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Research on the Teaching Mode Reform Based on "MOOC+SPOC+Flipped Classroom"

-- Taking "Computer Network Foundation" as an Example

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Abstract: Taking the demand for talent cultivation in applied universities as a starting point, this study explores the application and effects of the blended learning model of MOOC SPOC flipped classroom using “Computer Network Foundation” as an example. The course content is divided into units and provides online learning resources. Students engage in self-directed learning through the online platform, while teachers deepen understanding through discussions, case analysis, and other methods in the classroom. Practical experience has shown that this model significantly improves students’ academic performance, satisfaction, and self-directed learning abilities. Although there are challenges in implementation, such as the quality of online learning resources, teaching skills, and student self-discipline, overall, the blended learning model of MOOC SPOC flipped classroom holds immense potential and value in the “Computer Network Foundation” course.

Keywords: MOOC; SPOC; Flipped Classroom; Blended Learning Model; Computer Network Foundation.

1. Introduction

With the rapid development of the Internet plus era and the rapid changes of the fourth generation of technological revolution, the Internet and artificial intelligence have been quickly and comprehensively integrated into people's daily life, learning and work. For society and enterprises, the demand for high-quality IT talents is increasing. For college students, with the increasing availability of mobile learning resources, online educational resources, and MOOC, the traditional teaching methods and information provided by offline courses are no longer able to satisfy students' curiosity and expectations for the classroom. Obviously, the shift of teaching methods from lecture-style to seminar-style in the past few years is far from enough to counter the impact of the Internet and artificial intelligence on education and teaching. If the education model can make timely changes with the help of the Internet, it can not only effectively improve the quality of teaching, but also enhance students' ability to learn independently, thereby cultivating high-quality information-based talents that are in line with the times and recognized and accepted by society and enterprises.

2. MOOC SPOC Flipped Classroom

2.1. MOOC Learning Model

MOOC (Massive Open Online Courses), which refer to large-scale open online courses published by individuals and organizations with a spirit of sharing and collaboration to enhance knowledge dissemination, are openly available on the Internet. Based on connectivism theory and the open pedagogy of networked learning, MOOC are characterized by diversified tool resources, ease of use, wide audience reach, and participant autonomy. In 2012, three major MOOC platforms, Coursera, Udacity, and edX, were established in the United States. In 2013, Tsinghua University, Peking University, The University of Hong Kong, and The Hong Kong University of Science and Technology joined the edX consortium, while Shanghai Jiao Tong University and Fudan University joined the Coursera consortium. To date, China has basically formed four types of MOOC platforms: academic MOOC (XuetangX, China's Open Education Platform, UOOC Alliance, Ewant) established by ordinary universities and their course alliances; adult education MOOC (Adult Higher Education MOOC Alliance) established by open universities; academic MOOC (iCourse, Chinese MOOC, Chaoxing MOOC, Zhihuishu) independently or collaboratively developed by enterprises; and vocational MOOC (Railway Academy, Dingni Academy, Netease Cloud Classroom) developed with the participation of universities or enterprises. These MOOC platforms have become a significant force in transforming teaching, improving teaching quality, and enhancing learning outcomes in China[1].

2.2. SPOC Learning Model

SPOC (Small Private Online Course) is a small-scale, customized online course based on a web-based learning platform, and it is a derivative form of MOOC (Massive Open Online Course)[2]. Compared to MOOC, SPOC courses are smaller in scale and more personalized, with closer interaction between students and teachers. The SPOC teaching mode combines online learning resources with classroom instruction, providing personalized learning resources through an online learning platform and then facilitating in-depth discussions and practical operations in the classroom.

2.3. Flipped Classroom Learning Model

Flipped classroom is an educational approach that rearranges learning activities both inside and outside the classroom. In the traditional teaching mode, teachers mainly lecture on theoretical knowledge in class, and students practice after class[3]. However, the flipped classroom model allocates classroom time for practice, discussion, and in-depth learning, while the learning of theoretical knowledge is completed before class through online learning resources, aiming to enhance students' active participation and learning

outcomes.

2.4. Blended Learning Model

The MOOC (Massive Open Online Courses) the SPOC (Small Private Online Course) and flipped classroom approach is a hybrid education model that integrates the concept of the flipped classroom with the MOOC and the SPOC teaching method. It combines learning activities both inside and outside the classroom, providing personalized learning resources through an online learning platform. Students engage in autonomous learning before class and resolve issues and deepen their understanding through online discussions and interactions. Then, during class time, in-depth discussions, practical operations, and teacher guidance are conducted to promote students' critical thinking and enhance their learning abilities[1].

3. Problems Existing in Traditional Teaching

In 2014, the School of Computer Science included "Fundamentals of Computer Networks" in the basic required course module. In order to meet the needs of talent cultivation in the information society, the "Fundamentals of Computer Networks" course aims to cultivate students' basic IT literacy and Internet+ thinking habits, enabling them to use computers as tools in their studies, daily lives, and work. However, there are many issues that need to be resolved in the "Fundamentals of Computer Networks" course:

(1) Insufficient teaching resources: The "Fundamentals of Computer Networks" course covers many and diverse knowledge points, and with only 3.5 credits, teaching resources are even more scarce.

(2) Single teaching method: Students have varying levels of computer proficiency, and the traditional classroom lecture-based teaching method cannot arouse students' interest, leading to low learning enthusiasm.

(3) Disorderly teaching order: The "Fundamentals of Computer Networks" course is mainly taught in large classes (with 50-60 students per class), and student attendance is not high. Students do not follow the teacher's explanation progress for supplementary exercises.

(4) Simple evaluation method: The "Fundamentals of Computer Networks" course mainly relies on teachers grading students' assignments and final exams, which leads students to engage in exam-oriented learning based on what the teacher will test, and also results in a very large amount of assignment grading for teachers.

4. Research Methods

The main research methods adopted in this study are the experimental method and the questionnaire survey method.

4.1. Experimental Method

The MOOC SPOC flipped classroom model is applied in the Fundamentals of Computer Networks course, and its effects are observed and tested. By establishing an experimental group and a control group, the learning outcomes of the two groups are compared to explore the impact of the hybrid model on students' academic performance [3].

4.2. Questionnaire Survey Method

Through questionnaire surveys, the level of acceptance of the SPOC flipped classroom model by students and the challenges and needs they encounter during the learning process are explored. If you follow the “checklist” your paper will conform to the requirements of the publisher and facilitate a problem-free publication process[2].

5. Hybrid Teaching Mode Design

5.1. Pre-class

Pre-class Instruction through "MOOC+SPOC Guided Learning" to Achieve Key Subject Teaching, Making Teaching Easier for Teachers and Learning More Enjoyable and Efficient for Students.

Currently, "MOOC+SPOC" has become a new hotspot in the development of educational informatization in China. MOOC, defined as a new type of contextualized online video course that supports multiple learning methods, primarily uses online teaching videos as its main carrier, designed and developed for specific subject knowledge points (such as key points, difficulties, doubts, examination points, etc.) and teaching links (such as learning activities, themes, experiments, tasks, etc.). SPOC, on the other hand, is a small-scale restricted online course that implements openness restrictions based on MOOC. The relationship between MOOC and SPOC is illustrated in Figure 2. Firstly, in line with the national epidemic prevention and control arrangements, blended online and offline teaching will become the norm. "MOOC+SPOC" is suitable for online teaching, achieving basic teaching goals through mobile learning, autonomous learning, and collaborative learning via computers, mobile phones, tablets, etc., with low requirements for students' learning conditions, making it friendly for blended online and offline teaching. Secondly, given the differences in students' levels and the speed at which they grasp knowledge, students can use MOOC+SPOC for learning. For difficult points in the "Fundamentals of Computer Networks" course, they can repeatedly play and rewind MOOC+SPOC videos, freeing teachers from the dilemma of having to answer the same question multiple times to multiple students in the classroom[4]. Therefore, the existence of MOOC+SPOC allows teachers to teach more easily and students to learn more happily and efficiently. Thus, constructing a "MOOC+SPOC Guided Learning" teaching mode also aligns with the needs of the Internet era.

5.2. In-class

In-class Group-based Teaching through "Flipped Classroom" to Achieve Full Participation Learning and Establish a Mixed Learning Mode of Direct Guidance and Suggestive Assistance for Teaching Organization.

In the learning process, the "Flipped Classroom" reverses the two stages of knowledge impartation and knowledge internalization, with knowledge impartation taking place outside the classroom through learners watching teachers' micro-video courses and completing targeted exercises before class, and knowledge internalization occurring inside the classroom through collaborative exploration. Its teaching process mainly involves pre-class and in-class activities, with teachers and students having different tasks in each link. Through group-based teaching, not only can effective communication between teachers and students be ensured, but also sufficient interaction among students.

5.3. Post-class

Post-class Improvement through "Differentiated Treatment" to Achieve Enhanced Comprehensive Ability and Teaching Quality, Helping Students Achieve Diversified Development.

The "Flipped Classroom" teaching mode mainly emphasizes the cooperative learning of students and teachers before and during class, but lacks a post-class review and reflection component. A "student-centered" teaching mode requires shifting the focus of evaluation from assessing teachers' teaching effectiveness to evaluating students' learning outcomes[4]. Under these conditions, the "Differentiated Treatment" teaching mode can scientifically assess the achievement of students' learning outcomes. The implementation method involves releasing post-class tasks for knowledge consolidation, evaluation and reflection, and extension and improvement based on the teaching objectives, target audience, and content of the course. In this link, teachers can, through proactive communication with students or post-class survey feedback, assign targeted post-class tasks to students of different levels of reception[5]. For students with stronger reception and better learning progress, tasks should focus on consolidating and deepening the course content. Conversely, for students with weaker reception, individual tutoring and remedial tasks should be implemented. The structural model of this teaching mode is shown in Figure 1.

6. Practice Process and Results of the Teaching Mode

6.1. Research Objects and Grouping

Eighty students from Class 1 and Class 2 majoring in Internet of Things technology were selected and divided into two groups for teaching. Class 1 served as the experimental group, while Class 2 served as the control group, with both classes having the same learning objectives. The experimental group adopted the MOOC+SPOC+flipped classroom hybrid teaching mode practice plan designed in this study, while the control group used the traditional classroom teaching mode.

6.2. Objective Evaluation of Learning Effects

The comprehensive course performance scores were calculated on a 100-point scale, including: 20 points for pre-class presentation preview, 30 points for classroom interaction, 40 points for course reports, and 10 points for classroom performance, totaling four components. The experimental group adopted hybrid teaching, while the control group did not. The average comprehensive performance scores of the experimental and control groups are compared in Table 1. Compared with the control group, the experimental group scored slightly higher on pre-class presentation previews, but their enthusiasm for active participation in classroom interactions and course report scores were significantly higher.

Table 1. Comparison of Average Scores in Students' Comprehensive Performance Feedback

Category	Pre-class Material Preview (20 points)	Classroom Interaction (30 points)	Course Report (40 points)	Classroom Performance (10 points)	Total Score (100 points)
Experimental Group	16.09	23.55	29.96	7.52	77.12
Control Group	14.88	21.75	28.04	6.81	71.48

6.3. Subjective Evaluation of Learning Effects

After the end of the semester's course teaching, a questionnaire on teaching satisfaction with the Computer Network Technology course was distributed to students in the experimental group, with a response rate of 100%. The survey mainly investigated whether it improved learning interest, self-learning ability, social interaction skills, and team awareness, and analyzed the ratio of students who voluntarily responded to the number of valid questionnaires (Table 2).

Table 2. Statistical Survey Analysis of "Experimental Group Students' Satisfaction with Classroom Teaching"

Survey Items	Positive Response Rate	Negative Response Rate
Improving Learning Interest	75.00%	25.00%
Improving Autonomous Learning Ability	77.50%	22.50%
Improving Teamwork Ability	87.50%	12.50%
Satisfaction with Teaching Platform Resources	70.00%	30.00%

The survey results indicate that: Firstly, regarding the survey on enhancing learning interest, compared with the traditional teaching mode, 75% of students preferred to participate in the MOOC+SPOC+flipped classroom, indicating that this hybrid teaching method can enhance the learning interest of most students. Secondly, regarding the improvement of self-learning ability, 77.5% of students believed that the MOOC+SPOC+flipped classroom hybrid teaching mode helps to enhance students' self-learning ability, indicating that the hybrid teaching method promotes students' self-learning ability. Thirdly, the survey on improving teamwork ability showed that 87.5% of students believed it was helpful for improving social skills and team awareness, indicating that this hybrid teaching method has a good effect on enhancing students' team collaboration ability. Fourthly, the survey on satisfaction with teaching platform resources showed that 70% of students were relatively satisfied with the resources on the online teaching platform, indicating that there is room for improvement and optimization of the teaching platform resources. Overall, through direct observation and evaluation, it was found that the experimental group outperformed the control group in terms of learning interest, attitude, teamwork, self-learning, language expression, and learning efficiency. By comparing the objective and subjective evaluation results of the learning effects mentioned above, it can be seen that the "MOOC+SPOC+flipped classroom" teaching method in the Computer Network Technology course has achieved relatively ideal results in improving students' comprehensive abilities. However, there may still be a need for further optimization in terms of teaching resources.

7. Summary

This study has improved the teaching mode of the Computer Network Technology course and proposed a new teaching mode for the information age. Experimental results indicate that the blended teaching approach combining MOOC, SPOC, and flipped classrooms can effectively enhance students' learning enthusiasm and initiative. By integrating online learning resources with offline classroom discussions, students can learn at their own pace while interacting with teachers and classmates in the classroom, thereby improving learning outcomes. This teaching mode is conducive to cultivating students' autonomous learning and team collaboration skills. Before class, students engage in autonomous learning through online resources, and during class, they delve deeper into the material through group discussions, case analyses, and other methods, which exercise their autonomous learning and team collaboration abilities. Meanwhile, the Computer Network Technology course that adopts this blended teaching approach has achieved excellent teaching results. Students' academic performance, satisfaction, and course evaluations have all improved. Although the blended teaching approach combining MOOC, SPOC, and flipped classrooms has achieved certain effects in this course, it still faces some issues and challenges, such as the quality of online learning resources, teachers' teaching abilities, and students' self-discipline. Future research will continue to focus on these issues to further optimize and refine this teaching mode.

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