

Exploration of the Teaching Mode of Electrical Engineering Course Based on MOOC + SPOC + Flipped Classroom

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Abstract: *In view of the common problems in the curriculum of domestic universities, this paper takes electrical engineering course as a case to implement MOOC+SPOC+flipped classroom teaching mode based on student-centered education concept. The elements of the curriculum (teaching objective, teaching content, teaching method, teaching evaluation.) are studied, and moral elements are integrated into the teaching. Practice has proved that this teaching mode can improve students' learning autonomy, and enhance their comprehensive abilities and qualities such as operation skills, teamwork and innovation consciousness.*

Keywords: *electrical engineering course. MOOC. SPOC. flipped classroom.*

1. Introduction

With the development of internet information technology, MOOC has been widely used because of its abundant network teaching resources and autonomous learning methods[1-2]. In the process of the continuous development of MOOC, its shortcomings gradually appear. For example, course content is repeated, interactive experience is poor, and course loss rate is high. Therefore, SPOC teaching mode, which combines MOOC resources with traditional classroom, emerges[3-4]. It is a more refined and niche type of online open course, which not only adopts the advantages of MOOC, but also makes up for the shortcomings of traditional classroom teaching. On the one hand, the abundant online course resources of MOOC are fully shared to ensure the sufficiency of SPOC teaching resources. On the other hand, it improves the access threshold of courses and reduces the scale of students. At the same time, combined with the traditional entity classroom, it makes education more targeted and greatly improves teaching quality and efficiency.

Supported by the rapid development of information technology, the network teaching environment of flipped classroom is built[5]. Teachers provide learning resources based on teaching videos. Students watch videos before class, study independently, communicate and interact in class, complete homework, and explore cooperatively. A new teaching mode of "learning knowledge in extracurricular, internalizing knowledge in classroom" has been formed. In this mode, teachers become the designers of curriculum content and the guides of learning process. students become the center of active learning. The roles of teachers and students are reversed.

2. Problems in the curriculum teaching

Curriculum is the most microcosmic problem of education, which solves the most fundamental problem of education. At present, there are the following problems in the curriculum teaching of domestic universities.

(1) The goal of curriculum is to pursue knowledge transfer. It emphasizes how much knowledge students have memorized and pays little attention to what abilities students have formed.

(2) The curriculum program, which is composed of syllabus, is more embodied by the "old three center theory" of textbook centered, teacher centered and classroom centered.

(3) The content of curriculum is outdated, insufficient and low-level, which can not meet the needs

of the development of times.

(4) The means and methods of curriculum implementation are old-fashioned. There are no teaching activities centered on students' learning and development, and there are no effective teaching strategies and methods to arouse students' active participation, independent exploration and mutual cooperation.

(5) The mechanism, method and means of curriculum evaluation are unscientific. It focuses only on the results, not on the process.

3. Exploration of the teaching mode based on MOOC + SPOC + flipped classroom

It can be seen from the above that the goal, program, content, implementation and evaluation mechanism of curriculum are the key factors which restrict the quality of education. Adopting student-centered concept, this paper implements the teaching mode of MOOC+SPOC+flipped classroom for electrical engineering course.

3.1. Formulation of syllabus

Teachers investigate on-site, exchange and consult with high-level experts, and discuss and formulate syllabus together. As shown in Figure1, the syllabus of electrical engineering course consists of teaching objective, teaching content, teaching method and means, teaching evaluation.

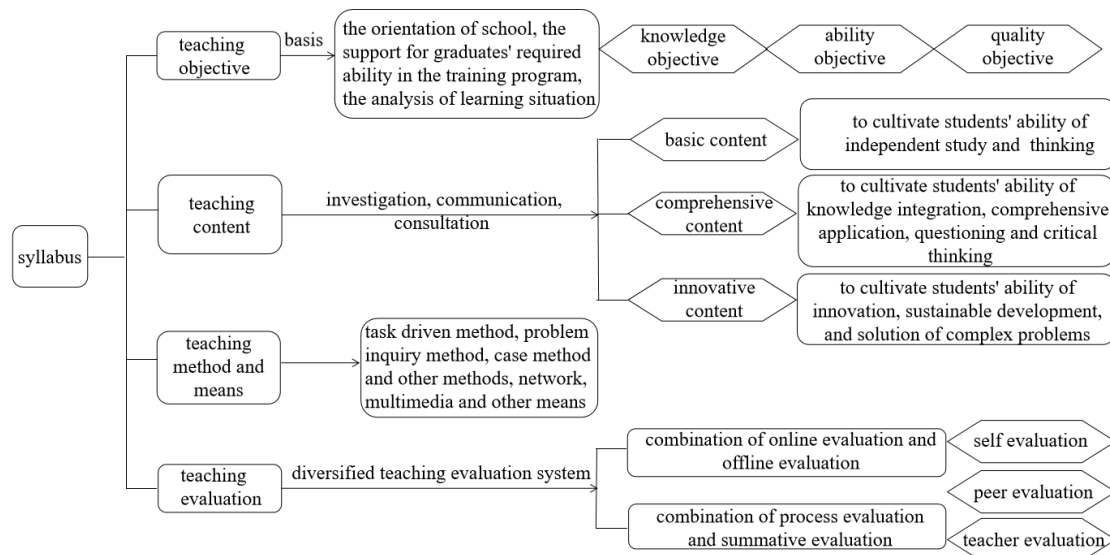


Figure 1: Teaching syllabus

The training requirements of electrical engineering course in three aspects of knowledge, ability and quality are combed, and the high-level teaching objective is formulated. It should be made to improve students' comprehensive ability and advanced thinking in solving complex problems. At the same time, moral elements should be integrated into the teaching objective. Teaching content is the way to achieve teaching objective, and it is the composition structure of students' ultimate mastery of knowledge, and improvement of ability and quality. According to the characteristics of online learning, the traditional teaching content is integrated and optimized. A large number of new teaching resources is increased, and a complete teaching content system is formed. Students learn the basic content independently online through MOOC and SPOC platforms. Under the guidance of teachers, they complete the learning of comprehensive content and innovative content through flipped classroom offline. According to the characteristics of the teaching content, various teaching means such as network and multimedia can be used. One or more teaching methods, such as task driven method, situational method and case method, can be adopted. Scientific, comprehensive and objective teaching evaluation standards is set up, and diversified evaluation system is constructed. The online evaluation and offline evaluation is combined, and the process evaluation and summative evaluation is combined. This kind of evaluation system can promote teachers to optimize and adjust teaching strategies, and improve the effectiveness of teaching. It also can promote students to continue reflection deeply, adjust learning strategies in time, and understand the learning content in depth.

3.2. Preparation of courseware and auxiliary teaching resources

There are online courseware and offline courseware. Online courseware provides students with preview content before class, including the knowledge points involved in each teaching content. Offline courseware is the meeting-class courseware, including the key points and difficulties in the process of teaching implementation. In addition, auxiliary teaching resources is provided to students, including learning objective, learning schedule, preview task list, exercise bank, assessment form and other supplementary learning materials.

3.3. Implementation of teaching mode

3.3.1. Online teaching

Taking the advantages of MOOC and SPOC and combining with the characteristics of students, the online teaching and evaluation is carried out. It is shown in Figure 2.

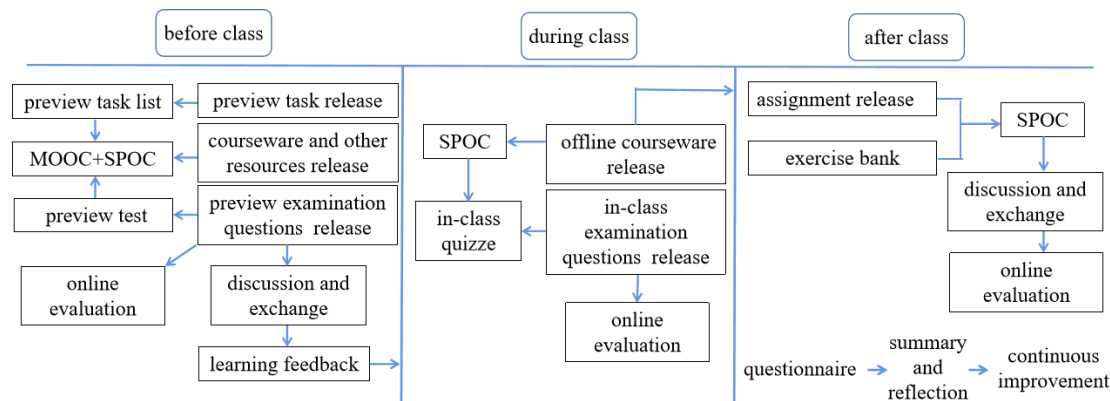


Figure 2: online teaching

For blended teaching, teachers' preparation and students' preview before class is a very important link, which directly determines the teaching effect and quality of offline flipped classroom. First, teachers need to design high-quality teaching content and auxiliary teaching resources carefully, and provide students with challenging learning tasks and materials. Secondly, students complete online learning and test independently according to the requirements of preview task list. For the difficult problems encountered in learning, they need to think deeply independently, then communicate with classmates, and collide with the spark of thought. If there is still no idea, they can discuss with teachers and solve the problems through teachers' advice. Finally, teachers give evaluation according to students' online performance (participation) and test results. At the same time, teachers collect common problems, make records, adjust the offline teaching strategies, and prepare for offline teaching. During class, online teaching is mainly to release the meeting-class courseware through the SPOC platform, carry out the in-class test, and record the test results. After class, students complete the assignments as required and submit them to SPOC platform. In order to further expand the learning content, teachers release the exercise bank related to the knowledge points of this course to SPOC platform. Students who have not enough to learn can study deeply. In addition, students can be investigated in the middle or the end of the term to promote teachers' continuous reflection and improvement of teaching strategies.

3.3.2. Offline teaching

Theoretical flipped teaching and experimental flipped teaching are combined offline which is carried out in a cross way to solve the problem of disconnection between theory and practice. Through online learning and discussion before class, students are familiar with the new learning content. But only scattered knowledge points are in students' mind. Students did not form a complete knowledge system, which is disadvantageous for students to understand and master deeply. In entity classroom, teachers guide students to integrate, synthesize, deepen and apply the scattered knowledge points in the form of project, problem exploration or case analysis, so as to help students build a systematic knowledge framework. For example, the control of motor is taken as a project. Through the explanation of the inching control and long-term control of motor, students can further understand and master the common low-voltage electrical appliances which has been learned online. They know how to integrate these low-voltage electrical appliances into the motor control circuit, and understand its working principle. When explaining the forward and reverse rotation control of motor, starting from the long-term control circuit,

the teacher constantly put forward "how to realize the reverse rotation?" "What's the danger of no-interlocking control circuit, how to solve the problems?" "what's the defect of forward rotation-stop-reverse rotation control circuit, how to solve the problems?" "what's the working principle of forward rotation-reverse rotation-stop control circuit?" to lead students to continuously think and explore, carry out discussion and communication, and form a complete knowledge system in the process of solving the problems, then internalize it. Teachers can also ask more complex questions to let students complete the innovation and design of complex control circuit through cooperation.

After students learning the theoretical knowledge of a certain chapter, experimental teaching is carried out immediately, so as to combine theory with practice in time. This can strike while the iron is hot, consolidate students' knowledge, and improve the operation efficiency and quality. After entering the laboratory, students are divided into groups. According to the learning task list released by teachers, they analyze task, determine plans, carry out implementation and debugging, and share achievements and file. The whole process is guided by teachers and dominated by students, which realizes the role reversal. Teachers guide in teaching and students do in learning, which realizes the integration of teaching, learning and doing. In addition, moral education is integrated into teaching, focusing on students' emotions, attitudes and values. experimental teaching process is shown as Figure 3.

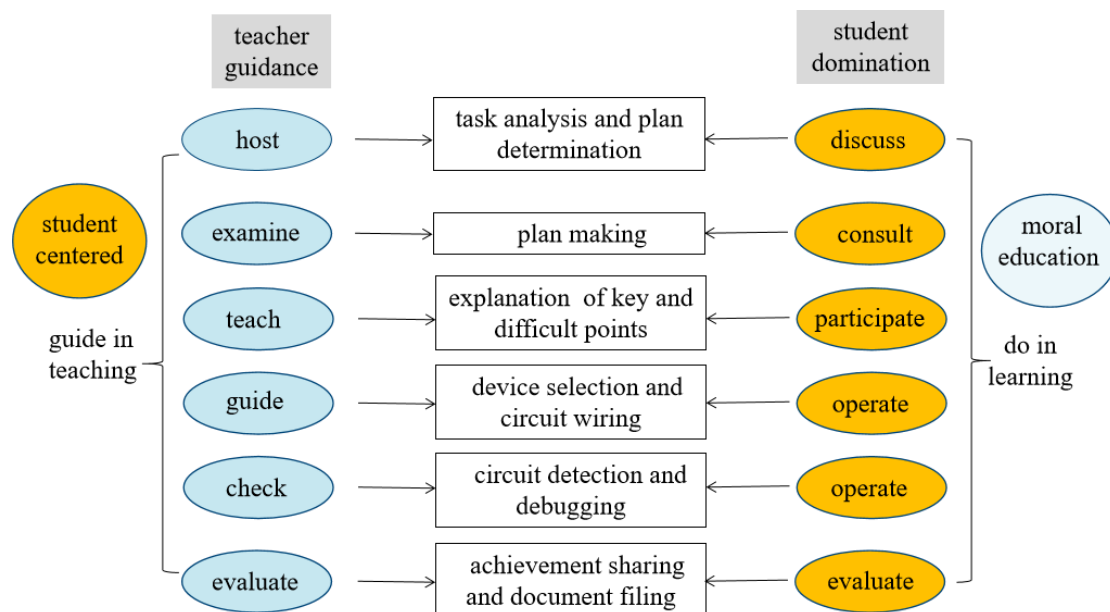


Figure 3: Experimental teaching

For example, after completing the online learning and entity classroom teaching of motor control project, students are arranged to enter the laboratory to operate the inching control, long-term control and forward and reverse rotation control of motor. In the process of operation, students will encounter a variety of problems, such as the motor does not rotate, the noise is too large in the process of motor rotation, etc. At this time, teachers guide students to carry out discussion, think deeply, explore the reason according to the phenomenon, find and solve the problem step by step. Through the experimental teaching, students' practical ability, team cooperation ability, communication ability and innovation ability are effectively improved.

4. Conclusions

This paper explores the teaching mode based on MOOC+SPOC+flipped classroom and applies it to electrical engineering course. After adopting this mode, the students' interest and initiative in learning the course can run through the whole process. Their participation and activity in the classroom are improved, and their comprehensive abilities and qualities such as autonomous learning ability, practical ability and exploration spirit are also significantly enhanced. In brief, this teaching mode really makes students' mind move, classroom atmosphere live and teachers' ability strong.

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