ISSN 2663-8169 Vol. 4, Issue 14: 66-72, DOI: 10.25236/IJNDE.2022.041413

Research on the design and practice path of online and offline blended teaching mode in colleges from the perspective of ideological and political curriculum

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Abstract: *Under the promotion of professional accreditation of engineering education, the hybrid teaching mode is widely used in various courses. In this paper, a blended teaching mode is constructed from teaching contents, teaching methods, teaching implementation and evaluation in terms of online and offline teaching, taking into account the course characteristics of Engineering Fluid Mechanics. Through the development of the course teaching activities and the comparative analysis with the situation before the development, it is found that most of the students can carry out in-depth learning of knowledge under this mode, and their independent learning ability and analytical and problem-solving ability have been significantly improved.*

Keywords: *professional accreditation; blended learning model; engineering fluid mechanics*

1. Introduction

China has the largest engineering education system in the world, and the number of enrollment, students and graduates of engineering majors in colleges and universities is the first in the world, which has cultivated and delivered a huge number of engineering and technology talents for the modernization of the country, but the quality of talent cultivation is not satisfactory, and there is still a certain gap with developed countries [1]. At present, the concept of the internationally prevailing engineering education accreditation standards is people-oriented, student-centered, and whether students meet the graduation requirements as the grasp, and its foundation work is to evaluate the quality of courses completed by students [2]. Engineering fluid mechanics is characterized by strong theoretical, abstract concepts and close connection with engineering practice, which is a bridge course for safety engineering majors and is crucial in the knowledge structure.

Traditional classroom teaching is still the main mode of teaching "Engineering Fluid Mechanics", which can better carry out the interaction between teachers and students and facilitate the management of students. However, it is not possible to realize the personalized learning needs of students according to their abilities. Students with better foundation and faster knowledge acceptance will find it boring and waste time, while students with poorer foundation and slower acceptance will be intimidated and gradually lose interest in learning. In contrast, online teaching is highly repeatable and has more freedom in terms of learning time and space, as well as the ability to select targeted learning content according to their own situation, and teachers can also make personalized "private customization" according to the different situations of students. However, because of the lack of synchronization between teachers and students in the online teaching process, there are problems such as high requirements for students' learning autonomy, poor interaction in the teaching process, students' difficulties in the course cannot be solved immediately, and students' learning status cannot be accurately grasped [3]. Traditional classroom teaching and online teaching have their own advantages and disadvantages, and hybrid classroom teaching is a new teaching mode that combines the two and complements their strengths and weaknesses.

2. Design of teaching activities based on OBE concept

Relying on online teaching resources, the course of Engineering Fluid Mechanics is deeply explored with the help of blended teaching mode in an attempt to improve the teaching quality of the course and meet the requirements for students' knowledge ability, practical ability, innovation ability and other

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abilities in the professional accreditation standards for engineering education.

With reference to the requirements of engineering education professional accreditation standards for graduates, the course objectives of Engineering Fluid Mechanics are divided into three levels: knowledge objectives, ability objectives and quality objectives. The knowledge objective requires students to master the basic concepts and theories of fluid mechanics, learn to perform fluid mechanics analysis and calculation, and have corresponding experimental skills; the ability objective requires students to be able to flexibly apply their knowledge to analyze and solve practical engineering problems; the quality objective requires students to develop rigorous logical thinking and keen insight in the process of completing the knowledge objective and ability objective, as well as The quality objectives require students to develop rigorous logical thinking and keen insight, as well as the ability of self-learning by applying the knowledge and ability objectives.

In order to achieve the course objectives, when designing specific teaching activities, the BOPPPS method is adopted to divide the whole teaching process into different modules, fill in the knowledge points in different modules, and design the salient objectives, and design Bridge-in, Pre-assessment, Participatory Learning around the salient objectives. The modules are designed with the objectives of Bridge-in, Pre-assessment, Participatory Learning, Post-assessment, and Summary.

Taking hydrostatic pressure acting on a curved surface in hydrostatics as an example, the salient objectives of this section are.

To illustrate the force analysis on a curved gate.

Complete the calculation of hydrostatic pressure acting on a curved surface.

Around the set salient objectives, students are required to use the online learning platform of China University Catechism and Tsinghua University Catechism. To guarantee the online learning effect, corresponding measures can be taken, such as.

- Stipulating the length of the first play online.
- Inserting questions in the video, which must be completed before continuing to play.
- Require students to try to sort out the knowledge points by themselves using mind maps after completing the study.
- Group questions among students, test each other PK, etc.

The offline classroom also focuses on the salient objectives. Firstly, the news of Baihetan Hydropower Station being connected to the grid is used as an introduction to bring up the difference between arch dams and gravity dams to pave the way for the participatory learning session. Students are guided to think about and discuss the different force characteristics of gravity dams from those they have previously studied, and representatives are selected to present the results of the group discussion to determine the students' prior knowledge of the theory. If the results are satisfactory, the session can be accelerated; otherwise, the participatory learning session should be extended to deepen the mastery of the knowledge points. The post-test takes the salience goal as the entry point, and the learning effect is tested again in the form of quizzes and tests. Finally, the key knowledge points are summarized and the knowledge points that are prone to errors throughout the teaching session are analyzed to strengthen the memory.

3. Practice of teaching mode

The construction of online courses is the focus of blended teaching and the workload is large. In order to better serve the teaching, it is necessary to modularize the original teaching process, split, refine, streamline and reorganize the knowledge points in the teaching content, and transform each knowledge point into a video. The overall structure of the video should be complete and smoothly connected. The content before the lesson needs to be concise and thorough, so that it can be easily understood and mastered for self-study. In addition to the video, there should be a learning task list designed to help students grasp the knowledge points, design questioning sessions, discussion sessions, etc. to help students integrate the knowledge points.

Compared with the traditional teaching mode, the reform of hybrid teaching in the course of Engineering Fluid Mechanics is mainly reflected in the organization of teaching contents, the presentation of teaching methods, the design of teaching process and teaching evaluation, which can be

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generally divided into three major aspects before, during and after the class [4].

3.1. Pre-lesson

Before the class, specific learning objectives are released in the form of learning task sheets, so that students can carry out personalized independent learning with their own problems. The learning process is mainly to move the traditional classroom lecture content forward through online learning, combining the SPOC courses built by China University Catechism and the ppt, exercises and discussion forums released by Tsinghua Education Online UMC platform for learning and mastering theoretical knowledge, allowing students to arrange their own learning time, making their learning progress clear through questions embedded in videos and pre-class quizzes, and helping Teachers grasp students' learning situation and let every student enter the classroom with good basic knowledge reserve as much as possible to guarantee the quality of classroom teaching, in which the requirements of knowledge objectives in the professional certification of engineering education need to be accomplished initially.

3.2. In-class

The lecture part of classroom teaching is mainly a knowledge lecture, in which the content of the lecture before the class is sorted out and some important and difficult knowledge points are lectured according to students' feedback and pre-test results, aiming to check the gaps and fill them. At the same time, we conduct inquiry-based and interactive learning, and combine engineering examples to train the application of important knowledge points, stimulate students' learning potential, develop their independent thinking, analysis and problem-solving habits, cultivate rigorous logical thinking and keen insight, as well as the ability to learn by example.

The lecture process is designed in BOPPPS teaching mode. The introduction part adopts animation and video to show students the fluid scenes in life or fluid engineering which are easy to attract students' attention, and at the same time, it can internalize the elements of Civic Science and Politics to achieve the purpose of education. From the introduction to the learning objectives, students will know why and how to learn, and what and how to use. In combination with the introduction, the unmeasurable verbs such as "know, familiarize, understand, and master" are replaced by reachable words such as "point out, list, explain, illustrate, select advantages and disadvantages, optimize, and design" [4]. Pre-testing can be done by using Learning Pass, or assistive teaching software, for self-testing, integrating games into learning and increasing interest in learning [5]. The participatory learning session is the most important, in which students are the center and project-based learning is the lead, and questions, group discussions, group representatives speaking, debates between groups, and voting to choose a better solution are used to guide the process and achieve active learning, while broadening thinking and deepening understanding and mastery of knowledge points[6].The post-test is used to accept the effectiveness of this teaching, and the teacher can use the results of the students' test to determine whether the teaching objectives are met, whether the teaching plan needs to be revised, and to reflect on the problems that occurred in teaching and improve them in time. In this part, teachers should help students summarize the course content, sort out the knowledge chain, re-emphasize the key learning contents, point out the problems and shortcomings of students in the learning process, and give a preview of the next course learning contents, which can be explained article by article in the form of dynamic animation playing on PowerPoint[7].

In the classroom teaching session, it is necessary to further accomplish the knowledge target requirements of students for professional accreditation in engineering education, and pay attention to cultivate students' ability and quality on this basis.

3.3. After Lesson

The post-class session is used to consolidate and expand the pre-class and in-class sessions. Through the pre-learning, students can complete self-assessment through post-class assignments and tests, and clarify their mastery of easy-to-error and easy-to-mix concepts and difficult knowledge points through the test results, and return to re-learning in a targeted manner. After-class assignments can be project-guided to further exercise students' ability to solve practical engineering problems. On this basis, the requirements of the professional certification of engineering education for competence goals and quality goals can also be accomplished through experimental practice and extended reading.

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4. Reform analysis of teaching mode

In this paper, the course teaching of Engineering Fluid Mechanics of Shandong Industrial and Commercial College of Safety Engineering Class 2020 is used as a pilot, and the teaching effect of blended teaching mode on the teaching effect of the course is analyzed by comparing the teaching effect of Engineering Fluid Mechanics of Safety Engineering Class 2017. The course study of Engineering Fluid Mechanics was carried out in the second semester of the 2018-2019 academic year for safety engineering class of 2017 students, and the time point was before the start of the new crown epidemic, and the teaching mode of traditional classroom lectures was basically adopted for the course.

4.1. Evaluation method reform

The teaching evaluation of Engineering Fluid Mechanics in class of 2017 is based on the final examination, supplemented by attendance, homework and experiments as usual grades, which are summarized as the evaluation results.

The class of 2020, on the other hand, forms a hybrid online and offline teaching evaluation with the help of information-based teaching tools. The file covers attendance, chapter study times, total chapter study hours, breakthrough answer times, breakthrough ranking, participation in discussions, classroom interaction activity, chapter quizzes, lab operations, lab reports, midterm tests, innovative ideas proposed, etc.

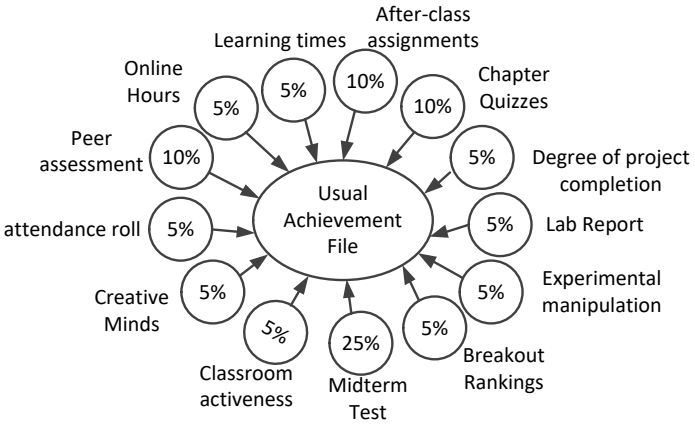

Figure 1: Percentage of points for each activity in the usual performance file

The final paper test is still an important way to fairly evaluate students' achievement of knowledge and ability goals, but compared to traditional teaching, the proportion of this evaluation has been reduced from 80% to 60%, and the remaining 40% is formed into a diversified evaluation system through the construction of the usual grade file (as shown in Figure 1). The personnel involved in the evaluation is also no longer limited to the teacher of the class. In the online teaching activities, the teaching platform used will make an objective and fair evaluation of the learning time, times and quiz results, etc. Group discussion, mutual evaluation within the group, mutual evaluation of homework and students' self-evaluation realize the diversity of evaluators and avoid the appearance of one-sided and unobjective results due to the teacher's evaluation alone.

4.2. Achievement of teaching objectives

4.2.1. Comprehensive achievement

According to different evaluation composition system, the comprehensive grades of class 2017 and class 2020 are shown in Fig. 2. the highest grade of class 2017 students is 96, the lowest is 48, three students failed, and the average grade is 76.6; the highest grade of class 2020 students is 97, the lowest is 63, all passed, and the average grade is 81.1; from the distribution comparison chart (Fig. 3) We can see that the results of the two classes are basically in line with the normal distribution, but the distribution of the results of the 2017 class is more scattered, and some students usually do not participate in the assessment, and when they take the test, their results are very unsatisfactory and do not get the expected learning effect, while the 2020 class adopts the hybrid teaching method under the OBE concept, which can dynamically test the learning situation in the usual learning process, and teachers and students can

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be more clear about the learning The results are relatively concentrated and there is no failure phenomenon, which proves the applicability of the blended teaching mode and has better teaching effect.

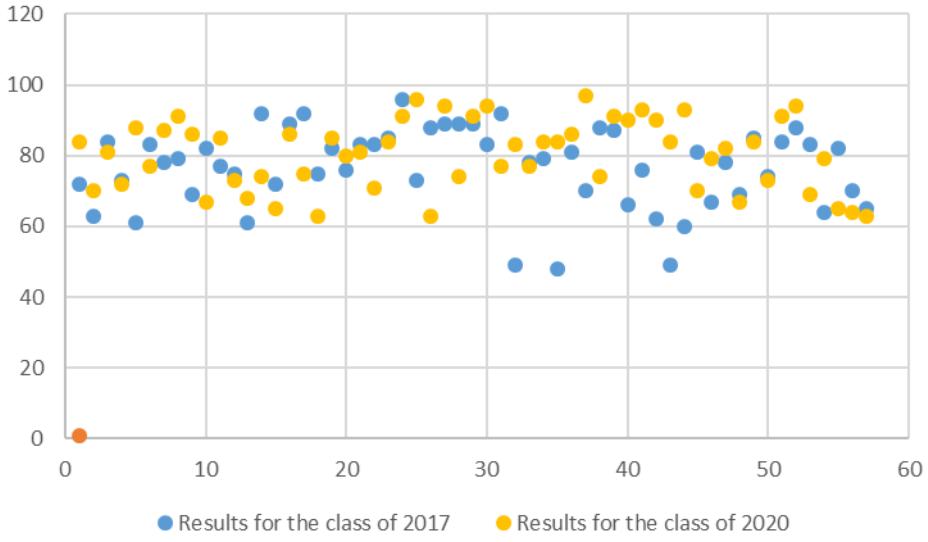

Figure 2: Statistical distribution of comprehensive results

Figure 3: Comparison of the distribution of comprehensive results

4.2.2. Analysis of the achievement of knowledge objectives, ability objectives and quality objectives

The course of the class of 2017 is conducted in the traditional teaching mode, and the achievement of course objectives is evaluated in a single way. The knowledge objectives and some of the ability objectives can be illustrated by the final written test scores, while the quality objectives can only be evaluated subjectively, vaguely and qualitatively by the teachers.

A comparison of the written test scores is shown in Figure 4, from which it can be seen that the difference between the objective and conceptual question scores is not very large, and that the 2020 level scores are relatively convergent. The multiple-choice questions can be analyzed in the calculation questions section, while the students of class 2020 obtained higher scores. From the perspective of the examination of question setting, students who adopt hybrid teaching have stronger independent thinking ability and better accomplishment of knowledge and ability objectives in engineering education accreditation.

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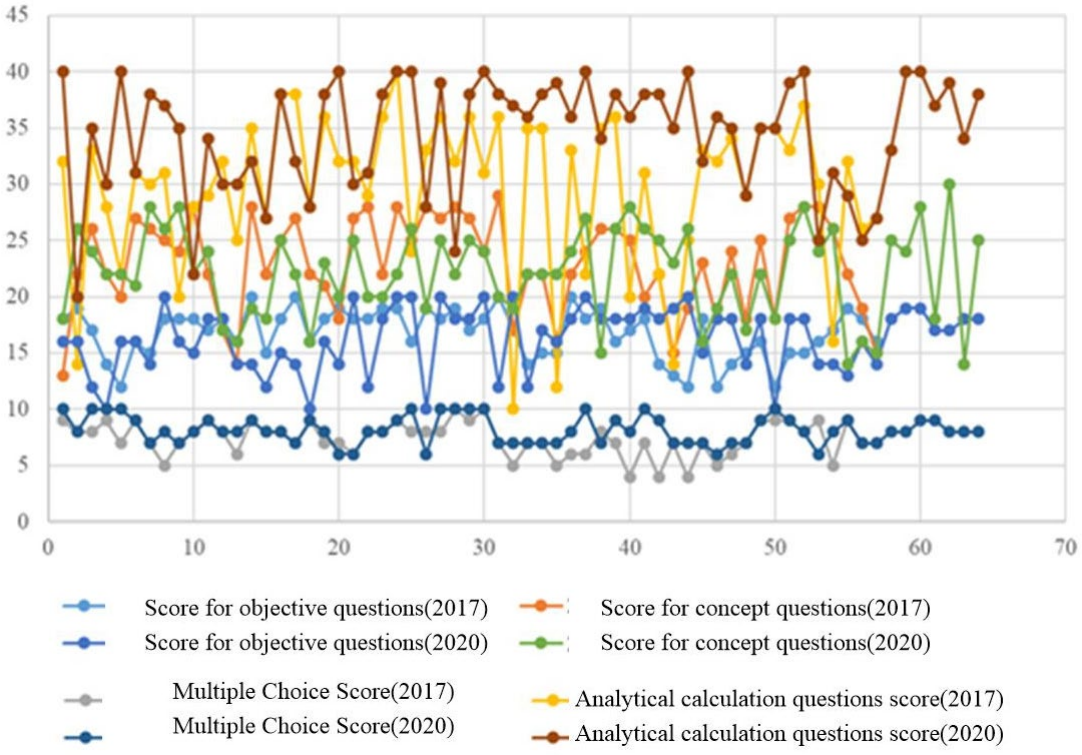

Figure 4: Comparison of written test score distribution

For the blended teaching conducted for the class of 2020 students, the evaluation items were corresponded to the training objectives required in the engineering education accreditation when the course evaluation system was constructed, and the achievement of course objectives is shown in Figure 5. From the figure, we can observe that the achievement of course objectives is not completely consistent, and there are individual differences among students, some students have a higher degree of accomplishment of knowledge objectives and some students have a higher degree of accomplishment of quality objectives. However, the ability to analyze, solve problems and relate theory to practice is poor, and the evaluation value is relatively low.

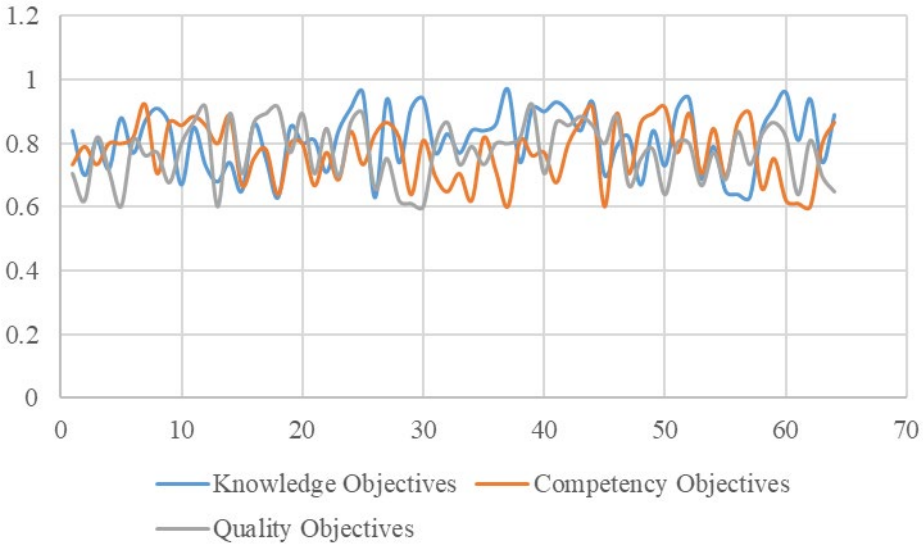

Figure 5: Achievement of blended learning objectives for the class of 2020

5. Summary and Prospect

Under the background of engineering accreditation, the reform of hybrid teaching mode based on the concept of OBE is a frequently adopted approach in the current stage of undergraduate training. Through

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the exploration and practice of the teaching mode of Engineering Fluid Mechanics in two different semesters, we can see that the teaching design under this mode can promote students' in-depth learning of knowledge and improve their independent learning ability and ability to analyze and solve practical problems. In view of the first time to adopt the hybrid teaching mode to reform the course, so there are still many shortcomings, and we will subsequently optimize the teaching program, enrich the online course resources, and other ways to better complete the teaching work and achieve the purpose of student-centered, goal-oriented and continuous improvement teaching reform.

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