Exploration of Multimedia Teaching Mode of Electronic Technology Practice in Smart Classroom

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Abstract. The electronic and electrical experimental course is the most significant part of the engineering teaching of electronic information specialty. Among them, the electronic technology experiment provides a platform for students to transform theory and practice. Responding to the call to stimulate the interest of students and the enthusiasm of teachers in the emerging engineering education, the article explores the model of electrical and electronic practice teaching. The results show that the adoption of smart classroom, an online and offline multimedia teaching mode, combined with open engineering practice teaching cases, can stimulate teachers' teaching enthusiasm, cultivate students' engineering practice ability and innovation spirit, and significantly improve students' ability to solve practical problems and master basic knowledge.

Keywords: electronic technology · smart classroom · multimedia technology · practical teaching mode · emerging engineering education

1 Introduction

Under the comprehensive development of the engineering education certification, higher requirements have been put forward for higher education [1, 2], aiming to adopt multi-dimensional thinking methods and cultivate a number of high-level application-oriented talents of engineering, many scholars have carried out research an innovative education mode for electronic and electrical experimental courses [3–5]. Among them, a research team [6] has introduced the concept of integrating OBE and PAD into the course teaching, achieving the teaching effect of effectively improving the course teaching level and

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students' flexible use of knowledge, indicating that this reform experience and practice of integrating multimedia technology into teaching has made certain achievements. However, there is not enough research on the practical teaching mode application of smart classroom. This new multimedia lecture mode can be student-oriented and help teachers to establish a whole process and three-dimensional effective assessment system.

2 Smart Classroom Teaching Mode

Electronic technology is changing with each passing day, and the society's requirements for high-level talents in the electro circuit field are also increasing [7]. However, the current problem in the theory and practice teaching of electrical and electronic courses for non-electrical majors is that the low compatibility between the theory and practice, and the practical teaching method is relatively simple, which is the key point for students' low learning enthusiasm [8]. Therefore, from the perspective of personalization, diversification and three-dimensional integration of theory and teaching, we propose a practical teaching concept of smart classroom based on multimedia technology. Specifically, on the basis of the online and offline mixed teaching experience in the theoretical classroom, this work focuses on how to construct the online and offline mixed teaching mode during the pre-class, in-class and after-class teaching process in the practical classroom, and how to promote a new mode system for practical teaching of electrical and electronic technology that combines theory and practice closely.

Figure 1 shows the framework of construction the teaching mode in smart classroom. This framework has two characteristics: first, it connects three teaching stages in the practical teaching idea which includes preview, study and review, forming a complete practical teaching system; Second, through the smart classroom, a network teaching platform, the three stages are organically combined to realize the practical teaching mode of electronics and electrical engineering in the smart classroom. Under the teaching mode of the smart classroom, a networked teaching resource for the self-developed experimental platform has been built, which can better strengthen the interaction between teachers and students and share experimental resources.

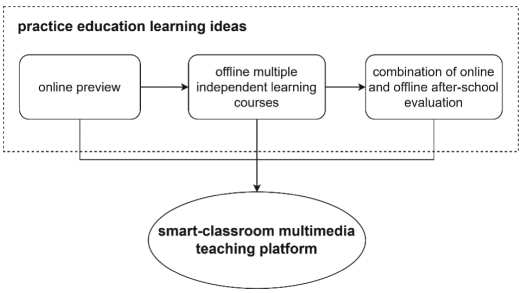

Fig. 1. The core framework of the teaching mode in smart classroom [Self-drawn]

3 Open Subject Case

The effective implementation of smart classroom is inseparable from multi-field integration and open teaching cases. The knowledge of the electrical and electronic technology course is complex and the concepts are highly theoretical, and the high requirements are required for the ability of both theoretical knowledge and practical skills. Therefore, this work takes the electronic technology experimental classroom of the Automation College as an example to explore a new teaching case of open practical courses suitable for smart classrooms. As an interdisciplinary practical teaching course, electrical and electronic technology teaching cases are too simple and have little connection with actual production [9], and with the development and upgrading of the intelligent industry and the continuous innovation of artificial intelligence technology [10], we use multimedia technology to integrate the three aspects of industrial practice, classroom teaching and scientific research results.

Based on the above analysis, we proposed a fusion case of electronic technology experiment course based on the design of emotional change test device using skin resistance. The main content of this case is to design a circuit to represent the changes of different emotions (happy, nervous) by collecting the impedance of the human body through the electrode sensor, and mainly complete the measurement and processing of the skin resistance of the human body. The specific practical process is shown in Fig. 2.

Learned from the chart, teaching is divided into three stages, this kind of completely independent circuit module design maximizes the open design concept and broadens the knowledge of students.

Experimental Process	Experiment Task
Experiment background introduction and preparation	① Find more physiological signals that can represent emotions as possible, understand the inner connection between physiological signals and emotions, and focus on understanding the principles and conditions of use of the galvanic skin response (GSR); ② Understand the working principle of the sensor, and combine the working characteristics of the sensor to select the electrode sheet to obtain the human body impedance signal, and select the signal acquisition part by consulting the generation principle of the human body impedance;
Circuit Design and Simulation Circuit construction and debugging	① Convert the collected non-electrical signal into a voltage signal output, try to use two forms of conventional voltage division and bridge voltage division, and compare the difference in results; ② Select and design different amplification circuits according to the signal characteristics, and compare the amplification effects of different circuits; ③ On the basis of simulation optimization, the acquisition and amplification circuit of electrodermal signal is realized; the human body impedance signal is selected to be displayed and output in the form of voltage change waveform;
Experiment summary and acceptance	① Improve the circuit structure to achieve the goal of fast response and small fluctuation range; ② Write a design summary report, and learn and communicate the characteristics of different solutions through group speeches.

Fig. 2. The chart of teaching reform practice case based on “production, teaching and research"[Self-drawn]

4 The Practice of Electronic and Electrical Engineering Teaching in Smart Classroom

This section takes the automation major as an example to show the practice of students applying the smart classroom teaching mode in the electronic technology experiment course, so as to verify the practicability and effectiveness of this multimedia teaching mode.

4.1 General Teaching Ideas

According to the organization method of the research content, with the combination of theory and practice course Electronic Technology IV and the independent practical teaching course Electronic Technology Experiment 1 as the research and implementation carrier, the overall research plan and technical route of teaching ideas are shown in Fig. 3.

4.2 Online Pre-class Preview Stage

First of all, teachers push preview tasks through the online platform before class, including courseware and pre-recorded small teaching knowledge points videos, to replace handwritten preview reports, it can effectively reduce the phenomenon of students' distraction in offline classrooms. Second, task points have been set on the platform to track students' learning progress and completion. Finally, a pre-class theoretical test is added to give feedback on the students' preview effect, and it will be used as a part of the process assessment of the course. In addition, the test part added in the pre-study stage, the answer is not provided first, and the specific questions fed back by the students can be automatically sorted out through the Xuexitong platform. In this way, students can bring questions to the classroom and mobilize the initiative of students.

4.3 Offline Experimental Teaching Stage

Since students have already learned some basic operations and knowledge points in the experiment in the preview stage, teachers only need to explain key points and difficulties. Thus, increasing the time for students to practice and complete the experiment more effectively. Therefore, in the offline laboratory teaching stage, this research designs two teaching methods, one is for the students to ask questions to the teacher on the spot, and the other is for the teacher to lead the students to review the lesson.

4.4 Online and Offline Post-class Consolidation Stage

At present, after the electronic technology experiment class, the main task is to summarize and write the experiment report. This work will use both online and offline. On the one hand, students need to complete the experimental report; on the other hand, some opening experimental topics have provided to a part of the students. Students design their own experimental contents in the open lab to achieve personalized practical teaching and cultivation of practical innovation ability.

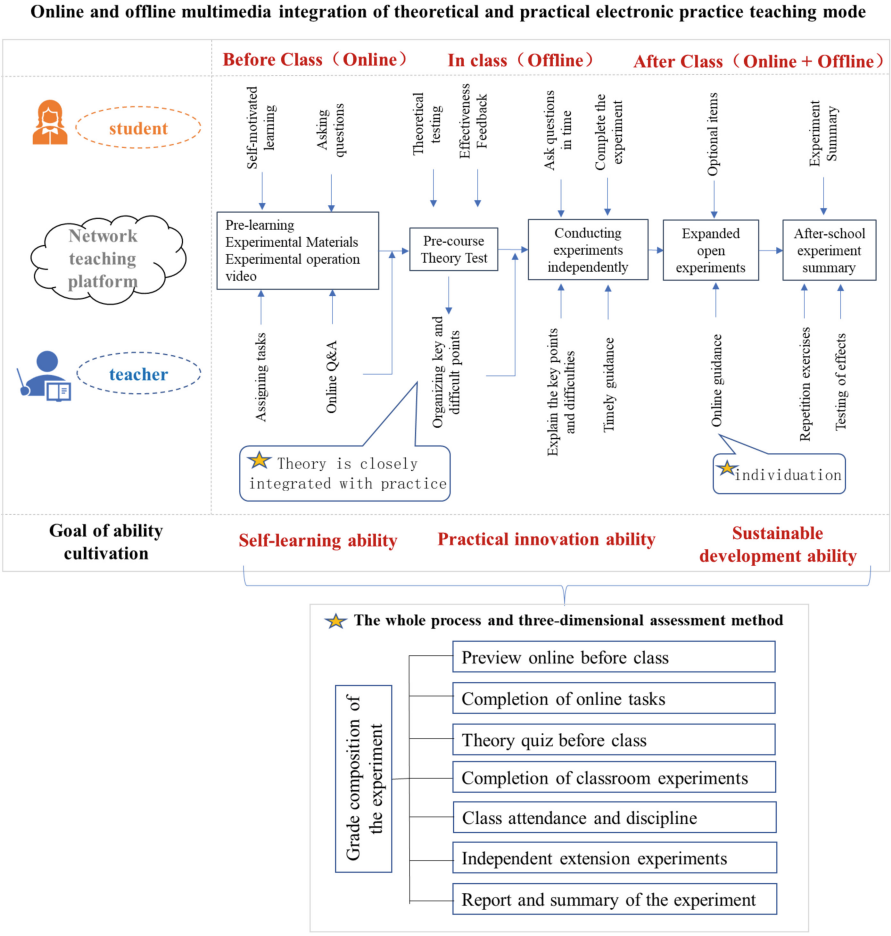

Fig. 3. The overall research plan and technology route of teaching ideas [Self-drawn]

4.5 The Whole Process, Three-dimensional Effective Assessment Method

On the smart classroom platform, the assessment of grades includes the whole process of assessment items such as preview before class, discussion in class, in-class test, homework after class, and attendance. Moreover, new models such as student-student mutual evaluation have been introduced in the evaluation of homework to improve students' enthusiasm in class. The operation effect of the platform is shown in Fig. 4.

In addition, this work also adds an after-class teaching reflection module, and conducts statistical analysis of student assessment and questionnaire data using both after-class test and questionnaire, which is helpful for evaluating the new teaching mode.

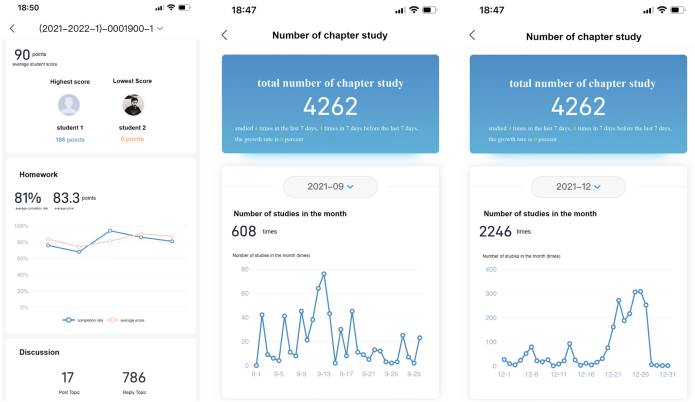

Fig. 4. Screen capture of electronic technology courses on Xuexitong platform [Self-drawn]

5 Conclusion

Our research combines the direction of multimedia technology teaching reform and explores a smart classroom teaching model based on a practical electronics technology course in the electronics and information category. In the teaching process, we guide students from many aspects to strengthen the understanding and application of theory in practice. Simultaneously, students' learning enthusiasm has been improved as much as possible, therefore the goal of improving the teaching effect has been achieved. The construction of this diversified multimedia education mode not only improves the professional skills and engineering practice ability of the overall students, but also provides talents with high comprehensive quality for universities and society.

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