



Research on the Mixed Teaching Mode of Circuit Courses in Zhejiang Higher Vocational Colleges Based on Multimedia Technology

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Abstract. Multimedia computer technology to assist classroom teaching has been widely used. It digitally collects, acquires, compresses/decompresses multimedia teaching information through computer technology, and makes the teaching content have the characteristics of pictures, texts and sounds. Under the new college entrance examination policy, the knowledge structure of most freshmen is mixed with the knowledge of liberal arts and sciences. Students' poor engineering foundation and lack of understanding of basic electrical courses are problems that need to be solved urgently. Under the support of powerful mobile network technology, multimedia technology provides good interactive ability of images and sounds across regions, time and space for the teaching of circuit courses. With the help of graphic image tool software, teachers can simulate simple graphic features to help students understand the changing process of complex circuits, and conduct DC analysis, AC analysis, and transient analysis of circuits. Therefore, this paper deeply studies the multimedia technology, analyzes the characteristics and technical support of the blended teaching mode, designs the appropriate design principles of the blended teaching mode, and designs a teaching activity of the blended mode.

Keywords: Computer Simulation · Multimedia Technology · Circuit Course · Information Technology · Mixed Mod

1 Introduction

Under the new college entrance examination policy, there is a big difference in the combination of subjects among students admitted to the same major. The knowledge structure of freshmen has undergone tremendous changes, and most students have mixed knowledge of liberal arts and sciences [1]. Therefore, the percentage of applicants for physics in these two provinces is slightly higher, while Wenzhou Vocational College of Science and Technology will recruit 6 science candidates from traditional colleges and universities outside the province in 2020. The students in the province rarely have a physics background and have remained at a relatively high level and low level. Students' poor

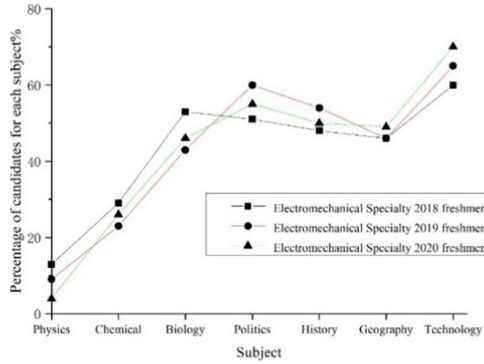


Fig. 1. Percentage of elective candidates for each subject in electromechanical majors in 2018–2020

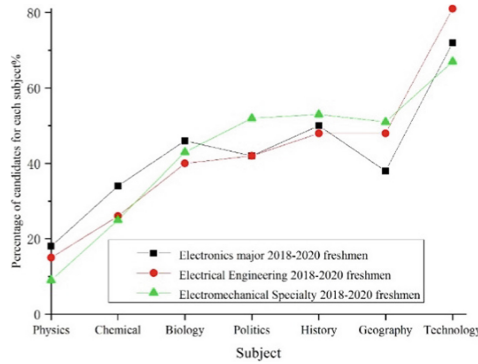


Fig. 2. Percentage of candidates for each subject in 3 majors in 2018–2020

engineering foundation and lack of understanding of basic electrical courses are problems that need to be solved urgently for teachers of basic electrical courses. Percentage of elective candidates for each subject in electromechanical majors in 2018–2020 as shown in Fig. 1.

Percentage of candidates for each subject in 3 majors in 2018–2020 as shown in Fig. 2. According to the survey data in Fig. 2, it is found that electrical automation and electronic information engineering, as traditional electrical majors, recruit slightly more students with physical background every year than electrical majors, but they are not optimistic, accounting for only 1/5 of the total [4]. In general, the number of candidates with physical background in the three electrical majors of Wenzhou Vocational and Technical College is generally low. Candidates from different backgrounds have different foundations and huge differences in knowledge composition. Zhejiang higher vocational colleges are undoubtedly facing great difficulties in requiring physics background majors. Therefore, this paper makes an in-depth study of the teaching mode in this situation [2].

2 Material Simulation Design Based on Multimedia Technology

2.1 Animation Material Production Technology

Electrotechnical sinusoidal alternating current circuit discusses the time domain analysis problem under steady state, requires students to understand the three elements, phase difference and effective value of sinusoidal alternating current circuit; master the representation method and mutual relationship of sinusoidal alternating current. Produced by the frame-by-frame animation production technology in Flash, using sine waveforms and rotating directed line segments to represent sinusoidal animations, dynamically displaying the relationship between rotating directed line segments and sinusoidal waveforms, and helping students master the relationship between phasor representation and sinusoidal waveforms [3]. Teachers use transition animation production technology to dynamically demonstrate the rotation principle of three-phase asynchronous motor, the rotating magnetic field generated by three-phase current, and the rotating magnetic field.

2.2 Simulation Module Design Technology

MATLAB/Simulink includes a power system simulation block set. Using computer simulation technology in the teaching of circuit courses, with the help of simulation software such as ORCAD, EWB, PSPICE, MATLAB/Simulink, etc., help to master the difficulties in learning and achieve good teaching results. The method flow of dynamic system simulation under Simulink includes several aspects. To generate the model block diagram of the simulated system, first open a blank model editing window, then select the required module from the module library browser, and drag it to the editing window with the mouse, draw lines in the editing window to connect those modules, and modify the module parameters of the editing window according to the required parameters to complete the drawing of the model block diagram; then specify the time range to simulate the entire model.

3 Features of Blended Teaching Mode and Technical Support

3.1 Features of the Blended Teaching Model

The blended teaching mode is different from the traditional teaching mode, see Table 1. In the form of teaching organization, the hybrid teaching mode can break the time and space limitations of traditional teaching, and organically integrate open teaching, group teaching and individual teaching. In terms of teaching methods, traditional methods are integrated with information technology, combined with text, pictures and videos to form multimodal teaching. In teaching evaluation, not only focus on summative evaluation, but also on the process evaluation of students [5].

The blended teaching mode expands the time and space of the traditional teaching mode, so that “teaching” and “learning” do not have to happen at the same time and place, creating more learning opportunities for students. For the teaching of circuit courses in higher vocational colleges, through the development of online experimental resources, students can also independently design and conduct simulation experiments

Table 1. Comparison of traditional teaching mode and blended teaching mode

	traditional mode	blend mode
Teaching form	Focus on teachers imparting knowledge, mainly face-to-face teaching	Integrate face-to-face and online teaching to cultivate the ability of the educated in an all-round way
Teaching environment	face-to-face teaching environment	Face-to-face + online teaching environment
Instructional Media	based on real	A variety of types, choose according to your needs
teacher-student role	Main body of teachers, passive acceptance of students	student-led, teacher-led
learning method	One way of learning	multimodal learning
Teaching content	Textbooks and lesson plans	Rich online teaching resources as a supplement
Teaching process	The main method of delivery and reception	Diversified teaching process and mode
Teaching Evaluation	based on summative evaluation	Integrate online and offline to strengthen process evaluation

for many times, first self-reflect, then conduct exchanges, discussions and practice to make a summary, and finally check for leaks through various channels fill in the gaps and consolidate knowledge.

3.2 Mixed Teaching Model Technical Support

The design of hybrid experimental teaching must integrate the online environment with actual classroom teaching, take advantage of the respective advantages of online and offline modes, systematically and structurally organize teaching content, design experimental teaching resources, teaching interaction and teaching evaluation, enable students to learn independently, complete relevant tasks and activities, and achieve the teaching objectives of the course [6].

Smartphones and computers are highly popularized in today's society. With the continuous development of information technology, a series of online interactive learning platforms have been gradually derived from mobile terminals, such as large-scale open online courses: WeChat, "MOOC", MOCC, Rain Classroom Wait [7]. At the same time, some virtual experiment APPs have been gradually developed, such as NOBOOK virtual demonstration experiment, virtual experiment, Multisim, etc. Compared with other software, Multisim has obvious advantages: browser-based, without any software installation; compatible with Mac OS X, iOS, Android, Windows and Linux operating systems, running in any terminal; industry standard SPICE model; Editable at runtime, and real-time feedback of simulation status; cloud-based digital community, shared circuits, and collaborative learning. Therefore, after comparison, WeChat is finally selected

for online teaching, and Multisim is selected for online experiments, which can meet the current teaching needs.

4 Design Principles of Blended Teaching Mode and Teaching Case Design

4.1 Design Principles of Blended Teaching Mode

- 1) *purpose principle*. The design of online courses must be linked with actual classroom teaching and serve the teaching objectives of the course. Based on specific teaching objectives, teaching resources, teaching evaluation and teaching interaction are designed, and students conduct autonomous learning based on online courses [8]. Activities related to classroom teaching should be carried out around the teaching objectives of the course.
- 2) *Double principal principle*. The “dual main” instructional design is the product of the combination of teaching-centered and learning-centered instructional designs, both in terms of theoretical basis and practical design methods.
- 3) *3R principles*. The 3R principle of blended teaching refers to: blended teaching should design suitable learning time and suitable teaching blending mode for learners. The first R is Right Time, which means that the teaching time should be appropriate; the second R is Right Mix, which means that the mixing method should be appropriate, according to different teaching contents, using different mixing methods; the third R is Right Audience, which means that the teaching object should be appropriate, and it should be mixed according to the ability of the teaching object. In a word: blend instruction at the right time, with the right blend, for the right students.
- 4) *Khan Octagonal Structure*. Badurl Khan proposed an octagonal model to guide the design of blended instruction, as shown in Fig. 3. The main factors are: teaching institution, teaching elements, teaching technology, interface design, evaluation, management, resource support, ethics. It can be seen from the octagonal structure model that various factors can affect the final effect of blended teaching. Khan’s octagonal structure model can guide the design, development, implementation, management and evaluation of blended instructional courses.

4.2 Mixed Teaching Mode Case Design

The blended teaching process mainly includes four steps: (1) According to the learning situation analysis theory, do a good job of learning situation analysis of the learners, set the teaching objectives according to the level of the learners, and achieve hierarchical teaching. (2) On the basis of learner analysis, make teaching plan and teaching progress based on learner characteristics, and design evaluation strategies. (3) Select the appropriate teaching media and online learning platform, develop and deploy various forms of teaching resources on the platform, and design the interaction between students and the media. (4) According to the teaching progress and teaching plan, teachers should monitor and track students’ learning, conduct formative evaluations on each stage of

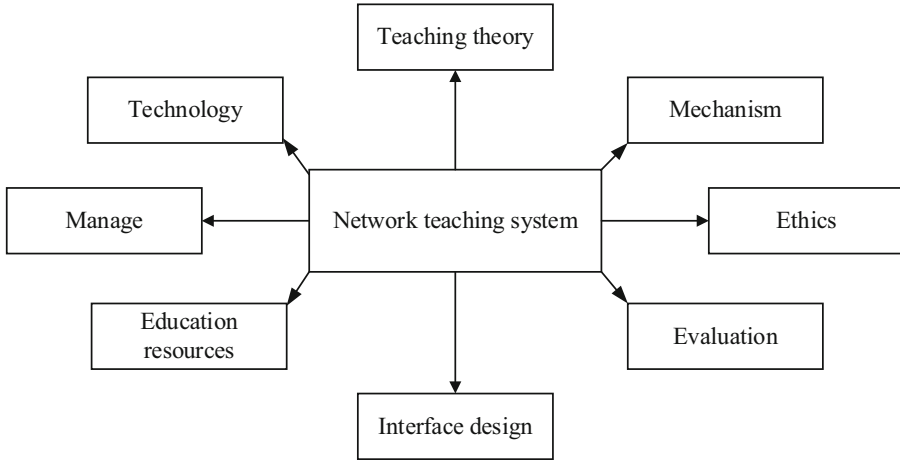


Fig. 3. Khan Octagonal Structure

teaching, and finally conduct summative evaluations to determine that the final effect of blended teaching has reached the plan set in the previous stage.

In the teaching of higher vocational colleges, we should create a convenient, active and effective learning environment for students. Provide adequate learning resources for learning activities (traditional classroom instruction and online learning) in this learning environment. Based on the ADDIE instructional design model, this study proposes a hybrid instructional design model, as shown in Fig. 4.

1) *Front-end analysis.* This paper mainly analyzes the characteristics of learners, and designs teaching courses according to the characteristics of learners. Learner characteristic analysis refers to people who have acquired knowledge or skills through reading, listening, thinking, and doing. After studying in middle school, college students have mastered a certain theoretical basis and hands-on ability. However, at present, the physical foundation of students majoring in electrical engineering in higher vocational colleges is generally weak.

Learning content refers to the knowledge, skills and experience that the educated acquire through systematic learning. When clarifying the learning content, we should focus on the characteristics of the educated, meet the needs of the educated, consider all aspects of the level that the educated should achieve, and determine the depth and breadth of the content. The steps of learning content analysis generally include: selecting organizational units, determining Unit learning objectives and identifying learning tasks. After analyzing the basic circuit course, this paper divides it into three parts: basic knowledge, classroom experiment, student group experiment and extracurricular project research.

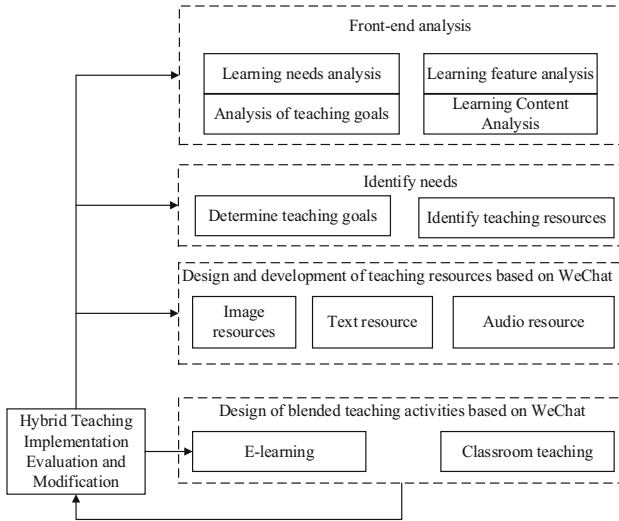


Fig. 4. Design of blended teaching mode supported by online courses

2) *Design of blended teaching activities based on online courses.* Wechat-based blended teaching activities include two levels of content, namely formal learning in classrooms and informal learning after class. Specifically, it can be regarded as a mixture of traditional classroom teaching and online learning supported by the WeChat public platform. Before the formal learning in the classroom, students independently learn preparatory knowledge through the WeChat platform to prepare for classroom teaching; in classroom teaching, teachers impart theoretical and systematic knowledge to students through face-to-face lectures, and assign online learning tasks to students, students can obtain learning support from the platform during learning; after classroom teaching, students complete the learning tasks assigned by teachers. Online learning supported by the WeChat public platform can be used as an auxiliary means of classroom teaching. Students use mobile phones to conduct autonomous learning and participatory learning, so that they can grasp, deepen and expand the knowledge learned in the classroom in a timely manner.

The design process of mixed teaching activities based on WeChat is shown in Fig. 5, which can be described as teachers design teaching activities according to teaching objectives, set activities tasks and push the tasks to students through WeChat; students prepare for pre-class teaching after receiving learning tasks, learn the preparatory knowledge and complete the preparatory tasks; in classroom teaching, teachers explain the knowledge points according to the preparatory tasks completed by the students, and assign the learning tasks to be completed after class; students complete the learning tasks in their spare time, and revise them according to the completion of the final tasks and improve the activity goals, cycle.

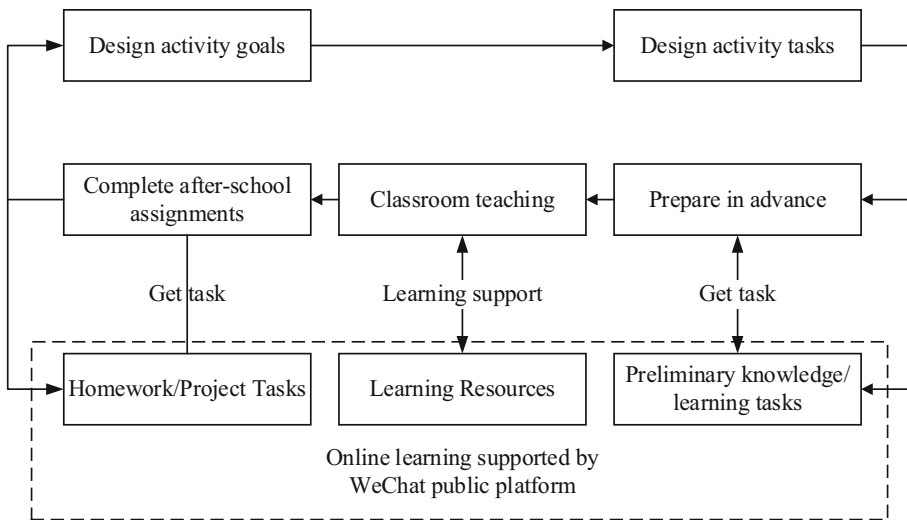


Fig. 5. Flow chart of blended teaching activity design

5 Conclusion

As a compulsory course for electronic, electrical and information majors in higher vocational colleges, the basic circuit course requires students to master basic theoretical knowledge and basic operational skills on the one hand, and on the other hand, to cultivate students to master the learning methods of professional courses. Complete the transition from secondary school to university. The teaching of electrical and electronic technology courses in higher vocational colleges should keep pace with the times, take the current problems as the guide, actively explore teaching reform, improve students' professional quality and practical ability, and cultivate more and better professional and skilled talents for the society.

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