering, Qingdao City University. The teaching mode of this course has mainly adopted offline methods since its establishment, but the offline teaching method mainly has the following shortcomings:

1) Engineering economy is used to study the economic laws and problems in the field of engineering. However, due to the large number of theoretical formulas and close connection with mathematics, many students have difficulty to learning the course and feel bored in actively learning.

2) The traditional indoctrination based teaching model generally consists of several steps such as lectures, example questions, assignments, and exams. The teacher's lectures are the main focus instead of connecting with actual projects. The students passively receive knowledge and cannot deeply understand the entire process of engineering economic analysis problems, nor do they master the overall economic concepts of the project.

3) The current teaching evaluation mainly focuses on the assessment of students' academic performance, which is composed of final exam scores and regular grades. The main purpose is to test whether the knowledge taught is accepted by the students. Under this exam based system, most students review and memorize knowledge points before exams. This assessment method is not conducive to achieving the teaching objectives of the course and is not conducive to the systematic evaluation of teaching.

With the trend of teaching mode transformation and the rapid development of Internet technology in recent years, the engineering economy teaching team of the School of Civil Engineering of Qingdao City University has carried out the reform and practice of the online and offline hybrid teaching mode based on the teaching concept of OBE and students-oriented teaching method.

2. Course Objectives Based On OBE Concept

Outcome based education (OBE) is an educational model based on learning outcomes, emphasizing reverse design. Its core philosophy is student-centered, output oriented, and continuous improvement, evaluating teaching design and objectives based on learning outcomes. Taking "learning" as the center and students as the main body, starting from the demand for talents in today's society, schools and teachers are required to first clarify learning outcomes, cooperating with diverse and flexible personalized learning requirements, enabling students to achieve self-realization through the learning process, and then using feedback on the results to improve the original curriculum teaching. At present, the OBE concept has been widely recognized in the education sector and is also an inevitable trend for future curriculum reform in universities.

The courses objectives are formulated based on the educational requirements and graduation requirements of professional innovation and entrepreneurship ability, as well as the ability to solve complex engineering problems, and based on the requirements of employers for talent knowledge

system and practical ability, and drawing on the same curriculum training objectives and teacher-student suggestions of similar universities. The course is required to support graduation requirements in three aspects: engineering knowledge, design solutions, and research. When the course is completed, the students should have a grasp of subject specific knowledge, subject teaching knowledge, and lifelong learning awareness. The teaching syllabus should further clarify specific teaching content, teaching requirements, teaching hours, achievement methods, etc., reflecting support for the course objectives and enhancing the high-level and challenging nature of the course (Table 1).

Table 1. Relationship between Course Objectives and Graduation Requirements

Graduation requirements	Course objectives
Engineering knowledge: the students should systematically understand the theoretical foundations of mathematics, natural sciences, computing, and engineering science and apply them to the formulation of engineering problems in this professional field	Objective 1: By studying the overall framework of engineering economics, students are able to explain the overall content and basic ideas of engineering economics, and establish a thinking framework for engineering economy. Objective 2: By studying the basic concepts and indicators of engineering economics, students are able to describe the fundamental theories and methods of engineering economics and apply them to pre project decision-making. Objective 3: The students should understand basic economic and management knowledge, and possess comprehensive qualities and abilities for operating and managing in a market economy.
Design solutions: the students should compare and select solutions based on specific structural systems, management techniques, and methods, and complete the formation of solutions	Objective 4: The students should objective the indicators and methods of project economic evaluation, project funding, project feasibility study, etc., and be able to conduct fair, objective, reasonable, and accurate analysis and evaluation of the project.
Research: the students should investigate and analyze solutions to complex engineering problems based on scientific principles, through literature research or related methods	Objective 5: This course is to cultivate students' economic awareness, so that they can possess economic literacy and awareness. The students should be able to use qualitative and quantitative methods to analyze the economic value of engineering projects.

3. Construction of the Blended Online and Offline Teaching Mode

3.1 Optimizing Teaching Content

This course adopts the case (or question) approach for teaching design, selecting teaching methods and designing teaching activities based on teaching objectives and content. The course is mainly divided into three stages: self-study before class; discussion and exploration during class; and deepening and expanding after class. Before class, the teacher releases a learning task list, and students complete online learning and testing. In class, the teacher uses a flipped classroom to understand the students' mastery of knowledge, further answers difficult questions, and then enters the new lesson learning, discussion, and interactive activities. After class, the teacher summarizes the course and uses a learning task list to encourage students to expand their learning. In order to enhance their practical and innovative abilities, the teacher can also guide students to write project proposals.

3.2 Reforming Teaching Methods

To truly utilize the blended learning model, the first step is to build a suitable teaching platform. The "Xuexi Tong" smart platform has been popularized due to its comprehensive functions. Under the conditions of uneven class learning conditions and limited teaching hours, traditional offline teaching cannot enable each student to complete personalized pre class preparation. By Uploading the talent training plan and curriculum outline of the major to the learning platform in advance, the students can understand the content they are learning. Before each class, the principle, operation process, and cutting-edge development of the engineering economy will be released in a task driven form, providing a comprehensive introduction to the operation, operation, and mixed use of the technology with other technologies. Students can verify their preview results through pre class testing and group discussions. In the classroom, as teachers have already understood students' preview situation through online teaching, they can consolidate the knowledge points they have already mastered through flipped classroom format.

For difficult knowledge points, case study and situational game methods are used to explain, and functions such as barrage, voting, submission, and word cloud are synchronously activated. After the explanation is completed, students are grouped to start brainstorming. After class, students can connect online and offline at will. While completing resource push, students can independently conduct post class checks, complete assignments pre assigned by teachers, or design a section to upload relevant data or videos. Using online platforms as learning platforms, students can learn independently without being limited by time and location, and can listen to teachers' lectures anytime and anywhere.

3.3 Multivariate Assessment and Evaluation System

The assessment and evaluation system of a course is the most concerned point for students, and it is also an aspect that teachers should focus on planning and designing. This course adopts a diversified assessment and evaluation system. The total grade of the course consists of class performance, group tasks, periodic tests, and final assessment (Table 2).

Table 2. Student Performance Assessment

NO.	Assessment Task	Description	Course objectives	Percentage(%)
1	Class performance	Organizing student grades based on the interaction and communication with teachers in the classroom, as well as the interaction data on the “Xuexi Tong” platform	1、2、3、4	10
2	Group tasks	Students are divided into groups to analyze various engineering economy cases, and their grades are evaluated based on the completion of group achievements and individual performance	2、3、4、5	10
3	Daily assignments	After each chapter, appropriate Thinking and calculation questions are assigned, and grades are evaluated based on the completion and accuracy of the assignments	1、2、3、4、5	10
4	Periodic tests	Two stage tests will be conducted in total, with a score of 100 points each time. The final average score will be taken	1、2、3、4	20
5	Final assessment	Conducting a comprehensive assessment of the learned content in the form of a test, and evaluating the grades based on completion and quality	1、2、3、4、5	50

4. The Outcome of the Blended Online and Offline Teaching Mode

Following the principles of OBE, we practice a “learning centered” approach in all aspects of teaching and construct a blended learning model (Figure 1), achieving an organic combination of teaching and learning. Through the teaching reform of engineering economics courses, a hybrid teaching mode of online and offline has been basically constructed and applied in practical teaching. Most students believe that after implementing the curriculum teaching reform, students’ participation has greatly increased, and their focus during class has significantly improved. As the main body of teaching, they participate in the teaching process and organically integrate the comprehensive application ability of engineering economics into the teaching evaluation of the course. As a result, students’ ability to solve complex problems has significantly improved.

5. Conclusion

OBE, as an advanced educational concept, is the direction of higher education reform. In order to improve the quality of teaching, teachers of engineering economics courses should actively promote educational reform under the guidance of OBE education philosophy, clarify course objectives, put students at the center, adhere to the combination of knowledge imparting and value guidance, integrate multiple teaching methods, construct a blended online and offline teaching mode, expand the time and space of teaching and learning, enhance the depth of student learning, and continuously improve the quality of talent cultivation. The case course is student-centered, goal oriented, and guided. The thematic discussion section encourages students to think divergently, actively search for literature, increase their sense of participation, engage in exploratory learning, exercise innovative thinking, and facilitate deep learning and improve learning outcomes. This teaching activity design has certain reference value for the teaching design of other blended courses, and has certain promotability and replicability.

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