Mixed Teaching Reform of Online and Offline in Applied Undergraduate Colleges —— A Case Study of Electrical and Electronic Practice Course

Yujing Xu, Jing Ji, Qing Xu
Chengxian College of Southeast University, Nanjing 210088, China.

Abstract: Experimental teaching is an efficient way of education, through practical operation and experimental activities to help students deeply understand theoretical knowledge, cultivate practical ability and solve practical problems. As an important engineering practice course, "Electrical and Electronic practice" has a special status and function in application-oriented undergraduate colleges. In the face of the rapid development of science and technology, the way of education must be innovated constantly. In this paper, a combination of Online and offline teaching reform is carried out for the Course "Electrical and Electronic Practice" offered by application-oriented undergraduate colleges. SPOC (Small Private Online Course) is established on the basis of MOOC, which combines online and offline teaching to promote the all-round development of students. It cultivates their practical ability and competitiveness, and lays a solid foundation for their future career and academic path.

Keywords: MOOC; SPOC; Blended Education Reform

Introduction

Application-oriented undergraduate colleges are a kind of higher education institutions, which mainly aim at cultivating application-oriented talents. Colleges and universities pay attention to the cultivation of students' practical ability, and are committed to enabling students to flexibly use their knowledge and skills in practical work. The educational methods of colleges and universities emphasize experimental teaching, consolidating theoretical knowledge through practical operation and experimental activities, and cultivating students' practical application ability and the ability to solve real world problems. Experimental teaching is an efficient way of education, which helps students to deeply understand theoretical knowledge, cultivate practical ability and solve practical problems through practical operation and experimental activities. It not only helps students transform abstract theoretical knowledge into practical skills, but also stimulates their innovative thinking and problem-solving ability. In the face of the rapid development of science and technology, education methods must also be constantly innovative. Although online teaching provides convenience in some aspects, it is difficult for pure online teaching to meet the needs of students for courses such as "Electrical and Electronic Practice", which requires practical operation and experiments. The interaction between hands-on and experimental sites is essential for a deep understanding of learning, which cannot be completely replaced. Therefore, applied undergraduate colleges and universities need to constantly explore innovative educational models that combine online and offline resources to provide a richer learning experience.

1. The current situation of practical courses in electricians and electronics

1.1 Teaching content

With the continuous progress of electronic science and technology, the teaching content and knowledge points of the course must keep pace with The Times. Old knowledge points and content may no longer meet the needs of modern electronic engineering. Therefore, the curriculum should be reviewed and updated regularly to include the latest techniques, instruments and applications. The

goal of practical courses should be to develop students' hands-on skills, including proficiency in the operation of instruments and testing methods. If students can only operate simple instruments and cannot effectively measure signal parameters, then their application ability in practical engineering projects will be limited. Courses should pay more attention to the cultivation of practical skills, including the correct use of instruments and troubleshooting. Students in different electrical and electrical majors may have different career directions and interests, so individualized education is needed. Course content and methods should be adapted to the requirements of different fields of specialization to ensure that students will be equipped with practical skills and knowledge in the relevant fields at the end of the course. At the same time, the academic levels and interests of different students vary, and there should be opportunities for layered development. Some students may need more challenge, while others may need more support. Courses can have different levels of difficulty or offer different electives to meet the diverse needs of students.

1.2 Teaching methods

The traditional teaching mode is usually teacher-centered, and students lack the opportunity to actively think and explore in the process of passively accepting knowledge. This may lead to a decline in students' interest in learning and a relatively superficial understanding of knowledge. In the process of passively completing the experiment and writing the experiment report, students may just repeat the operation mechanically, without really mastering the practical operation skills. In this case, students' actual ability may be limited. Traditional models are usually not enough to encourage students to think and solve practical problems. Students may perform well in handling standardized experiments, but be overwhelmed when faced with new problems. The traditional model often struggles to meet the individual needs of different students because it is too standardized. Some students may need more challenges, while others may need more support and tutoring. While traditional explanations and demonstrations can be effective in transferring basic knowledge and skills, especially in situations where basic concepts and techniques are needed in a subject, today's education is increasingly moving towards more interactive, hands-on and personalized teaching methods that can better stimulate students' interest and develop their critical thinking and practical application skills. In order to better meet the needs of future careers and society.

1.3 Assessment Method

The assessment result of the course is composed of three parts: the usual result, the experimental acceptance result and the experimental report. The usual scores are mainly the students' experiment performance and experiment preview; The experimental acceptance score is mainly whether the students' experimental data results are correct or not; The results of the experimental report mainly test whether the content of the experimental report is complete and whether the conclusion is correct. In the whole assessment process, the assessment of students' practical ability is insufficient, and the assessment results can not fully reflect the students' understanding of the experiment and the ability to operate the experiment.

2. Integration of online and offline teaching methods

2.1 Revise the syllabus

With the rapid development of science and technology, knowledge in the field of electronic engineering is constantly evolving. Revising the syllabus requires regular review and updating of the knowledge content of the course to ensure that students are exposed to the latest knowledge of electronic components, circuit design techniques and related fields. This helps to cultivate professionals with practical application value. Educational theories and teaching practices continue to evolve, and teaching methods and strategies need to be adjusted in order to improve teaching effectiveness. The use of interactive and hands-on teaching methods, such as lab lessons, project work and group discussions, helps students better understand and apply what they are learning. Dividing learning objectives into different levels is an important way to personalize learning. Different students have different levels of ability, so setting different learning goals for beginner, intermediate, and advanced students can help meet their needs. This way, each student can gradually improve at his or her own level of ability. It is very important to set specific teaching goals for each learning goal level. For example, at the beginning level, students may need to learn to recognize various electronic components, while at the advanced level, they may need to independently design complex electronic systems. These specific goals can help teachers and students understand the standards they need to meet at each level.

2.2 Reframe teaching content

For the reconstruction of electrical and electronic engineering course content, to ensure that the teaching content is consistent with the latest technological trends, as well as to strengthen the basic knowledge and cultivate the engineering application ability. In terms of introducing new electronic devices and technologies, in order to keep up with the latest developments in the field of electronic engineering, the teaching content can introduce new electronic devices and technologies, such as quantum electronics, nanotechnology, flexible electronics, photonics, etc. Students can learn about the basic concepts in these fields, as well as their potential and challenges in practical applications. In terms of green electronic technology and renewable energy, courses can enhance content on green electronic technology and renewable energy, given the importance of sustainable development. Students can learn how to design low-power electronic systems and use a constant supply of electricity from renewable sources. This helps develop students' environmental awareness and ability to apply sustainable technologies. In terms of updating experimental tasks, the experimental tasks are updated to reflect the latest technological trends. For example, experimental tasks could be designed to have students use new types of electronics to build functional circuits, or experiment with the performance of renewable energy systems. These tasks can both reinforce basic knowledge and develop students' hands-on skills.

2.3 Reform teaching models and methods

More problem-oriented learning, project-driven teaching and laboratory practice can be adopted for practical courses such as electrical and electronic practice. Students will gain a better understanding of theoretical knowledge in the process of solving practical problems. The reform of assessment method is an important measure in the field of education, and its implementation can significantly improve the learning effect and comprehensive quality of students. This comprehensive assessment approach, which incorporates SPOC (Small Private Online Course) and experimental teaching, aims to provide students with a wider range of learning opportunities while fostering their self-guided learning and problem-solving skills. Experimental teaching is an important part of the curriculum, and students' practical ability and scientific thinking can be comprehensively assessed by examining their performance during the experimental process. Students need to record the experiment process, results and analysis, which helps cultivate their ability of data analysis and experiment design, allowing them to better translate theoretical knowledge into practical operation. This approach emphasizes the process, not just the result. It focuses on performance during the learning process and emphasizes the achievement of curriculum objectives, rather than just measuring students' level of knowledge through one-time exams. The specific requirements of the examination and the detailed rules of evaluation are shown in Table 1. The process assessment method encourages students to actively participate in learning, continuous improvement and enhance their academic and practical abilities. The introduction of an integrated assessment approach is essential for the overall development of students. Through diversified assessment methods, it can better meet the needs and learning styles of different students, and cultivate graduates with solid theoretical knowledge and practical application ability. This education model reflects the continuous innovation of education, emphasizing the cultivation of students' ability in real situations and innovative thinking. This educational mode will help students better cope with future challenges and opportunities, and lay a solid foundation for their careers.

Table 1 Specific requirements and evaluation rules for the assessment

SPOC	Attendance	5%	5. Complete theory courses on time.	The study record of the SPOC course is graded.
	Online testing	5%	5.After you have finished your online study, take an online test.	Test scores for SPOC courses
	Peacetime	10%	Preview attendance and attendance	Students' attendance in laboratory classes and preparation for experiments

Experimental teaching	Experimental process and results	60%	Students shall prepare, operate and sort out the experiment according to the laboratory regulations, keep the experimental bench clean and tidy, and use the experimental instruments correctly. Practical electronic circuit welding success and can realize the function, welding technology to pass.	Whether the students' experimental attitude in class, independent completion of the experiment, operation specifications, operation proficiency, measurement data and data processing methods are correct. The cleanliness and saturation of solder joints should meet the requirements, and the functions of practical electronic circuits should be able to achieve their rated functions.
	Report	20%	Turn in lab reports on time and report well.	Write the experiment report carefully and independently, summarize the problems in the experiment and analyze the solutions.

3. Effects

After the implementation of the teaching reform, this three-stage teaching model was found to have significant advantages in the SPOC curriculum, helping to improve students' learning effectiveness and interactive engagement, and providing them with a richer learning experience. In the pre-class preview for the first stage, students will quickly build up their knowledge of the course content by watching instructional videos and completing online tests. This not only provides the students with the opportunity to learn independently, but also helps the teacher understand the students' basic knowledge level, so that they can better adjust the teaching content and difficulty. In-class application in the second stage is the core of the curriculum. By getting students into the actual classroom environment and interacting with teachers and classmates to apply knowledge in hierarchical tasks, students will gain a deeper understanding of the course content. The teacher's role is not just as a knowledge giver, but also as a guide and problem solver of the learning process. This interactive teaching model stimulates students' interest in learning and cultivates their critical thinking and teamwork skills. The internalization after class in the third stage is the consolidation and extension of knowledge. Students not only consolidate their knowledge by reviewing the course content, but can also further expand their learning by asking questions and looking up materials. Such self-directed learning opportunities develop students' self-management and independent learning skills, which are very important for their future career development. The implementation of the teaching reform has brought about a significant positive impact on students' participation and development. Students take an active part in practice, which not only improves their practical skills and application ability, but also cultivates their innovation awareness and practical operation ability. Especially in the Dachuang Practical engineering projects, students' interest has increased significantly, and they have gained valuable practical experience through these projects, laying a solid foundation for their future career development. In addition, the teaching reform has stimulated students' enthusiasm to participate in provincial and national competitions, leading to an increase in the number of participants. These students have performed well in various competitions and won excellent results such as first prizes many times, earning the school a reputation. This is not only good for personal growth, but also builds a shining image for the school and attracts more ambitious students. In general, the teaching reform provides students with more practical opportunities, promotes their all-round development, cultivates their practical abilities and competitiveness, and lays a solid foundation for their future career and academic paths. This is also one of the important goals of the education reform, which has made important contributions to students' success and social progress.

References

[1] Yu YH, Yuan HQ, Chen HF. Research on Effective Model of Online and Offline Mixed Teaching [J]. Heilongjiang Science, 2019, 11(9):34-35.

[2] Li XJ, Wan H, Zhang SY. Analysis and integration of Online and Offline Teaching Models in new engineering colleges [J]. Education and Teaching Forum, 2020,44 (10):286-287. (in Chinese)