Research on the Blended Course Teaching Design of C Programming

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Abstract. The current "mainstream education" includes traditional classroom teaching and online teaching. Traditional teaching can no longer meet the needs of application-oriented undergraduate education. Although online teaching has made up for the shortcomings of traditional teaching to a certain extent, MOOC, as a new online teaching platform arising from the development of the Internet and information technology, has been favored by teachers and students and universities in recent years, but its main shortcomings include the inability to provide targeted teaching Inadequacies such as the unlimited number of students have gradually emerged. In view of this situation, this paper proposes to use the "Small Private Online Course (SPOC) combined with hybrid teaching mode" in the application oriented undergraduate education, and take C Programming, one of the compulsory courses for students majoring in intelligent manufacturing, as an example to conduct curriculum design research. Through the comparative analysis of the scores before and after the teaching experiment, it is found that under the mixed teaching mode based on SPOC, the students' scores have changed significantly compared with those before the beginning of the teaching mode. The excellent rate and passing rate of the students in the experimental class are higher than those before. It can be seen that the teaching mode can improve the students' learning performance.

Keywords: blended Course Teaching · SPOC · C Language Programming · teaching mode

1 Introduction

In 2020, the outbreak of the COVID-19 made it impossible for teachers and students in major, primary and secondary schools to return to school normally. Based on the national policy of "suspending classes without stopping schools", teachers in major, primary and secondary schools, colleges and universities have used online teaching platforms to carry out online teaching, making teaching order normal. From this we can see the importance of network teaching in today's education and teaching [1]. SPOC is a small-scale targeted online classroom. Compared with MOOC, which can accommodate thousands of students at the same time without limitation, SPOC has strict restrictions on

the number of students. Only students who meet the relevant conditions set by teachers can enter the SPOC classroom to learn, which is conducive to teachers' understanding of the specific learning situation of students in the whole class, improving the efficiency and quality of students' learning in class, grasping class teaching Precise teaching and other aspects have considerable advantages [2].

With the continuous transformation and development of the current relevant industrial structure in China, under the background of application-oriented undergraduate majors, all walks of life need not only talents with solid professional and practical skills, but also innovative talents with integrated disciplines. Under the new situation, the construction of application-oriented undergraduate major also has new requirements for C language teaching [3]. The construction of application-oriented undergraduate majors focuses more on practice and production cooperation to promote interdisciplinary integration. Promoting the integration of disciplines under the background of application-oriented undergraduate majors refers to gathering different knowledge in a single module with some logic, and learning to use in-depth knowledge of one or more courses to solve problems [4]. Intersection and integration are the core of the cultivation of innovative engineering talents. The teaching of C language must also be developed into a multidisciplinary thinking field, so as to promote C language teaching talents to have knowledge in multiple professional fields and form compound talents [5]. C language programming course is a professional basic course for non computer majors in colleges and universities. It is an important basis for the application of various professional technologies, as well as a software tool for various practical links. This course has a relatively wide coverage and strong applicability, and students' practical ability and comprehensive quality play a crucial role. Setting up C language programming course can promote students' practical ability and plays an indispensable role in the curriculum system. The research on the mixed teaching mode based on SPOC abroad first elaborates the basic concept definition of SPOC separately, then discusses its theoretical implementation path, and finally applies it to teaching practice [6]. Although the mixed teaching research in China started later than that in developed countries such as the West, it has been widely used in China's education and teaching at this stage, and has also achieved certain teaching and research results [7].

Based on the above background, this paper proposes "SPOC combined with hybrid teaching mode", and conducts curriculum design research around C Programming, one of the compulsory courses for students majoring in intelligent manufacturing, as an example, in order to better apply the SPOC hybrid teaching method to the applied undergraduate education and teaching, so as to improve the overall teaching quality of the applied undergraduate classroom and improve the comprehensive quality and ability of students, It adds a little bit of strength to the development of application-oriented undergraduate education towards high-quality development.

2   Research Object, Method and Research Path

2.1   Research Object

In this study, two classes of the first grade of intelligent manufacturing major in a university in Shandong Province were taken as the research objects, of which class 1 was the experimental group and class 2 was the control group. There are 49 students in the experimental group of Class 1, 49 students in the control group of Class 2, and 98 students in both classes. The average enrollment scores of the students in the two classes are almost the same and the class size is also equal, which provides good comparability and reference for this study and is suitable for subsequent research.

2.2   Research Method

In this study, we first investigated the definition and research background of SPOC at home and abroad, and then analyzed the application practice cases of the SPOC based hybrid teaching method and the corresponding research results. After constructing the SPOC based hybrid teaching mode, we conducted planned teaching in the experimental class according to the pre planned process, but the traditional teaching method was still followed in the control class, but the teaching content of the control class and the experimental class The progress, assignment and other aspects are completely consistent, and the two classes have no differences in other aspects except teaching methods, so as to ensure that a more complete, scientific and effective control experiment can be formed after the completion of this study.

2.3   Research Path

The study is divided into 4 parts, as follows:

The first part is "pattern construction". Any subject needs to establish a certain teaching mode before teaching, so as to better continue teaching. Teaching mode is a relatively macro and large concept, which is based on certain guiding ideology, has relevant operable teaching concepts, and has a complete system of teaching activity framework and teaching steps. Then it puts forward the corresponding design principles, and finally constructs the process of mixed teaching mode based on SPOC.

The second part is "teaching implementation". After constructing the teaching mode based on SPOC hybrid teaching method suitable for this paper, the mode is applied to the teaching of related courses from the perspective of specific practice.

The third part is "result analysis". At the end of this teaching session, the students' scores before and after the experiment were compared and analyzed, and then the relevant data were statistically collated to draw conclusions.

The fourth part is the summary and outlook. This chapter mainly summarizes the teaching enlightenment of the mixed teaching method based on SPOC to the applied undergraduate professional teaching.

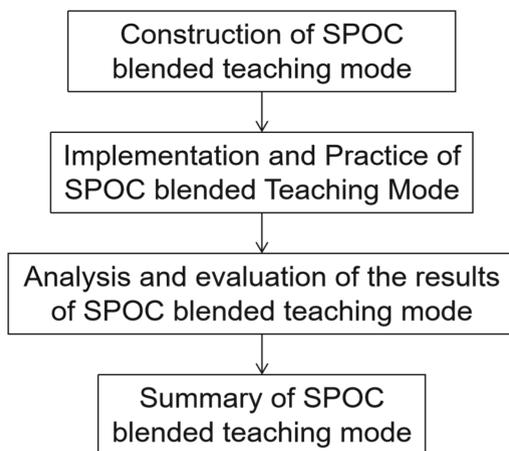The research route of the paper is shown in Fig. 1.

Fig. 1. Research path

3   Construction of SPOC Blended Teaching Mode

Teachers need to do a lot of preparatory work before formally carrying out mixed teaching. The online learning resources for the mixed teaching of C Programming based on SPOC should include the learning contents of three links: before class, in class and after class. The resource type needs to include mind map, learning task list, PPT, network link, micro class, test question bank, group announcement, online puzzle answering, etc. In the teaching process, we need to pay attention to the determination of the teaching objectives. The curriculum is divided into chapters according to the teaching objectives and teaching content. Each chapter is divided into three teaching links: pre class, in class and after class. As is show in Fig. 2, A mixed teaching flow chart based on SPOC is developed.

The pre-class objects are mainly teachers, which is also the busiest part for teachers. Before formal classes, teachers need to carefully design and prepare teaching resources, upload them to the corresponding SPOC platform, set teaching objectives according to
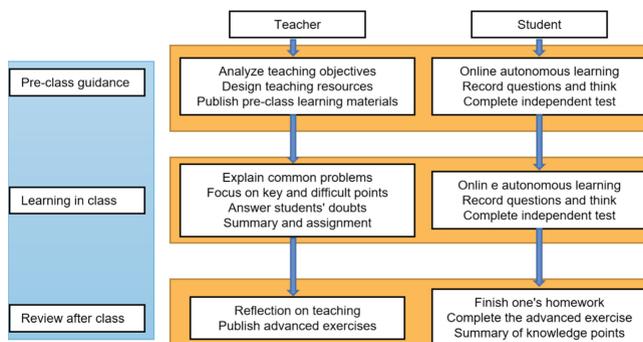

Fig. 2. Blended teaching process chart

the course content of this section, and guide students to learn according to the course objectives. Teachers should also design the corresponding test questions according to the teaching content and upload them to the SPOC platform, so that students can test their knowledge level through the test questions after independent learning, so that students can timely record what they do not understand. Teachers can also understand the weaknesses of students in the learning process through students' feedback, so as to strengthen the teaching of weak areas during offline teaching.

The course is mainly divided into online and offline. Online students mainly learn independently, while offline students learn in traditional physical classrooms. During online teaching, students need to carefully watch and complete the curriculum resources issued by teachers, complete the corresponding exercises, and timely record difficult problems.

After class refers to the end of the course. At the end of each lesson, teachers should reflect on teaching so as to gradually improve and perfect the mixed teaching. On the other hand, teachers can release advanced exercises in the Learning Pass for students to further explore and learn and expand their knowledge capacity. Students should repeatedly use teaching resources after class to digest and consolidate review in time. After completing the assignment, try to complete the advanced exercise.

4   Implementation and Practice of SPOC Blended Teaching Mode

The experimental site of this teaching is selected to carry out a five month teaching practice in an undergraduate school in Shandong Province. Finally, the specific implementation effect of this teaching mode is analyzed according to the students' test scores, questionnaires, interviews and other forms. In this study, Tencent Classroom, a network platform commonly used in current online teaching, is taken as the online SPOC platform. Tencent Classroom is a new online teaching platform with multiple functions such as flipped classroom, micro course and interactive classroom.

In order to ensure the authenticity and preciseness of the teaching effect, the textbook and teaching schedule are completely consistent in the teaching implementation of the two classes. In order to better match the classroom teaching content with the teaching model, in the process of collecting, preparing and making teaching resources, the teaching resources that are easy to accept but not shallow are selected as much as possible to ensure that students can learn. When teaching in the control class, the teaching method is still in accordance with the traditional teaching mode of "teachers speak and students listen". At the end of each lesson, students also need to complete the relevant assignments assigned by the teacher. In terms of assignment and teaching schedule, the two classes are completely consistent with the experimental class. Except for differences in teaching methods, the two classes have no differences in other aspects, so as to ensure the accuracy of the final experimental results and the fairness of students' learning.

To sum up, the mixed teaching model based on SPOC can be roughly divided into three steps: the first step is preliminary preparation and preliminary analysis; The second step is the design of teaching process activities; The third step is the design of learning evaluation. In a word, the above three steps are the basic process of forming and developing the SPOC based hybrid teaching model. The three are closely linked to form a complete SPOC hybrid teaching model.

5   Analysis and Evaluation of the Results of SPOC Blended Teaching Mode

The teaching practice lasts for five months. One month after using the mixed teaching mode based on SPOC, the first four sections of the course were tested in order to understand the practical effect of the teaching method, as shown in Table 1.

According to the results of the first unit test, the students in the experimental class scored slightly higher than those in the control class, but considering that the test may be accidental. Therefore, it is necessary to conduct the test again after the experiment is completely completed, and take the second test results (final test results) of two classes of students as the final test results, as shown in Table 2.

According to the second analysis of students' academic performance data, after five months of mixed teaching practice based on SPOC, the maximum score, average score and pass rate of the overall students in the experimental class are slightly higher than those in the control class. In general, this teaching practice has achieved good results, which is better than the expected actual effect. This teaching mode is really helpful to improve students' learning performance, and at the same time, it can "force" students to learn by themselves, enhance their independent learning ability and improve their own learning interest in constant exercise. In addition, in the communication with classmates, it can imperceptibly enhance the friendship between classmates, Improve class cohesion.

It is difficult to accurately implement the assessment designed in the syllabus in the actual assessment implementation process. Therefore, in order to ensure that the assessment proportion of the outline plan can be effectively implemented in the actual assessment, the allowable error mechanism has been developed, and the allowable deviation value of the actual assessment proportion has been set. The actual assessment proportion is within the allowable deviation range, which is recognized as the assessment proportion of the outline design, and has been effectively implemented in the actual implementation process. The following Fig. 3 shows the analysis of students' achievements.

Table 1. First performance data comparison

	highest score	*lowest score*	*average score*	*passing rate*	*excellence rate*
Control class	94	53	71.63	73.47%	6.12%
Experimental class	95	51	73.47	75.51%	8.16%

Table 2. Second performance data comparison

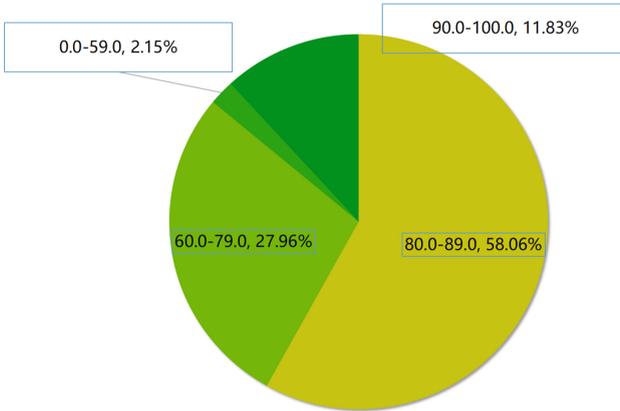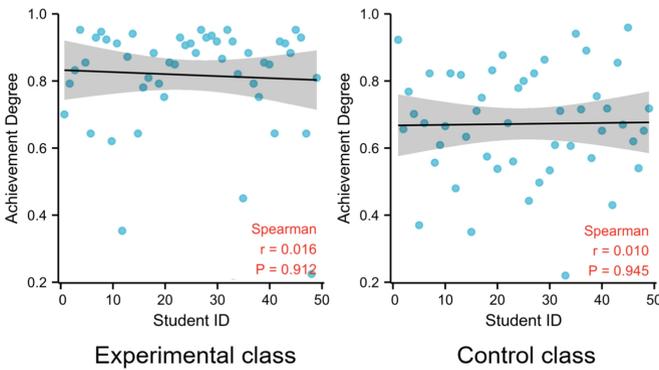|	*highest score*	*lowest score*	*average score*	*passing rate*	*excellence rate*
Control class	97	53	74.88	81.63%	10.20%
Experimental class	99	58	82.64	97.96%	22.45%

Fig. 3. Chart of final exam scores

Fig. 4. Results of academic performance comparison

As is show in Fig. 4, for students who have passed the SPOC mode, the actual achievement degree of their academic performance is 0.866, the expected value is 0.7, 93.55% of the students have met the expected value, and 6.45% of the students have not met the expected value. However, for students who have not passed the SPOC mode, the actual achievement degree is 0.726, the expected value is 0.7, 54.74% of the students have met the expected value, and 45.26% of the students have not met the expected value. It can be seen that our teaching methods have a significant impact on students' performance.

6   Conclusions

SPOC teaching mode is one of the popular teaching methods at present. It can make up for the shortcomings of traditional MOOC, organically combine the advantages of MOOC teaching, pay attention to the ability level of different learners, and ensure the efficiency

of a small number of learners. Through teaching practice, the following conclusions are drawn:

6.1 SPOC Blended Teaching Mode Can Effectively Improve Students' Academic Performance

Through the comparative analysis of the pre experiment and post experiment performance data of the students in the two classes, it is found that before the application of the teaching mode, the scores of the students in the experimental class and the students in the control class almost converge, and the gap is very small or almost no. However, about a month after the use of this teaching mode, the first test was carried out, and it was found that the students in the experimental class had slightly higher scores than those in the control class. When the test was carried out after all the teaching experiments were completed, the scores of the students in the experimental class were significantly higher than those in the control class, and the excellence rate, passing rate and average score of the students in the experimental class were improved compared with those in the control class The pass rate and other aspects should be better.

6.2 SPOC Blended Teaching Mode Can Effectively Improve Students' Interest in Learning

The traditional teaching mode is mainly a one-way indoctrination mode of "teachers speak and students listen". When students encounter problems they do not understand, they are also lazy to think, and are often used to waiting for teachers to answer. On the other hand, the online link of SPOC hybrid teaching mode "forces" students to learn autonomous learning. Teachers should become leaders and guides in the learning process of students, rather than direct knowledge indoctrinators. Students must first become familiar with relevant knowledge points, and try to find answers to questions they do not understand. In the long run, students can naturally develop the habit of independent learning, and find the fun in learning, from "Let me learn" to "I want to learn".

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