ISSN 2522-6398 Vol. 6, Issue 17: 135-140, DOI: 10.25236/FER.2023.061721

Research on the Teaching Model Based on "MOOC+ Flipped Classroom" with the Concept of "Student Centered, Output Oriented"

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Abstract: *In order to cultivate applied talents serving regional economic development as the goal, local undergraduate universities must empower first-class undergraduate education with first-class curriculum construction. Taking programming courses as an example, this article proposes a "student centered" hybrid teaching implementation plan. Starting from the three dimensions of pre class, during class, and after class, this article discusses the five-stage teaching method of "online resource and teaching platform selection, teaching content and organization adjustment, exercise testing and homework design, integration of ideological and political elements into teaching, assessment and evaluation, and teaching feedback", and finally explains the teaching and learning effect.*

Keywords: *Programming Courses, Online and Offline Hybrid Teaching, Student Centered*

1. Introduction

Currently, the world is in the transformation period of the fourth industrial technology revolution, and the traditional technology industry paradigm will rapidly upgrade, transform, and enter a new paradigm. In the context of the international trade war, the key to the success of countries in upgrading their industrial institutions is to cultivate talents with innovative and entrepreneurial capabilities. In order to achieve the goal of talent cultivation, higher education should make full use of network and information technology, effectively connect online and offline teaching activities, and achieve a "student centered" teaching model transformation. The online teaching mode is conducive to the collection and analysis of student learning activity data, thereby forming a dynamic feedback mechanism, providing the possibility for teachers to make targeted teaching adjustments. In the mixed teaching model, the evaluation method is also commonly used for the whole learning process oriented formative evaluation, which can well reflect the student centered and output oriented teaching philosophy [1]. Currently, many scholars are also concerned about the relationship between the two: Literature [2] takes the innovative mechanism of curriculum teaching evaluation in the United States as an example, pointing out its important significance in the final evaluation of teaching effectiveness. In document [3], a high-quality curriculum construction path that deeply integrates intelligent technology is proposed, and the role of diversified formative learning effect evaluation in improving teaching quality is elaborated. Literature [4] focuses on rigorous mathematical modeling and analysis of curriculum learning effectiveness evaluation methods that incorporate formative evaluation. By setting reasonable weights, it effectively improves the positive impact of formative evaluation on learning engagement and effectiveness [5]. In foreign research [6-7], the purpose of university education and teaching is to promote the four major development of students, namely physiological development, psychological development, social ability development, and professional ability development. To achieve these goals, Western universities generally adopt a "student-centered" teaching design model and teaching methods, and have achieved good educational effects.

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2. Course Overview and Existing Problems

2.1. Course Overview

The college computer course is an important public basic course in colleges and universities, which cultivates students' computational and programming thinking. The basic course of college computer programming for science and engineering students is based on the Python language, focusing on training students' programming thinking and engineering practical abilities [8].

2.2. Existing Problems

(1) Due to the compression of class hours, this course currently has only 48 class hours. Due to insufficient classroom teaching time, it is difficult to achieve personalized teaching and stimulate students' innovation through content differentiation.

(2) The traditional "teacher led" teaching method cannot mobilize students' learning initiative and enthusiasm, resulting in a situation where teachers and students are separated from each other. Curriculum reform aims to create a "student centered" teaching process.

(3) Traditional teaching pays more attention to theory, students lack the environment for innovative practice, and lack hands-on ability. Through the curriculum reform, it is hoped to increase experimental machine time through new ways to improve students' practical abilities in intelligent technology.

(4) Traditional teaching focuses on the accumulation of teaching resources, but the teaching implementation and evaluation methods still follow the old ideas, with insufficient testing of students' formative learning effects, and a lack of comprehensive evaluation of their achievements [9-11].

3. Design of Blended Teaching Methods

The guiding ideology of the design of blended teaching methods for this course is "student centered, practice oriented, and result oriented." In the teaching process, we have designed different teaching methods around different teaching objectives.

(1) Online: According to learning tasks, students log on to the MOOC platform to learn independently through micro class videos and expand learning hours; Timely verify learning effectiveness through chapter tests and online experiments to achieve knowledge goals; Through online discussion, teachers and students interact to achieve feedback on teaching effects;

(2) Offline: Based on online learning self-test results and interactive feedback, teachers design flipped classroom learning activities and teaching resources, provide customized learning support, and improve students' learning initiative and participation; Arrange offline experiments to improve students' comprehensive practical skills and internalize knowledge into wisdom.

(3) Online + offline: Carry out innovation and entrepreneurship quality education, promote the cultivation of engineering ability and form correct values [12-15].

4. Teaching Organization and Implementation

4.1. Implementation Introduction

This course focuses on the course objectives, improves the teaching content with a case driven approach, reflects the integration of cross professional capabilities, and highlights high-level and challenging aspects. Teaching organization is divided into three dimensions:

(1) Before class - Teachers can push preview courseware and micro class videos, publish learning tasks online, and keep abreast of student learning dynamics and feedback.

(2) In class - Explain key and difficult knowledge through flipped classes, and organize discussions and offline experiments. The purpose is to expand the depth and breadth of students' learning and cultivate their hands-on practical abilities.

(3) After class - The teacher assigns assignments and online simulation experiments, observes the teaching effect through online data, and updates the teaching plan.

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The specific situation is shown in the figure 1:

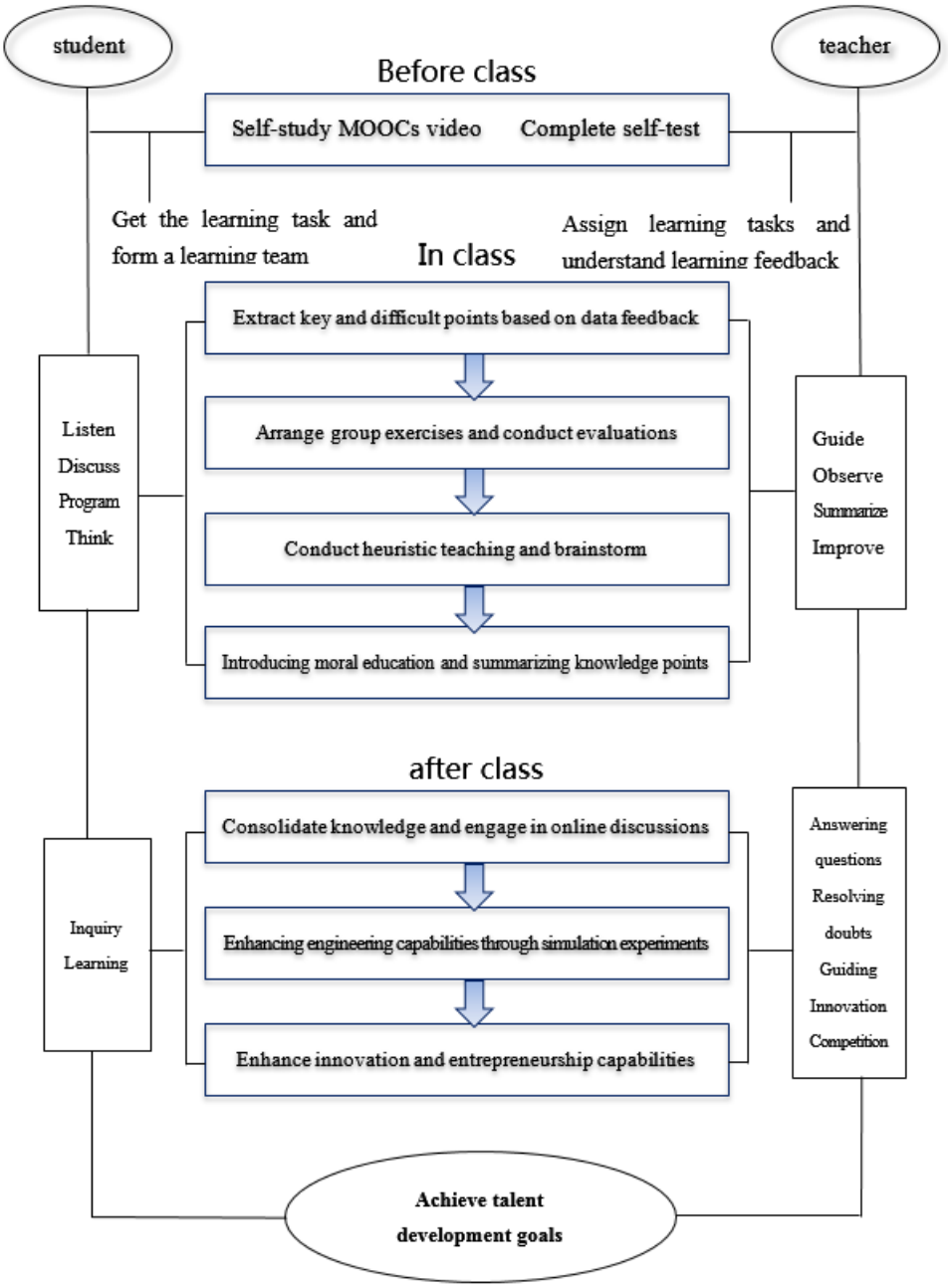

Figure 1. Three Stage Teaching Organization

4.2. Introduction to Resource Construction

The teaching resources of this course are very rich. As follows:

(1) Online teaching platform. The course team has built online courses on the Wisdom Tree teaching platform, with rich course resources. Currently, there are more than 5000 students who have selected courses, and the cumulative interaction between teachers and students has exceeded 110000 times. The number of course selection schools has also accumulated to 66. The course resources have been successfully selected for the online open curriculum of colleges and universities in Shandong Province.

(2) Online experiment and evaluation system. The course team has built its own online simulation experiment system, with a large question library that supports both objective question evaluation and online compilation of programming questions. The system operates 24 hours a day, ensuring that

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students can practice and evaluate themselves anytime, anywhere.

(3) Compile textbooks and problem sets based on students' characteristics. The teaching accumulation of the course team over the years has also turned into fruitful teaching materials. The self compiled teaching materials and problem sets for this course have received favorable comments from teachers and students.

4.3. Performance Evaluation Method

The course performance evaluation system is diversified and multi-dimensional.

(1) The average score is 50%, including online video and expanded resource learning (10%), and online homework and chapter test scores (15%), totaling 25%, which corresponds to knowledge goals; The score for answering questions and group discussions in flipped classrooms is (10%), which corresponds to the competency and quality goals. The comprehensive score for offline experimental projects is (15%). The experimental results are derived from the design of experimental projects, group practice of comprehensive projects, and defense performance. This part mainly reflects the high-level assessment content.

(2) Final score 50%. In the final exam papers, some of the questions also fully reflect the high-level, innovative, and challenging aspects of students' comprehensive literacy.

The usual and final grades will constitute the student's overall grade for the course.

5. Evaluation and Effectiveness Of Curriculum Reform

(1) Evaluation of Curriculum Reform

According to the survey questionnaire, over 90% of students believe that the combination of online and offline teaching mode is the trend. 85% of students believe that the quality of the course resources is excellent, especially with excellent video production and a large question bank, which is conducive to self-learning. In addition, 84% of students believe that online simulation experiments and testing systems are flexible and convenient to use. The detailed information of the survey questionnaire is shown in Table 1.

Table 1. Learning situation questionnaire

question	Very satisfied	satisfied	medium	Dissatisfied
Are you satisfied with the blended teaching mode of this course?	55.67	38.97	5.36	0
Are you satisfied with the three-stage teaching method adopted in this course?	60.87	25.69	11.07	2.37
Are you satisfied with the online course resources?	63.75	21.83	9.88	4.54
Are you satisfied with the online simulation experimental platform?	53.71	30.25	9.52	6.52
Are you satisfied with using a multi-dimensional assessment method?	37.65	39.44	17.67	5.24

(2)Effects of curriculum reform

In terms of teaching research, the curriculum team has carried out 5 educational reform projects at all levels, published 5 papers, and published 7 textbooks around the curriculum and talent cultivation. After years of accumulation, the course has also been approved for awards such as school level first-class courses, school level excellent teaching cases, and successfully selected for online open courses in Shandong Province's universities. The course team members have also repeatedly achieved excellent results in teaching competitions at all levels.

After implementing the curriculum reform of combining online and offline courses, on the one hand, students' performance has generally improved. On the other hand, this course strongly supports the school's various professional discipline competitions, and students have excelled in various discipline competitions, both in terms of quantity and quality.

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6. Innovation and Characteristics of Teaching Reform

(1) Reorganization of teaching content

Reorganize the teaching content based on the OBE teaching concept, with the goal of cultivating innovation and entrepreneurship abilities. The teaching content and class hour arrangement focus on the three main lines of improving students' practical ability, problem-solving ability, and autonomous learning ability, accurately teaching, and implementing task driven experimental design methods.

(2) Rebuilding classroom processes

A teaching model based on "MOOC+Advanced Classroom" is proposed. This teaching mode focuses on the cultivation of computational thinking and programming thinking, innovative program design teaching knowledge points outline, and reverse design teaching scheme. Under this teaching mode, online and offline teaching advantages complement each other, and the effect of flipped classroom teaching has been improved.

(3) Conduct online simulation experiments

In addition to using an online platform for online teaching, the course also has an online experiment and examination system. Through innovative Python programming online experiments, it breaks the limitations of time and space, effectively expanding the experimental class hours of students. Online and offline experimental teaching supports the achievement of course objectives, while achieving personalized training.

(4) "Multi dimensional" Teaching Process Evaluation

The curriculum team applies advanced quality concepts and constructs a scientific curriculum evaluation system guided by output standards. Course assessment consists of process and summative evaluations, which are diverse, comprehensive, and measurable. In the teaching process, special attention is paid to process management, and teaching evaluation data are used to guide the optimization of teaching content and improve teaching organizational activities.

7. Conclusion

Through teaching practice, the mixed teaching system established by the course teaching team from three levels of knowledge, ability, and quality has received high praise from students. The students' scores and comprehensive practical abilities have been greatly improved. In the future, the curriculum teaching team will continue to promote the optimization of curriculum content, highlight curriculum innovation, and increase the challenge of the curriculum. At the same time, we will strengthen industry-university cooperation, strengthen the introduction of engineering projects, and pay attention to the application of formative evaluation results in personalized learning guidance.

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