# Blended Teaching Reform of Data Structure Course Based on OBE Teaching Concept

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**Abstract.** Nowadays the teaching contents of many colleges and universities in China still have contradictions with advanced scientific development and technologies to varying degrees. The outmoded teaching contents and solidified teaching methods seriously limit the students' initiative in learning and diversification of development in the new era. This paper discusses the reform methods and implementation steps of the teaching mode under the OBE teaching concept, which has played a positive role in promoting the teaching of the data structure course and exercised the students' practical ability.

**Keywords:** OBE teaching · Blended teaching reform · network evaluation

## 1 Introduction

With the development of technology, people can easily access a large number of excellent teaching resources from the Internet. Information has brought a greater impact on higher education, and students tend to rely on technology to obtain information and demand higher and higher quality courses. At the same time, MOOC supported by technology and the Internet, has made a big development and set off a wave of educational reform [1, 2]. Students now have access to the resources of global quality courses anytime and anywhere. In the environment of the new crown epidemic hitting the world, more and more schools are adopting online network teaching mode to facilitate students to study remotely from home [3].

In contrast to the rapid development of technology, our education and teaching resources are updating slowly and the content of the current curriculum of many universities in China still has the problem of contradiction with advanced scientific theories and technologies to varying degrees. Outdated teaching contents and solidified teaching methods seriously restrict the initiative of learning and diversification of development of students in the new era. In such a situation, we should make some changes to the courses as the educator.

Therefore, as a university educator, it is more important to think what kind of talents we need to cultivate and how to cultivate to meet the requirements of the society. According to the training plan, the curriculum and syllabus will be subdivided to form the teaching program, the teaching content and the important and difficult points, and the

teaching activities will be designed according to the students' knowledge structure and ability, so as to achieve the teaching goal. Therefore, all teaching activities, teaching contents and teaching evaluation methods are based on whether the teaching objectives can be achieved [4]. Changing from teacher-professor-centered to student-learning-centered, changing the teaching mode and providing students with rich teaching practice resources are the urgent problems that teachers in private colleges and universities need to solve nowadays [6].

## 2 Ideas for Teaching Reform

### 2.1 OBE Education Philosophy

OBE education and teaching philosophy (outcome based education) is a kind of results oriented education, which is to reverse curriculum and teaching design with the final learning achievements as the starting point [5]. In a teaching system, including the curriculum system, teaching and learning methods, evaluation methods and other related activities, all students should focus on achieving the expected learning results at the end of learning. OBE is a kind of "life oriented" educational philosophy [6]. In practice, it is a training mode focusing on students' acquisition of knowledge, ability and quality after education.

The training target of a major should be the skills that students can obtain after graduation and serve the society. The teaching objectives of the course are designed according to the training objectives of the major of different student, including the design of teaching content, activities, implementation by teachers and the evaluation of the course. These activities should be based on whether students can achieve the teaching objectives of the curriculum.

In Fig. 1, based on the OBE teaching concept, we can design teaching method, implement of course, teaching content and formulate teaching evaluation according to the classroom teaching objectives, rather than directly design topics according to the teaching content. The design, implementation and evaluation of teaching positively check and adjust whether the teaching objectives are achieved. In this way, teaching activities form a closed-loop feedback process, wherefore it can optimize the topic according to the teaching effect.

In the view of the current situation of graduates' employment in private colleges and universities, as college teachers, they should timely reflect on and adjust the training objectives, evaluation methods, teaching course contents, etc. according to the social needs, so as to adapt to the changing needs of society and improve students' working ability after graduation. It is not allowed to separate course learning from employment, let alone the end point of students' graduation homework teaching process, and separate teaching and students' acquisition of skills. It is necessary to make continuous improvement on training objectives, graduation requirements, and teaching activities according to needs, and design the teaching system according to students' expectations.

### 2.2 Blended Teaching Reform

The traditional course teaching creates only mechanical "short-term memory" instead of "meaningful" learning, ignoring the students' subjective initiative [8]. The ways for
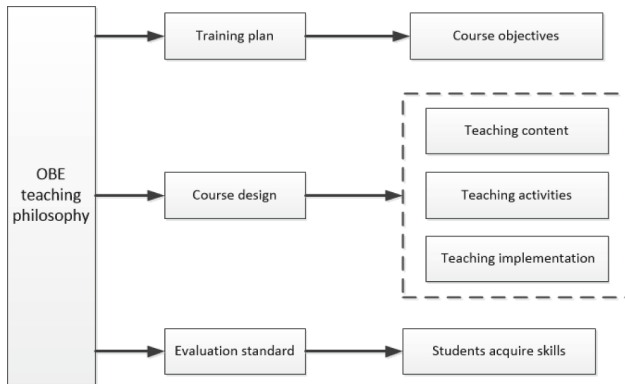
**Fig. 1.** The OBE teaching design model.

students to obtain information are greatly increased and the ways to obtain information are more diversified and convenient, which also puts forward new requirements for college teachers. Blended teaching refers to a teaching mode that combines the advantages of traditional teaching methods with the advantages of online teaching [7, 9]. It not only gives play to the leading role of teachers in guiding, enlightening and monitoring the teaching process, but also fully reflects the initiative, enthusiasm and creativity of students as a learning process [10].

In Fig. 2, in the traditional course, all teaching content needs to be taught by teachers, and teachers and students are all in the classroom focusing on teachers. But in the blended course, the process and content of students' learning are blended. The learning content is not limited to books, but also the blend of video, audio, website resources and experimental environment. Classroom forms include not only teachers' lectures, but also students' inductive learning, group discussion learning, video learning, online learning, practical learning, etc.
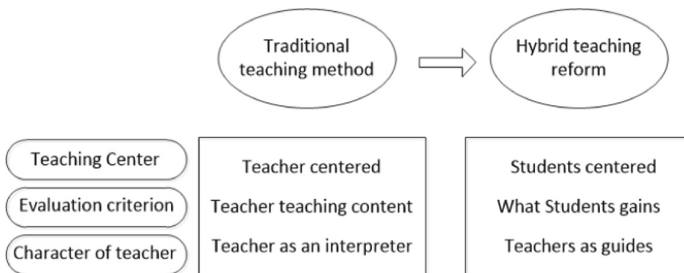


**Fig. 2.** Comparison between traditional teaching method and blended teaching reform

## 3   Implementation of Teaching Reform

In the teaching process, we should analyze the students' learning situation. Based on the students' learning experience, and according to the students' actual situation and the discipline training program, we should formulate practical curriculum teaching objectives and teaching methods. We should take students as the center, teach students in accordance with their aptitude, pay attention to the students' personal development, and conduct achievement evaluation rather than comparative evaluation. As a general application-oriented undergraduate school, there is a certain gap between the students' learning situation and that of key universities. Therefore, it is necessary to design learning objectives and evaluation systems that conform to the actual situation of the students of the university, and formulate teaching content and teaching methods according to the objectives. Through teaching, students can acquire corresponding skills, achieve the expected objectives of the training plan, and enable students to acquire and master the skills required by society, It is not just the teaching of theoretical knowledge.

On the basis of OBE teaching philosophy, we should provide a variety of learning resources to facilitate students' mixed learning, not only face-to-face communication with teachers in the classroom. Instead, we can use a variety of resources for diversified learning. Due to the change of learning mode and method, the original mode of evaluating students' learning effect through examination is not scientific, and then the evaluation method of classroom is changed to form a reasonable evaluation of students for the whole semester.

### 3.1   Provide Diverse Teaching Resources

In the environment of the Internet, educational resources can be quickly disseminated through the network, and learning resources are more abundant. Students can find the knowledge they need on the network and carry out independent learning. The traditional teaching process of teachers' board books, slides and other materials can be presented to students more intuitively and conveniently, and teachers can enliven the classroom atmosphere with a wide variety of multimedia information and materials on the Internet.

In Fig. 3, we set up a pool of teaching resources for blended teaching, establish a test bank, use information-based teaching software and platforms on Internet or applications, and establish online classes in the network, and conduct group practice after class.

The following principles should be followed when providing rich teaching resources under the OBE teaching philosophy.

- Provide differentiated tasks according to the different classes and groups of students.
- Adapt teaching methods to the teaching environment conditions.
- Provide targeted explanations and guidance based on students' classroom performance.
- Set evaluation criteria for individual acquisition of skills according to different groups of students.
- Provide teaching contents and practical examples that can keep up with the times and are relevant to social life according to the development of the economy.
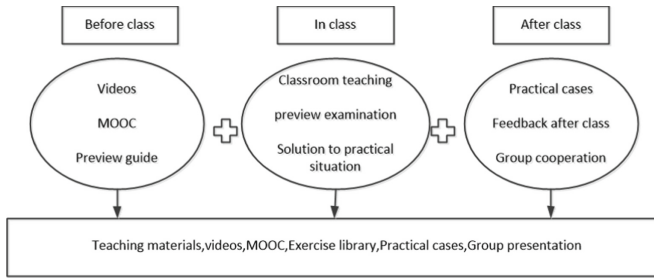
**Fig. 3.** Blended teaching mode

### 3.2  Organize Teaching Activities Use the Internet

Organize teaching activities use the Internet can help to arouse students' enthusiasm. The website "teacher-mate" is used in our course. Figure 4 shows the interface of the web-based teaching tool, which is at https://www.teachermate.com.cn/classes/1232528.

Students in the class can carry out group practice activities. Each group can complete different small tasks. Members of the group can jointly complete programming practice activities, which can exercise students' ability of team cooperation and communication, and can also discuss and overcome difficulties when they meet. Taking the course of Data Structure as an example, 4–5 students are divided into groups for extracurricular practice and exploration. It is found in the course that students have a strong interest in the practical exploration of the subject, which also greatly exercises the students' practical ability and thinking ability. For example, when teaching linear list, students cooperate to complete the program design of a book management system, and decompose the functions into warehousing, book price statistics, quantity statistics, most popular book statistics, location query and other functions. We can not only divide work and cooperate, but also integrate different subprograms together, training the ability of system integration.

Table 1 shows the practice problems associated with the relevant knowledge points of this course, in which students participate practice.
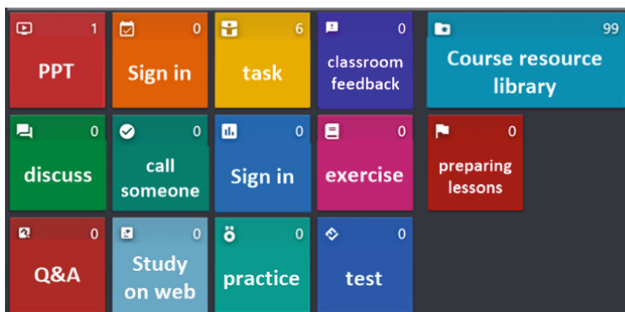


**Fig. 4.** Interface of the web-based teaching tool

**Table 1.** Examples of case-based practice

| Table Head | Case-based teaching | |
| --- | --- | --- |
| | *Teaching Points* | *Practice Cases* |
| 1 | Linear List | Library Management System |
| 2 | Stack | Bracket matching problem |
| 3 | Stack/Queue | Labyrinth problem |
| 4 | Queue | Hospital visit simulation |
| 5 | Tree and Binary Tree | Number of leaves and height of a binary tree |
| 6 | Graph | Shortest path |
| 7 | Sort | Implementation of sorting |
| … | … | … |

Integrate the course content into life reality and guide students to combine knowledge points with life reality. For example, in the course of teaching the concept of data structure queue, combined with the course of thinking about the life of the queue phenomenon, to help students understand the queue of last in last out problem.

### 3.3 Clear Evaluation Criteria on the Network

The traditional assessment method is based on the final evaluation, and its purpose is only to complete the teaching plan, sometimes the usual grades are given very arbitrarily, which is not conducive to students' learning and development. Student-centered assessment, on the other hand, is based on the usual grades and focuses on process evaluation, with the aim of cultivating students. Student-centered assessment is based on the principle of helping students, so that naturally students can learn more and grow more from the classroom.

There are more and more platforms and applications that can help college teachers to create an information-based classroom. Teachers can build a library of exercises for their courses, create group papers for chapters, and set up scoring for group papers. Students can answer questions online to measure their mastery, and the system can achieve automatic grading. Teachers can quickly see the overall mastery of each question and the complete performance of students throughout the semester based on their answers, which is part of the basis for the usual grade evaluation.

In Fig. 5, students' activity is recorded on the web and the pink block indicates commonly, green block indicates excellent. Teachers can evaluate students' overall performance throughout the website, which provides a basis for the process evaluation of the classroom, avoiding the "homogenization" of the course evaluation and the "exam-only" phenomenon, and more able to reflect the students' mastery of the real.

$$total = S * \alpha + P * \beta + T\chi + D * \varepsilon \tag{1}$$

In Eq. (1), Total is the score of a student, S indicates students sign in class, P indicates practise, T indicates test, D indicates discuss. Besides, $\alpha, \beta, \chi, \varepsilon$ indicates the percentage

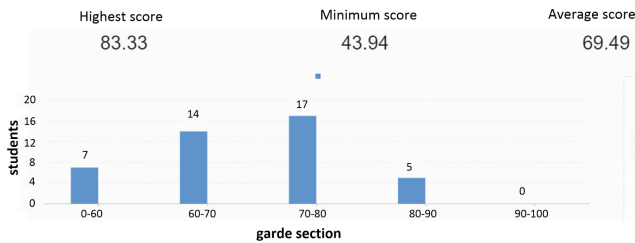**Fig. 5.** Student activity record



**Fig. 6.** Evaluation data of the course

of them respectively. The percentage of each point in the chart represents the percentage that can be set and modified by the teacher according to the actual classroom situation.

Figure 6 shows the evaluation score include the student's classroom examinations, students' class attendance, assignments, discussion questions, activity participation, and post-class practical tasks.

The student-centered assessment focuses on the usual performance, so that the usual homework, discussions, activities, questions and answers, and student feedback can become part of the student assessment, which can strengthen the students' attention to the course on the one hand, and on the other hand, the information and data of these assessments can be used as part of the resources of the course, providing data support for teachers' analysis and continuous improvement of teaching.

## 4   Conclusions

Based on the OBE education and teaching concept, this paper uses blended teaching methods to open up the online and offline learning channels in the classroom, and designs practical content for students to learn outside the classroom and provide feedback in the classroom. This project carries out teaching design and teaching reform according to the outcome orientation, explores the blended teaching methods suitable for the knowledge structure and literacy of students in private applied colleges and universities, improves

students' learning motivation, adapts to the development of technology and the digital information society, provides a combination of multiple ways of learning, and provides support for private college students to be able to gain higher competitiveness.

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