A Practical Application of Hybrid Teaching Based on Asynchronous SPOC in Circuit Course

Xiaojuan Sun*
School of Electronic Information Engineering, Xi’an Technological University, Xi’an 710021, Shaanxi, China
*Corresponding author(E-mail: sxj_a@163.com)

Xuewei Zhang
School of Electronic Information Engineering, Xi’an Technological University, Xi’an 710021, Shaanxi, China

Wei Jing
School of Electronic Information Engineering, Xi’an Technological University, Xi’an 710021, Shaanxi, China

Abstract
In order to improve the teaching quality of circuit course and the effectiveness of student learning, achieve the teaching objectives of circuit course, the MOOC platform of the Xi’an Jiao Tong University has been introduced into circuit course teaching. The MOOC platform is a high quality inter-school resource. So we began the hybrid teaching reform based on asynchronous SPOC and flipped classroom in circuit course. Combined with the characteristics of asynchronous SPOC and flipped classroom, this paper designs teaching activities from the three aspects of pre-class, in-class and after-class, and puts forward multiple evaluation methods. The teaching practice proves that the new mode of teaching with students as the main body, can provides effective space for the in-depth communication between teachers and students, improve the students’ initiative of learning circuit effectively, cultivate students' ability of analyze and solve problems, serve the circuit course learning better and eventually improve the teaching quality of the circuit course.

Key words: Small Private Online Course, Flipped Classroom, Hybrid Teaching, Teaching Model.

1. INTRODUCTION

Circuit course is a very important fundamental course for students with the majors of electronics and automation. It is a teaching material with long teaching time, rich content and strong practicality. But the basic principles and analytical methods involved in it play a crucial role in the follow-up courses. Different majors have different needs in circuit course of Xi’an Jiaotong University, usually 56 to 80 credit hours. Students generally think the course difficult, boring and the course does not interest them. Some even give up the subject. The students with better performance of the circuit course are only staying at the problem-solving level, can not really apply the circuit principle to the engineering practice.

Previously, our teaching methods were very traditional. Teachers lecturing in the classroom, and the students finish their homework after class. Some students can understand the contents of the class, but it is difficult to do exercises after class, not to mention the integration of theory and practical. These directly affect the teaching objectives of the circuit curriculum.

To improve this, we applied for a project. This study is founded on the teaching reform project of Shaanxi provincial MOOC (Massive Open Online Course) center. The practice of teaching reform show that this new teaching method takes students as the main body (Strayer, 2012), arouses students' study interest from various aspects, which can be changed from passivity to initiative, and can improve the ability on analyzing and solving problems of student little by little (ZHUB and YU, 2013).

2. CHARACTERISTICS OF ASYNCHRONOUS SPOC AND FLIPPED CLASSROOM

Since 2012, MOOC approach arose in the United States, which had a great impact on the development of online education in almost all countries in the world (Matkin, 2012). In 2013, with the huge increase of the platforms of online courses and the number of student registration, MOOC, as a popular teaching mode, have very high enrollment rate, but at the same time, it also have a high dropout rate, because of the low rate of course completion and the lack of interactions between teachers and students (WANG, 2017). In early 2013, in order to solve the above-mentioned problems of MOOC, SPOC (Small Practices Online Course) was proposed by Professor Amand Fokker of the University of California. SPOC adopts mixed learning method, combining the MOOC and traditional classroom teaching, which has both online learning and face-to-face learning. It also sets prerequisites and the number limitation of learners to ensure teaching effect and quality. SPOC is mainly...
composed by micro videos, interactive discussions, study practices and tests. It is currently considered as the new version of MOOC, which enables to combine the traditional classroom mode with updated online resources (ZHANG and TANG, 2016). Since 2013, a SPOC-based flipped classroom approach has been widespread in some top foreign universities such as Harvard University (Enfield, 2013), University of California, Stanford University. Flipped classroom is an innovative teaching mode created by American Salman Khan. It reconstructs the classroom process, students study on their own through the teaching video made by teachers, and then do practice in class and use the knowledge they have learned to solve problems. By this way, students are able to focus more on the active study based learning projects in class, learn how to solve a variety of practical problems, and the deepen their thinking. Students’ learning is more active and engagement is stronger. Flipped classroom redefined the role of teachers, which allows teachers to return to the campus, and to the small-scale online classrooms to become the true masters of the curriculum (CHANG, 2017).

Copy course’s content, teachers can add or delete the original content at will, which is called asynchronous SPOC (ZHANG, 2017). We use the MOOC resources which belong to Xi’an Jiao Tong University (XJTU), it has a novel video resources and exquisite PPT. The resources have unit tests and online exams, at the same time, the platform have the discussion area for communication between teachers and students. Above all, the learning period and chapter of resource can meet the needs of our school’s circuit course. In practice, the teacher can integrate the resources, add or delete the online content according to the teaching progress and teaching characteristics of the university (ZHENG and LU 2017). The research team is composed by four of my colleagues and me. The participants selected were 94 of three natural classes in grade one.

3. THE ORGANIZATION MODE OF HYBRID TEACHING

Hybrid teaching is not a new concept. It is a tacit combination of traditional classroom and flipped classroom but simply "traditional teaching + online learning". The organization of mixed learning must pay attention to the logical relationship between students' online learning and offline learning, to establish communication channels and multiple scoring methods. This does not change any learning law, but is the adaptation to it. The Hybrid teaching mode based on SPOC can fully reflect the “theoretical + practical” characteristics of circuit course, which is conducive to college students master the basic knowledge of circuit course, and can improve the ability of analyze and solve problems. The design of hybrid teaching mode for circuit course is shown in table 1.

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<th>Table 1. The design of hybrid teaching mode for circuit course</th>
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<td>Hybrid teaching</td>
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<td>Online classes</td>
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<td>Flipped classroom</td>
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In the offline classes, teacher explain the key points and answer question, the rest of the project executors are the students. This realizes the goal of the student as the main body. The hybrid teaching based on SPOC in the circuit course are used in pre-class module, in-class module and after-class module. Tasks and organization form of each module are carefully designed.

3.1. Pre-class Module

Pre-class module are divided into teacher tasks and student tasks. Most important of all, course resources should be produced first. The design of teaching resources based on SPOC can integrate the excellent curriculum resources on the MOOC platform of XJTU, and can also be designed according to the professional needs of students. In order to meet the needs of students, teaching resources be divided into compulsory and elective content based on the syllabus. The teaching resources online are mainly include online test module, discussion module and data analysis module. Our online test module is divided into academic test and post
test. The academic test is a small quiz in the student’s online learning process, post test is a comprehensive examination after the end of the course. The discussion module is an online communication channel between the teacher and the students. Online discussion module can solve the confusion of students in learning circuit course, reflecting the students dominant position. The data analysis module can be used to record the whole process of learning. Teacher can grasp students' learning progress through the data analysis module to adjust the teaching content in time. Of course, the teacher should assign the pre-class task list.

The student’s task in pre-class modules include watching the teaching video, completing online tasks, participating in online testing, online communication. If students run into problems during the learning process, they can communicate with classmates or teachers. Unresolved issues can be raised in flipped classrooms and in traditional classrooms, the teacher will give them the answers.

3.2. In-class Module
In-class modules, the students participate in the study are divided into 12 groups, each composed of 7-8. Members are composed of students freely. SPOC redefined the role of teachers, which allows teachers to return to the campus, and to the small-scale online classrooms to become the true masters of the curriculum. Pre-class, the teacher is the creator and integrator of teaching resources; In-class, teacher's role as inductor and supporter. The students in the execution group explained and displayed one by one according to the content of the pre-class task list. According to the results of the students' discussion, teachers should make a judgment on the mastery of knowledge points, and further arrange exercises to strengthen the students' learning effect. Teachers will carry out inspection evaluation and summarize, deal with the problems and the key difficult points encountered by students in the process of online learning in face to face class.

In-class modules, students sit in groups. Each group will have a discussion about the contents of the video and the questions put forward by teacher and finally form a summary of views. Through in-class modules, students can speak freely, so as to enhance the understanding and mastery of what they are studying. In the study group, students are the relationship between cooperation and competition. This learning atmosphere can stimulate students' potential and improve their learning efficiency.

3.3. After-class Module
In after-class module, teacher should grasp students' learning progress through the data analysis module in time. Interaction in discussion module between teachers and students is particularly important. The teacher should pay attention to the pertinence of the questions and answer the question in time. Teachers can also conduct in-depth exchanges with students on QQ, WeChat or other ways.

Students will be able to complete homework and exercises after class to further consolidate their knowledge. They can communicate with teachers and students online or offline to deepen the content of knowledge.

3.4. Evaluation Mode
Under the hybrid teaching mode, it takes more time to learn after class. In order to respect students' efforts, we adopt the evaluation model of process evaluation (50%) and termination evaluation (50%). The process evaluation includes teaching evaluation of online learning (40%) and classroom teaching evaluation (10%). Teachers can make use of SPOC online learning platform combined with the actual learning situation of the students in the class to achieve online automatonic scoring. The classroom teaching evaluation includes the enthusiasm of the members of the group, the effectiveness of solving problem and whether to achieve common progress. In the whole evaluation system, students can master the completion status of their learning tasks in time, can see the results of themself and other students clearly. These can fully promotes the enthusiasm and initiatives of students' learning as well as improves the teaching effect.

4. THE EFFECTS OF IMPLEMENTATION
In fact, the research of hybrid teaching reform based on asynchronous SPOC and flipped classroom in circuit course teaching is a kind of process that resources are re-collocated and integrated utilizing. It was the first implemented in Xi ‘an technological university. Xi ‘an technological university is offering circuit course in the second semester, the teaching effect is very good within a term.

4.1. Compared with the Traditional Class
The students in the experimental class used the same test as the traditional class in the final exam. A large class was selected randomly in the traditional teaching class, which consists of four natural classes of 133 students. The average score, pass rate and excellence rate of the traditional class and the experimental class are shown in figure 1 and figure 2.
The exam results of traditional class

![Bar chart showing average, pass rate, and excellent rate for traditional class.]

**Figure 1.** The final exam results of traditional class

The exam results of experimental class

![Bar chart showing average, pass rate, and excellent rate for experimental class.]

**Figure 2.** The final exam results of experimental class

The experimental results are as follows: the average score of the experimental class is 64.3, higher than that of traditional class of 60.8. The pass rate of the experimental class is 61.7%, higher than that of traditional class of 57.1%. The excellent rate of the experimental class is 22.3%, higher than that of traditional class of 13.5%. The date show that the hybrid teaching based on asynchronous SPOC can improve students' mastery of knowledge and improve the learning effect greatly.

4.2. Compared within the Experimental Class

One term's practice has proved that our reform is workable and we have achieved the elementary effect. Flipped classroom delivers the initiative of the class to students, help students build knowledge and improve students' language skills, enhance students' interest in learning. In this mode of teaching, students are able to focus more on the active study based learning projects in class and improve their studying efficiency. Figure 3 and figure 4 are the online results of two students in experimental class.

Feng's online results

![Bar chart showing online engagement metrics for Feng in experimental class.]

**Figure 3.** Feng's online results of experimental class
Lei's online results

According to figure 3 and figure 4, the SPOC score of the Feng is 90, higher than that of Lei of 65, the number of video and participating in the discussion of Feng are far more than that of Lei. In the final exam of the whole grade, Feng's score was 98, while the score of Lei was 59. Feng said that this kind of mixed learning method is very popular and his learning ability has been improved greatly. But Lei said that this kind of mixed learning method put a lot of stress on him, he still prefers traditional teaching. The data showed that 62% of the students can complete online SPOC course tasks assigned by the teacher with excellent scores, while only 16% of them feel it somewhat tough to finish all the tasks. 76% of the subjects think that the new teaching mode is suitable for them and the interaction between teachers and students have been strengthened during the class time. Furthermore, the overwhelming majority of 85% of the students hope that the teaching mode can be adopted continuously in the next semester. These data show that the teaching reform is workable, and we have achieved our teaching goals. The students who are not suitable for new methods of teaching, teachers should encourage them and not give up any one.

5. EXPERIENCES

In this hybrid teaching model, it actually set higher demands on teachers and teaching activities, even though they have fewer lectures. Teachers are required to devote more time to their teaching and have more knowledge. Teachers are required to have good ability to control classroom also. Teachers should have a good ability to organize teaching and to consider the students' interest (Steffenhagen, 2012).

Hybrid teaching is a teaching activity with students as its main body. Students are required to give out the subjective initiative sufficiently, have superb self-management skills and ability to interact with teachers or others. The key to the successful implementation of hybrid teaching mode is that students must have sufficient learning in pre-class module, otherwise the in-class and after-class sessions will be formality. Therefore, the number of students participating in hybrid teaching mode should not be too many, because not all students have the desire and ability to learn actively. The results show that, since some students' learning initiative is poor, relatively lack of independent learning ability, teachers should add face-to-face special instruction to online or offline teaching process to help students smooth the learning process and set reasonable plans.

6. CONCLUSIONS

SPOC is a new online learning platform in the post MOOC period, inherited the advantages of MOOC, but also has the new characteristics of the development of the times. The hybrid teaching mode based on SPOC can be applied to all aspects of the university curriculum. The students have given positive evaluation to the hybrid teaching and hope to have more courses take this form. In hybrid teaching mode, the role of the teacher has also led to a shift from the knowledge and classroom managers to the learning guides, the leading role of teachers is to teach students how to learn. The hybrid teaching is given prominence to be student-oriented in terms of target setting, focusing on the effectiveness of student learning, which is an effective guarantee to improve the teaching quality.

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