

Research on MOOC+SPOC Hybrid Teaching Mode for Engineering Optics

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Abstract. The current era is an era of informatization, which has become an important lever for national strategic development. The development of information technology has an increasingly significant impact on education. The vigorous rise of the Internet provides a strong guarantee for the implementation of online and offline hybrid teaching. "Internet plus education" is becoming the mainstream development trend. This article starts with the characteristics of MOOC and SPOC courses, and studies the hybrid teaching mode of engineering optics based on MOOC and SPOC, in order to provide reference and reference for the hybrid teaching of professional basic courses in higher vocational education institutions.

Keywords: MOOC; SPOC; Hybrid teaching model.

1. Introduction

Engineering Optics is a compulsory course for the optical measurement major. This course is closely integrated with optoelectronic equipment technology and plays an important role in helping students understand the working principles of equipment, laying the foundation for subsequent learning and job positions.

However, traditional teaching models inhibit students' enthusiasm and creativity in learning, leaving them in a passive state of acceptance and unable to meet the needs of talent cultivation. Therefore, in order to improve the teaching quality of this course and enhance students' interest and enthusiasm for autonomous learning, it is necessary to reform the teaching mode of the engineering optics course.[1]

2. Research background

In today's era, the rapid development of information technology has brought new challenges to education, but also contains new opportunities. In recent years, the country has introduced a series of policies to promote the deep integration of the Internet and education.

Since 2015, the State Council has issued the Guiding Opinions on Actively Promoting the Action of "Internet plus", the Notice on the 13th Five Year Plan for the Development of National Education, and other documents, clearly stating that "we should make every effort to promote the deep integration of information technology and education and teaching. We should use flipped classrooms, hybrid teaching and other ways to make good use of high-quality digital resources". In 2019, the two sessions further put forward the guiding spirit of "developing 'Internet plus education' and promoting high-quality resource sharing". Under this policy background, China has carried out a lot of exploration and practice in education informatization, and constantly innovated the teaching mode of "Internet plus Education". Mixed teaching was born in this era background.

2.1 Online and offline blended teaching

Blended teaching is a brand new teaching model that integrates online and offline teaching. It transforms the roles of teachers and students in traditional teaching processes, leading the teaching philosophy of "student-centered and teacher led". Blended teaching combines the advantages of traditional teaching and online self-directed learning for students. By utilizing online teaching platforms and resources, it can not only play the leading role of teachers in guiding, inspiring, and

monitoring the teaching process, but also promote students' enthusiasm and initiative in learning, thereby improving the quality of teaching.

The development of blended teaching mode cannot be separated from high-quality and rich online education resources, among which MOOC and SPOC have developed the most rapidly.[2]

2.2 MOOC course

The term MOOC was first coined in 2008 by David Cormier and Bryan Alexander. At present, the international definition of this concept is relatively unified, MOOC is the abbreviation of Massive Open Online Course, which is also the abbreviation of large-scale open online courses.

M (Massive) means a large number of participants, which can reach tens of thousands or even more. O (Open) means there are no admission conditions, that is, course resources are open to the world, regardless of gender, age, identity, and other factors. As long as you register through email, you can learn for free. O (Online) means using the internet as a carrier, meaning that all learning resource dissemination and participant information exchange rely on the internet. C (Course) means that the essence of MOOC is a course.[2]

Therefore, MOOC, also known as large-scale open online courses, is a curriculum system with a large number of participants, no admission conditions, and online as the carrier.

2.3 SPOC course

The term SPOC (Small Private Online Course) was first proposed by Professor Armando Fox of the University of California, Clipper, USA. Scholars at home and abroad generally believe that SPOC is a small-scale restricted online course that corresponds to MOOC's large-scale openness. Through analysis of domestic and foreign cases and research, it has been found that SPOC mainly has two types of development forms in its application.

The first approach is guided by the pursuit of high achievement values, implementing S (Small) and P (Private) guidelines globally, and setting admission conditions for students. Only those who meet the requirements can have the opportunity to enter SPOC for learning, strictly controlling the number of students in SPOC to several tens to hundreds.

The second type is a flexible strategy adopted by various universities to better cooperate with physical classroom teaching, usually based on one or several universities, with the audience being teachers and students of the school. The SPOC referred to in this article is officially of this type. Regardless of the type of implementation, it has been proven that SPOC is a curriculum system with fewer participants, admission conditions, targeted, and web-based as the carrier.[2]

2.4 Online and offline blended teaching based on "MOOC+SPOC"

The operation of MOOC relies on mature domestic MOOC platforms, such as China University MOOC and Xuetang Online, with high entry barriers and technical requirements. Therefore, MOOC courses generally have advantages such as excellent production, complete system, and strong universality, but their disadvantages are also obvious. For example, the course system content cannot fully meet teaching needs, teaching resource updates lag, student participation is low, and a single teaching mode is difficult to meet personalized learning needs.

SPOC, as a smaller and less accessible online course system compared to MOOC, can fully rely on campus websites or small online resource platforms to implement customized teaching management for students at the technical level. Although the MOOC platform has to some extent abandoned its vast resources, SPOC courses are more targeted and more conducive to blended teaching combined with offline classrooms.[3][4]

Therefore, the blended online and offline teaching based on "MOOC+SPOC" can fully leverage the advantages of MOOC, SPOC, and offline classrooms, learn from each other's strengths and make adjustments according to the "class", and achieve the effect of "one plus one plus one greater than three".

3. Construction of teaching mode

Based on the talent cultivation plan of vocational and technical education, combined with the actual teaching of engineering optics courses, a hybrid teaching mode of engineering optics based on MOOC+SPOC is constructed. Specifically, it includes:

3.1 Clear course positioning

The "Engineering Optics" course is a compulsory course for vocational and technical education students, aimed at enabling them to master the basic knowledge of engineering optics, cultivate the ability to use optical knowledge to solve equipment principles and problems encountered in operation, and lay the foundation for subsequent course learning. The planned class hours are 60 hours, theoretical 20 hours, and experimental 40 hours.

This course follows the design concept of combining theoretical learning and experiments, following the basic principle of going from shallow to deep. It consists of 8 chapters, including: Overview, Coaxial Spherical Optical Systems, Ideal Optical Systems, Planar Systems, Beam Limiting, Introduction to Aberration, Typical Optical Systems, and Fundamentals of Wave Optics.

3.2 Refine course objectives

The curriculum teaching starts and ends with the ability to hold a position, with the basic concepts of ability based and student based. The curriculum objectives are refined into three dimensions: "knowledge", "skills", and "literacy".

Among them, the goal of the "knowledge" dimension includes: understanding and mastering the basic principles of geometric optics and wave optics, and applying them to typical optical applications; The goals of the 'skills' dimension include: being able to analyze imaging, building a simple optical path, cultivating knowledge application ability, experimental operation ability, and self-learning ability; The goal of the 'literacy' dimension includes: cultivating a rigorous and meticulous academic style through the course learning process, establishing a scientific attitude that respects objective laws, and cultivating a spirit of teamwork.

3.3 Developing Course Resources

The course team uses the Rain Classroom platform to prepare teaching resources and develop an "Engineering Optics Courseware" that matches the teaching objects and objectives. It consists of 8 chapters and 16 sections, including preview videos, test questions, and expansion videos. The preview video is a MOOC video, with a duration of no more than 10 minutes; The test questions are used to assess the students' mastery of the knowledge in this lesson; The expansion video is a popular science video, with a duration of 8-15 minutes, for students who have spare time to expand their knowledge. In addition, the discussion area in Rain Classroom can provide an interactive platform for students, with instructors responsible for guiding and answering questions.

3.4 Creating Teaching Conditions

In terms of teaching conditions, a fully functional multimedia classroom is equipped for theoretical teaching; Equipped with 6 sets of engineering optical experimental systems, it can be used for experimental teaching.

3.5 Design Teaching Mode

The biggest feature of this model is the filtered combination of MOOC and SPOC, achieving the collaborative construction of MOOC, SPOC, and physical classroom courses. The specific implementation process is shown in "4 MOOC+SPOC Teaching Implementation Process".

4. MOOC+SPOC Teaching Implementation Process

The hybrid teaching of engineering optics based on MOOC+SPOC mainly includes three major links: course construction, teaching implementation, and evaluation feedback.[5]

4.1 Course construction process

Firstly, sufficient course preparation should be carried out to complete the SPOC course construction, including teaching design, content creation, and resource launch. Due to the large number of experimental classes involved in this course and the lack of targeted MOOC platform resources, the course team conducted targeted SPOC course development and relied on our school's internal network platform for online management and operation.

Before implementing the teaching process, teachers need to conduct targeted preliminary analysis and understand students' learning situation and needs through questionnaire surveys; At the same time, use the Rain Classroom to form an Engineering Optics course group, guide students to join this course group, and prepare well for teaching. Students need to complete pre learning preparations such as pre class questionnaire surveys and platform registration.

4.2 Teaching Implementation Links

The teaching implementation process is an important part of carrying out MOOC+SPOC blended teaching. It is divided into MOOC and SPOC modules, among which the SPOC module includes the offline physical classroom section. The specific implementation process is as follows:

Firstly, use the MOOC teaching module to address the basic content of theoretical learning in the teaching of engineering optics, laying the foundation for the next step of teaching. Then, students who meet the requirements are filtered into the SPOC teaching module, and SPOC resources are used to address the targeted content of practical training in course teaching. Then, students who meet the requirements are filtered into the physical classroom teaching module for student-centered offline teaching.

In addition, in response to the lack of pressure and learning motivation in the online resource learning process, teachers are responsible for organizing online qualification tests for students when filtering MOOC to SPOC and SPOC to physical classrooms. Students who pass the tests can enter the next stage, while students who fail to meet the standards still need to stay in this stage and be assisted by teachers to complete the learning of MOOC or SPOC course content within the specified time, To ensure teaching progress and quality.

4.2.1 MOOC Teaching Module

Due to the fact that the MOOC teaching part implemented in the MOOC+SPOC based engineering optics hybrid teaching mode is mainly aimed at utilizing the massive teaching resources in the MOOC platform, it is necessary to fully utilize the leading role of teachers and limit their openness to a certain extent. The MOOC teaching module belongs to the exploratory part and is carried out online. At this time, teachers and students in teaching activities are generally in the cognitive stage.

The implementation process of MOOC teaching mode is as follows:

Firstly, before the teaching activities are carried out, teachers will release announcements in the Rain Classroom course group to guide students to independently complete the MOOC platform course learning resource learning tasks pushed by Rain Classroom.

Then, the teacher fulfills their supervisory responsibilities by urging students to learn independently, while students engage in online learning and solve problems encountered during the learning process through independent research or group discussions. The teacher only needs to assist from the sidelines.

Finally, the teacher will organize the assessment and use the Rain Classroom Assessment module to check whether students are eligible to join SPOC. Students should actively participate in the assessment and actively test their learning outcomes.

4.2.2 SPOC Teaching Module

This module includes SPOC teaching and offline physical classroom teaching. The implementation process of SPOC teaching module is as follows:

Teachers need to conduct a qualification review on students, returning those who do not meet the standards to the MOOC module, and those who have already met the standards to the SPOC module. Students can achieve SPOC course learning through independent online, communication and discussion, online testing, and other methods. The results of online testing determine whether the student needs to stay in the SPOC stage to continue learning and consolidation, or can enter the next stage - physical classroom learning.

Physical classroom teaching belongs to the part of answering questions and solving doubts, and is carried out in the form of offline classes. Teachers master the rhythm of offline teaching to deliver precise lectures and guide students in skill training. The ultimate goal of online teaching is to serve the physical classroom, so offline teaching activities can be carried out based on the problems left by online teaching, using methods such as lecturing, heuristic, and discussion. The main activities of this group of students include face-to-face learning, skill training, problem-solving and problem-solving, and presentation of learning outcomes. The main activities of teachers correspond to face-to-face lectures, guidance skill training, problem-solving and problem-solving, classroom questioning and testing, etc. At this time, teachers and students in teaching activities are generally in the stage of knowledge internalization.

4.3 Evaluation and feedback process

The post class summary section mainly includes two main sections: summary and evaluation. The "summary" section includes: teachers summarizing teaching activities, students summarizing learning situations, and the "evaluation" section includes: students self-evaluation, teachers self-evaluation, student student evaluation, teacher teacher communication, and teacher teacher teacher evaluation.[6]

The improvement work after teaching belongs to the evaluation and feedback part, and is carried out in a mixed form of online and offline. Through a series of evaluation information, the existing problems and shortcomings of the model are fully exposed, and further feedback is provided to the course construction process, helping to further improve the entire teaching design process and forming a virtuous loop of mixed teaching mode.

The implementation process of Hybrid Teaching is shown in Fig. 1.

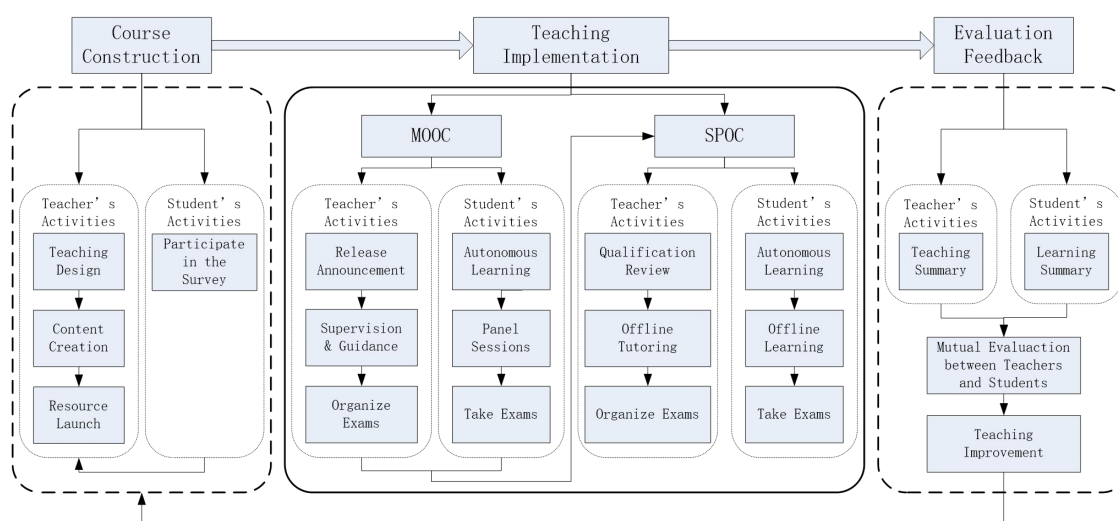


Fig. 1 Hybrid Teaching Flowchart

5. Summary and Reflection

Through research and practice, it has been summarized that the hybrid teaching mode based on MOOC+SPOC has the following advantages:

In terms of teaching philosophy, it breaks the subject object relationship between teachers and students, fully reflecting the teaching philosophy of "learning as the main body, teaching as the leading", that is, students are the main body of the learning process, teachers are the guides, and students independently carry out learning with the guidance and assistance of teachers.

In terms of teaching objectives, it breaks the traditional model of standardized training for all students in teaching. Students can rely on online platforms to learn the corresponding course content at their own pace. For difficult to understand knowledge points, they can repeat learning, and they can deeply track the knowledge points they are interested in, making it easier to achieve the goal of cultivating personalized development for students.

In terms of teaching methods, it subverts traditional cramming teaching methods, enriches the means and channels of knowledge dissemination, emphasizes the importance and initiative of students' "learning", rather than just passively receiving information and memorizing knowledge, which can effectively improve students' learning effectiveness.

In terms of teaching content, the massive online MOOC courses, micro courses and other online resources, as well as more targeted SPOC resources, jointly expand the depth and breadth of knowledge acquisition. The rich multimedia expression forms increase the intuitive and interesting nature of knowledge acquisition, which can effectively enhance students' learning interest.

In terms of teaching evaluation, MOOC+SPOC based blended teaching has achieved a shift in focus from focusing on teaching results to focusing on teaching processes, and from implementing outcome based evaluation to implementing process based evaluation, achieving the goal of educating students throughout the entire process. This is more conducive to comprehensively and objectively evaluating students' learning outcomes, and is conducive to continuous improvement in curriculum construction.

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