Exploration and Practice of Mixed Teaching in the Course of Digital Electronic Technology

Guoqin Zhang

The College of Electrical Engineering, Zhejiang University of Water Resources and Electric Power, Hangzhou, China
zhgq@zjweu.edu.cn

ABSTRACT. With the development of information technology, many emerging technologies have been widely used in education, such as online education and MOOCs. In order to solve the problems existing in the teaching of digital electronic technology, the mixed teaching method is adopted in this course. How to implement the online and offline mixed teaching method in this course is introduced, and the specific tasks and implementation methods in the three stages of before during and after class are introduced. The course evaluation is based on knowledge, skills and attitude. The specific scoring standard is given. Finally, the overall evaluation of the mixed teaching method is made.

KEYWORDS: Digital electronic technology, Mixed teaching, Flipped classroom

1. Introduction

Digital electronic technology course is a professional basic course for electronic information, automation, electrical major. It is applied in many fields, such as computing technology, automatic control, electronic measurement and so on. It plays an important role in the professional knowledge structure.

The mixed teaching method is an organic combination of "online" and "offline" teaching methods [1]. It can not only retain the advantages of traditional teaching methods, but also give full play to the advantages of advanced information technology, so that they can complement each other and achieve the best effect of teaching. The traditional teaching methods in my class have the following problems:

(1) The continuous compression of class hour is in contradiction with numerous and important knowledge of this curriculum. Without using online resources, if the class hour is decreasing, it will inevitably lead to the abandonment of learning and guidance of some important contents of the course, so the amount of information in the course will have a decreasing trend.

(2) The participation rate of students in class is low. In the classroom, when there are opportunities of practical operation, the enthusiasm and participation rate of students are very high, but when it comes to the study of theoretical knowledge, the participation rate of students is very low, and the theory is basically explained by the teacher alone.

(3) Students lack of communication and guidance in extracurricular study time, and the feedback of learning effect is not timely enough. The homework feedback cycle in the course is long, generally one week, and it can not reflect the learning and mastering of the course very well and timely. Students' extracurricular learning is also lack of targeted guidance from teachers and there is no good communication platform of the course among students, and communication among students is also not enough.

(4) The application of advanced teaching technology is still lacking. In addition to the introduction of multimedia teaching and simulation software, there is almost no introduction of Internet and other means, which limits the amount of information in the course and is not conducive to the "expansion" of the classroom and the further development of students.

2. The Teaching Implementation in the Course of Digital Electronic Technology

The implementation of mixed teaching in digital electronic technology course can be roughly completed in three stages of "before class", "in class" and "after class". The implementation process is shown in Figure 1. Before the implementation, the following preparatory works must have been done. One is the students have been divided into several groups (generally 4 students in one group). Two is one class is taught in the laboratory. Three is teacher has

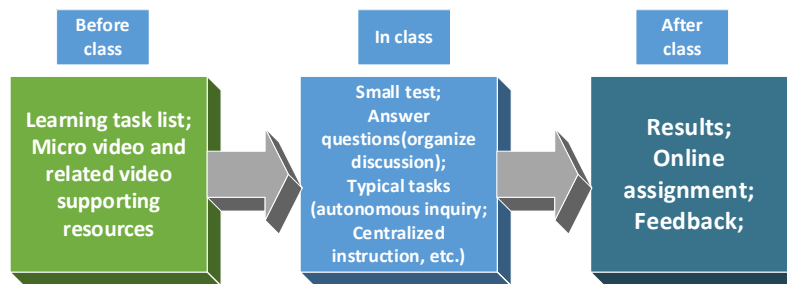recommended excellent MOOCs and learning resources.

Fig.1 Course Implementation Process

The following points need to be made in figure 1.

(1) Before class, a learning task list is made by teachers to lead students to finish learning micro videos of online courses and online tests. The specific tasks on the learning task list are all the questions corresponding to the knowledge points. For example, to learn the knowledge about JK Trigger, the task list is not written as: to master the edge-triggered JK-flip-flop, but as specific problems: what is the logic symbol of the JK-flip-flop? What is its feature list? What is its characteristic equation? How to draw its state diagram? How to draw its sequence diagram? Writing a task list in the form of questions can reduce the difficulty of students' learning, increase their sense of achievement to solve problem, and certainly help to improve their interest in learning.

(2) In class stage, a small test is a real-time detection of the learning effect before class. Students have a test using their cellphones through an APP named "Xuexitong", a classroom teaching software developed by Chaoxing company. The test which is generally five objective questions about 5 minutes, so that teachers can have a timely understanding of students' pre class learning, and put forward higher requirements for students' online learning. The theoretical knowledge or the task on the learning list is learned or solved mainly by group discussions, with students as the main body and teachers as the leading role. According to the specific situation, students can discuss with each other to learn, and the teacher explain some knowledge points which is more questions or difficult for students. In the course of digital electronic technology, the teaching content is carried out in the form of projects. The specific contents are as follows: ① introduction; ② project 1 is to design and make a voter; ③ project 2 is to design and make an alarm; ④ project 3 is to design and make a buzzer; ⑤project 4 is to design and make an electronic clock; ⑥project 5 is to design and make an electronic doorbell; ⑦ project 6 is to design and make a numerical control voltage source. The practical operation in projects includes: the test of the main parameters of the gate circuit; the test of the function of the priority encoder; the application research of the decoder; the application research of the data selector; the research of the preventative dithering function of the basic RS trigger; the design and verification of N base counter; the application research of the 555 timer; the application research of the DAC. Involving these knowledge points, direct hands-on operation, to achieve the integration of "teaching, learning and doing".

(3) After class, the teacher summarizes the teaching effect, make clear the components of process learning evaluation, and design a reasonable assessment method.

3. Course Evaluation of Digital Electronic Technology

In the course of digital electronic technology, the whole process and open curriculum assessment system shall be established, with knowledge, skills and attitude as the focus of assessment, reflecting the new concept of curriculum assessment focusing on both soft and hard abilities. In the process of mixed teaching, it is emphasized that not only the leading role of teachers, supervision and process regulation should be fully exerted, but also the initiative, enthusiasm and creativity of students in the process of learning should be fully reflected [2].

Each part of students' online learning before class, class performance, practical operation level, class discussion, class participation, team cooperation and innovation achievements are included in the overall evaluation of the course. Encourage students' spirit of innovation and stimulate their consciousness of innovation. Course evaluation can be divided into process evaluation and summative evaluation, and process evaluation can also be divided into pre-class evaluation, in-class evaluation and after-class evaluation. The specific implementations are shown in table 1. The diversified evaluation method based on mixed teaching process should truly and objectively reflect the correlation between students' learning behaviors, attitudes and results [3].

Table 1 Specific Evaluation Of Courses

evaluation type	evaluation node	evaluation index	evaluation content	weight （%）
process evaluation	before class	the length of micro class watching	learning time	15
		post or reply message	the number of post or reply messages on line	
		online test	video content understanding, master degree	
	in class	classroom performance	quality of questions and answers	15
		collaborative learning outcomes	content, creativity	
		hands-on operation	completion of operation contents and practical ability	
	after class	assignment	understanding, mastery, engagement and creativity	10
		training report	understanding and analysis	
summative evaluation	final evaluation	group summary report	team-work ability, application of knowledge	60
		course theory assessment	understanding and mastery of knowledge	
		course operation assessment	hands-on, practical ability	

4. Conclusion

Through the application of online and offline mixed teaching mode in digital electronic technology, the following conclusions can be drawn:

(1) mixed teaching method can effectively solve the problem of insufficient teaching information in digital electronic technology. Using online resources, the time of theoretical guidance in class can be significantly reduced.

(2) mixed teaching method can significantly improve the participation rate of students in theoretical learning. The mixed teaching gives students more "right of speech". Online learning before class and flipped classroom in class have changed from teaching-centered to learning-centered.

(3) The mixed teaching method can solve the problems of less communication and delayed learning feedback after class. After class, teachers use online resources to assign homework. With the help of information technology, students can immediately see the feedback results after submitting the homework, and teachers can also see the feedback information of students on the Internet. Micro-class and MOOCs also provide a good teaching communication and discussion platform for students and teachers after class. Students and teachers can publish discussion on the course problems at any time through Xuexitong, course platform, QQ, WeChat and so on.

(4) mixed teaching can provide students with more autonomy in learning. Online learning, the development of information technology, the time and place of learning is not restricted, students can use discrete time learning anytime and anywhere. Students can choose to study at their best and decide number of video views and playback, independent control of video playback speed, to cultivate the students' self-consciousness and initiative study [4].

(5) mixed teaching improves students' enthusiasm for learning. mixed teaching online can increase the interaction between teachers and students, due to the interaction is not restricted by space-time. This teaching method can give the students more and updated information related to the course and give the students more choices and freedom, turn theory study in the classroom, let the students in center position in process of teaching. All these give more help to improve students' learning interest [5].

References

[1] zheng jiming, zhang rong et al. Exploration and practice of mixed teaching mode reform in higher mathematics, scientific consultation (science and technology. Management), No.6, 2018.

[2] [3] li fengqing, han xiaoling. Construction and practice of hybrid teaching quality evaluation system, China electrochemical education, No.11, pp.108-113, 2017.

[3] su xiaohong, zhao lingling et al. Exploration and practice of mixed teaching based on MOOC + SPOC, Chinese university teaching, No.7, 2015.

[4] Tang bo, kong jianyi et al. "Internet +" hybrid teaching research, higher education development and evaluation, No.5, pp.90-99, 2018.