SPOC blended teaching reform and practice based on OBE concept

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Abstract: In order to promote the concept of outcome-based education and improve the quality of practical curriculum education in colleges and universities, at the same time, make "Internet plus" deeply integrated with education and teaching, and share high-quality teaching resources, this paper takes the course of "Website Design and Development" as an example for practicing, designing the teaching of the course by using the concept of outcome-based education, and carrying out the blended teaching reform by utilizing the MOOC and the offline classroom. The results show that the new teaching model has improved students' initiative and participation, and the achievement of course objectives is better than traditional teaching methods. This teaching model plays a positive role in meeting the needs of students and adapting to social development, and can be applied to other theoretical and practical curriculum teaching reforms.

Key words: OBE; SPOC; blended teaching; "Website Design and Development"

1 Introduction

In recent years, the concepts of outcome-based education, student-centered education, and continuous improvement have gradually penetrated into various fields of education, which is also the direction of higher education reform in China. Among them, outcome-based education has been widely applied in the design of talent cultivation systems [1], curriculum construction, and teaching reform [2], achieving a lot of gratifying results, while ensuring that the quality of engineering and technical talents cultivated in China is in line with international standards.

"Website Design and Development" is a compulsory course for educational technology major, with strong practicality and applicability. Traditional teaching methods make it difficult for students to apply what they have learned. Many scholars have explored teaching reform in this course, from optimizing teaching content to improving teaching models [3][4], proposing experiential, situational, CDIO based education models, and flipped classroom models [5][6][7][8], which have achieved good results and provided ideas and methods for the reform and quality improvement of higher engineering education. However, the SPOC blended teaching model based on the OBE concept has not received sufficient attention. In order to promote the OBE concept and improve the quality of engineering education in Weinan Normal University, and at the same time make Internet plus deeply integrated with education, we use the OBE concept to design curriculum teaching, use MOOC and offline classroom to carry out blended teaching reform research, and implement teaching reform practice on "Website Design and Development" to meet the needs of students and adapt to the needs of social development.

2 OBE educational philosophy and SPOC introduction

2.1 OBE educational philosophy

Outcome-based education (OBE), also known as output-oriented education, first emerged in North America in the 1980s and subsequently received high attention and widespread recognition from the educational community. American scholar Spady has provided a clear description of it [9]. The OBE concept occupies a core position among the three major concepts of engineering education professional certification. To implement OBE, it is necessary to truly understand its connotation, standards, characteristics, and implementation principles.

Compared to traditional teaching, OBE has the following characteristics [10]: ① truly achieving learner centered learning and providing personalized learning conditions. ② paying attention to the selection of learning content, combining expected outcomes with students' foundation, and providing a variety of learning content. ③ emphasizing the improvement of learners' abilities. Students will receive abilities at the end of their learning, not just knowledge. ④ Diversified teaching evaluation focus on learner self comparison and process evaluation. These characteristics are conducive to enhancing the initiative of learners. The implementation of OBE follows the principles of reverse design and forward implementation [11], generally including determining expected outcomes, selecting teaching content and methods, implementing the teaching process, curriculum assessment and evaluation.

2.2 SPOC overview

Small Private Online Course (SPOC) is a new type of course developed to address the low completion rate and quality crisis of Massive Open Online Course (MOOC). Rolf Hoffman believed that SPOC=Classroom+MOOC [12], which is the organic combination of classroom teaching and online teaching. SPOC empowers teachers at different stages and emphasizes more on students' complete and in-depth learning experiences, which can effectively improve the quality of teaching and learning.

3 Design and implementation of blended teaching based on SPOC under the OBE concept

According to the implementation principle of outcome-based education, combined with SPOC and student characteristics, this paper establishes a blended learning process for SPOC based courses as follows:

(1) Determine expected course outcomes: Determine expected course outcomes in terms of knowledge objectives, ability objectives, and quality objectives.

(2) Optimize content and methods: Optimize content and methods in terms of expected outcome content decomposition, teaching content and resource selection, SPOC+offline classroom teaching.

(3) Course implementation: Implement the course from the aspects of pre class release of learning tasks, in class student presentation and discussion, and post class discussion and Q&A.

(4) Course assessment: Conduct course assessment from three aspects including knowledge memorization and understanding, application ability, and innovation ability.

(5) Course evaluation: Conduct course evaluation from three aspects such as process evaluation, teacher student mutual evaluation, and exam scores. If the evaluation effect is not ideal, go back to the first step and continuously improve each step of the process until a good course evaluation effect is achieved.

3.1 Determine course learning outcomes

"Website Design and Development" is a compulsory course for students majoring in educational technology. Based on its role in talent cultivation and support for graduation requirements, as well as responding to the requirements of the Ministry of Education for moral education, a comprehensive education system is constructed to determine the expected learning outcomes of the course from the dimensions of knowledge, ability, and quality, as shown in Table 1.

Table 1. Expected learning outcomes of the course

Target	Expected Learning Outcomes
Target 1	Capable of using professional terminology to describe basic concepts and related standards and principles such as static websites, dynamic websites, e-commerce websites, dynamic web language PHP, database MySQL, shopping carts, etc., with an international perspective and awareness of lifelong active learning.
Target 2	Having dialectical materialism thinking, understanding the dialectical relationship between static and dynamic websites, website UI, website front-end, and website back-end essence.
Target 3	Capable of analyzing, evaluating, and designing websites, possessing a spirit of teamwork and engineering innovation, and able to effectively communicate and exchange ideas with industry peers.
Target 4	Able to comprehensively utilize "Website Design and Development" course content to design and develop medium-sized e-commerce websites, taking into account factors such as website design, front-end, back-end, and server.

3.2 Optimize course content and methods

Based on the expected learning outcomes of the course, decompose and reconstruct the course learning content into 6 modules, and decompose the objectives of each module to determine the learning content and methods. The target decomposition of each module is shown in Table 2.

Table 2. Example of target decomposition for each module

Module name	Learning content	Ability goals	Quality goals
1 Outline	Basic concepts, research content, tasks, development history, prospects, and trends	No	Students have the awareness of lifelong active learning
2 HTML basics, CSS, JavaScript	Common HTML tags, basic CSS syntax, and basics of JavaScript scripts	Ability to use HTML, CSS, and JavaScript to design and develop web front-end pages	Humanized design, people-oriented
3 PHP fundamentals	Basic PHP syntax, string operations, functions, arrays, and file operations, etc.	Familiar with the basic syntax of PHP, able to use PHP to process strings and files, etc.	Students have a solid theoretical foundation and establish a self-learning awareness.
4 Database and SQL	Basic syntax of SQL and PHP operations on databases.	Proficient in operating MySQL databases using PHP and SQL languages.	Students use dialectical materialism to analyze problems and have a sense of division of labor, cooperation and teamwork.
5 Comprehensive design cases	Design and implement a blog system using PHP and MySQL databases	Be able to comprehensively apply the knowledge learned in the course to design and implement a software system.	Having an awareness of engineering innovation, considering factors such as UI design, database design, system performance, and interactivity.

Based on the course and the learning content of each module, in order to adapt to the characteristics of modern students and the development of educational information technology, and promote the sharing of high-quality educational resources, a hybrid teaching model of MOOC+offline classroom is adopted. The advantage of blended learning lies in the rearrangement of knowledge transmission and internalization, maximizing the utilization of learning resources and time and space, and creating conditions for personalized learning. By comparing resources from various platforms, the course "Web Programming Technology" by Professor Xie Tao from Xi'an Jiaotong University on the MOOC platform of Chinese universities was selected as the main online learning resource. Based on the professional training objectives and course teaching outline of Weinan Normal University, online resource task points were selected and relevant content was supplemented. The construction of course resources is shown in Table 3.

3.3 Course implementation

The blended learning based on MOOC and offline classrooms mainly includes two parts: The first one is self-directed learning and discussion of learning resources in online classrooms, which allows real-time interaction and breaks the limitations of time and space. The second is group cooperative inquiry learning centered on student learning in offline classrooms. The implementation process of blended learning is mainly divided into pre-class, in class, and post class activities according to class time nodes, with different time activities having their own emphasis and interconnection. The whole process is student-centered, leveraging student initiative to increase their participation. Teachers play a role in guiding, supervising, and assisting students.

(1) Pre-class. Before the start of the new curriculum at the beginning of the semester, the teacher establishes a classroom on the MOOC platform of Chinese universities, and distributes teaching documents such as learning objectives, learning content, schedule, learning methods, learning resources, and reference books to students. Before class, teachers use notification or topic discussion tools to distribute a list of learning tasks and related tests or topic discussions to guide students in learning. After students receive tasks, they mainly complete online knowledge learning, testing, and discussions, with online activities as the main focus.

(2) In class. Classroom teaching is the main channel for developing students' thinking. The entire offline classroom is divided into three segments: the beginning, middle, and the end of the class. At the beginning of the class, the teacher reviews the key, difficult, and confusing knowledge points based on the test results, increases knowledge reserves, and prepares for subsequent discussions and explorations. In class, students engage in group cooperative inquiry learning, which involves in-depth discussions, presentations, and reports to enhance their abilities through training in knowledge internalization and application. At the end of class, group evaluations and teacher feedback summaries will be conducted. In class, offline activities are mainly used. In order to increase classroom stickiness and attract student attention, online activities such as selecting people and answering questions are randomly selected.

(3) After class. After class, the teacher assigns homework. And students summarize their gains in class, continue to discuss and answer questions, and then prepare for the next class, mainly through online activities.

(4) Summary and analysis of course implementation. After one cycle, this paper summarizes and analyzes the various learning data of the implementation class to identify problems, summarize patterns, and provide experience and methods for future blended learning. The data statistics of 33 students from Class 1 of the 22nd Education Technology after implementation are shown in Table 3.

Table 3. Curriculum resources and student learning data table

Data type		Data item	Specific value	Completion status
Online course resource data	Video resources	Number of videos/piece	43	—
		Total video duration/minute	343.8	—
	PPT courseware	Total pages of courseware/page	409	—
	Chapter test	Quantity/piece	43	—
	Homework and test papers	Total number/set	87	—
	Expanding information	Literature/article	30	—
Online learning activity data	Video learning	Total learning frequency/time	10,886	32 people learn 100%, 1 person learns 97%
	Chapter test	Completed quantity/piece	43	33 people with a completion rate of 100%, with an average score of 84.2 points
		Total number of test questions/question	172	
	Notice	Number of releases/piece	7	32 people read all, only 1 person reads 5
	Communication and interaction	Topic discussion/piece	57	Per capita participation 48.45 times, with an average participation rate of 86%
		Total number of participants/time	1,599	
	Homework	Distribution quantity/time	11	Each person submitted 10.36 times, with an average participation rate of 94.21% and an average score of 92.1 points
		Total number of exercises/question	54	
		Total number of submissions/time	342	
	questionnaire	Quantity/time	3	whole
	Public live streaming	Quantity/time	2	Average participation rate of 87%
Classroom learning activity data	Sign in	Quantity/time	7	The average participation rate is 92.12%
	Candidate	Quantity/time	8	Select 13 people
	Preemptive answer	Quantity/time	5	82 participants
	Group reporting	Quantity/time	4	

Table 3 shows that 32 students completed 100% of their video learning, 1 person completed 97%, and 33 students studied 10,886 times in total, with an average of 7.67 times per video per person. This indicates that the students in this class have a high level of learning initiative and participation. The average scores for tests and assignments are 84.2 and 92.1, indicating a good mastery of knowledge in online learning. The average participation rate in online topic discussions is 86%. However, by checking the content of online discussion replies, it is found that students have a lot of repetitive responses. Some students refer to already published comments when posting comments, resulting in a lot of duplicate comments. It is recommended to set the discussion replies to reply before viewing other people's comments. Selecting and answering questions can increase students' attention and participation. The use of in class practice is limited, and the voting and scoring functions are not fully utilized. In future teaching, activities should be designed to exercise students' evaluation abilities. The participation and effectiveness of group presentations by students in offline classrooms need to be improved. Students ask fewer questions, indicating that their problem thinking is not strong enough and their learning depth is not enough. This is also a key training area for offline classroom teaching in the future.

3.4 Course assessment and evaluation

3.4.1 Course assessment items

The course assessment and evaluation consist of two parts: process evaluation and summative evaluation. Process evaluation assesses students' mastery of theoretical knowledge in website design and development, focusing on their learning attitude and initiative in online and classroom learning, as well as their understanding and mastery of the learned content. Summative evaluation is a test of students' ability to comprehensively apply the theoretical knowledge they have learned and solve practical problems in website design and development through organizing test paper answering. The evaluation composition and proportion of each part are shown in Table 4.

Table 4. Evaluation items and proportion of course learning effectiveness

Assessment	Evaluation content	Proportion/%
Process evaluation (accounting for 70%)	Learning situation of video knowledge points	20
	Participate in interactions and discussions	10
	Group report situation	10
	Online chapter test score	10
	Quality of homework	5
	peer-assessment	5
	Teacher's comprehensive evaluation	10
Final evaluation (accounting for 30%)	Final exam scores	30

3.4.2 Evaluation of learning effectiveness

After the assessment, statistics will be conducted according to the proportion of each item in Table 4. The distribution of grades of the students in Class 1 of the 22nd Education Technology major is shown in Table 5. It can be seen that all online activity scores are concentrated between 70-89, indicating that the students in this class have a high level of participation in online learning activities and good results. The distribution of test scores is relatively ideal, with an average class score of 75.22 and no failing students. All comprehensive scores are above 70 points. Compared with the test scores of the same course conducted using conventional methods in previous year, there were no students with a score of 90 or above in the conventional teaching class, 7.14% failed, and the average score of the class was 69.19 points. There were

students with scores above 90 in the blended learning class, but no students with scores below 60. The class that adopts blended learning has achieved better course objectives.

Table 5. Score distribution table

Fractional range	Online grades		Exam score		Comprehensive score		Comparison of class test scores	
	Number of people	Proportion/%	Number of people	Proportion/%	Number of people	Proportion/%	Number of people	Proportion/%
90 ~ 100	0	0	1	3.03	0	0	0	0
80 ~ 89	26	78.79	7	21.21	12	36.36	1	3.3
70 ~ 79	7	21.21	15	45.46	21	63.64	15	50.00
60 ~ 69	0	0	10	30.30	0	0	11	36.7
Under 60	0	0	0	0	0	0	3	10
Average score	81.78		75.22		79.12		69.19	

4 Conclusion

The research group designed course teaching based on the OBE concept, conducted blended teaching research using MOOC+offline classrooms, and implemented teaching reform using "Website Design and Development" as an example to promote the sharing of high-quality online teaching resources. A cycle of learning activity data and comprehensive performance indicated that the achievement of student learning goals under the SPOC blended teaching mode based on the OBE concept was better than traditional classroom teaching, which has a positive effect on improving teaching quality and learning effectiveness.

Continuing to play the main role of classroom teaching in cultivating student thinking, classroom teaching reform should adapt to the development of modern society and the characteristics of students. In order to implement the three major concepts of outcome based, student-centered, and continuous improvement, the research group will conduct in-depth research on the design of teaching activities, guidance and evaluation of thematic discussions, feedback on teaching issues, and continuous improvement in future teaching, in order to promote the high-quality development of first-class professional construction in Shaanxi Province.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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