

Exploration on innovative path of experimental teaching of electronic circuit course in colleges and universities

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Abstract: In the Internet era, the demand for applied and innovative electronic communication talents is increasing. How to promote the reform of electronic circuit course experimental teaching, help students understand the course knowledge in practice and improve their practical ability has become the key issue for colleges and universities to improve the quality of electronic circuit teaching. This paper takes the electronic circuit course in colleges and universities as the research object, starts with the big gap in experiment progress, the single form of experimental teaching and the large consumption of experimental teaching resources, expounds the existing problems in the experimental teaching of electronic circuit course, and focuses on the development of micro-class experiment video, the design of stratified experiment in the course, the introduction of virtual simulation practical training and the optimization of experimental teaching assessment. To explore the innovative path of experimental teaching of electronic circuit courses in colleges and universities.

Key words: universities; Electronic circuit; Experimental teaching; Innovation; Path

Introduction

In the era of Internet and Internet of Things, the electronic communication industry has obtained unprecedented development opportunities. With the development of electronic information and communication technology in the direction of digitalization and intelligence, the electronic information and communication industry has an increasing demand for innovative and application-oriented talents, which requires colleges and universities to attach importance to the position of engineering experiment teaching in personnel training, and vigorously train college students' practical operation ability, comprehensive research ability and innovation ability. Among the majors of electronic communication, electronic circuit is a basic experimental course. Based on the experiment of electronic products, this course contains difficult and extensive knowledge, such as circuit simulation and debugging, software design, electronic circuit design and other modules. Students are required to consolidate the theoretical foundation of circuits in advance. To understand the use of electronic circuit instruments, experimental procedures and safety precautions, basic experimental methods, and participate in experimental activities such as circuit scheme design, safety and debugging. Through the scientific design of electronic circuit experiment activities, teachers can integrate experimental teaching resources and practical training activities, build an integrated teaching mode, stimulate students' interest in learning and applying theories, make them use electronic circuit knowledge, constantly analyze and solve problems, and simultaneously exercise their knowledge understanding ability and comprehensive practical ability, laying a foundation for learning professional core courses.

I. The problems existing in the experimental teaching of electronic circuit courses in colleges and universities

In the long-term experimental teaching, through the analysis of students' participation, teaching methods and experimental resources, we find the following problems in the experimental teaching of electronic circuit course

1. There is a big gap in experiment progress

In the training program for electronic communication professionals, the electronic circuit experiment course belongs to the professional basic course, and teachers usually carry out this course in the freshman year. The electronic circuit course is often the first professional basic experimental course that freshmen come into contact with after admission. Under the background of college enrollment expansion, the number of engineering majors is increasing day by day, coupled with the differences in the level of high school education and assessment in different regions, the ability of freshmen to understand experimental principles is also very different. For the same experimental teaching content and design principle, some students can easily understand and master, while some students can hardly keep up with the overall experimental teaching progress. At the same time, in the whole engineering professional system, electronic circuit courses are abstract and practical. Because students are still in the stage of understanding engineering principles, they fail to establish mature engineering concepts and cannot skillfully use theoretical concepts to solve practical problems. In particular, in the nonlinear circuit module of the electronic circuit course, in the face of some abstract physical phenomena, some students still analyze problems according to linear thinking, falling into thinking difficulties, and it is difficult to prepare for experimental learning.

2. The form of experimental teaching is single

In the course of electronic circuit, teachers usually follow the conventional experimental teaching mode and the process of teaching, demonstration and practical operation. Students are required to observe the teacher's experimental demonstration process after understanding the course theory, and complete the verification experiment activities independently. In the experimental teaching activities, some teachers directly use the experimental box, organize students according to the experimental steps and experimental schematics, explore the way of wiring, let everyone connect the line, record the experimental data and phenomena, less let students intuitively observe and understand the

components of the experimental panel, can not fully cultivate students' ability to design circuit diagrams and processing circuits. At the same time, in the engineering curriculum arrangement, some schools fail to coordinate the theory and practice teaching hours, do not pay attention to experimental teaching, experimental teaching management is relatively loose, resulting in students do not pay attention to the experiment preview, only the experiment as the process of verifying the theory, ignoring the experimental principle and theoretical calculation, less preview of the experiment content. In the experimental activities, some teachers fail to pay full attention to the students' experimental situation, organize independent experiment and cooperative experiment activities, and it is difficult to mobilize the students' enthusiasm for experimental operation, resulting in experimental teaching becoming a mere formality.

3. The consumption of experimental resources is large

The electronic circuit course experiment is based on electronic products, and the school needs to allocate a large number of components and experimental operation resources according to the number of students. Although many colleges and universities have equipped multi-functional experiment boxes to support teachers and students to carry out diversified experiments, some experiments still require colleges and universities to introduce advanced experimental operation materials. In the experimental teaching of electronic circuit, due to the gap in students' experimental understanding ability and hands-on operation ability, when using components to design and build circuits, experiments often fail and consume a lot of experimental resources for various reasons.

II. College electronic circuit course experimental teaching innovation path

1. Develop micro-class experiment videos to improve the effect of experiment preview

Before the experiment teaching of electronic circuit course, few students have the habit of preview, most of them do not understand the experiment specification, instrument use and experiment content, and are prone to encounter a series of problems in the experiment. First of all, according to the characteristics of experimental courses and the needs of students, teachers should integrate experimental safety norms, experimental environment, instrument use, basic experiments and other teaching contents, record demonstration videos in the way of live broadcasting, and update the experimental resources of micro-classes at any time according to the experimental teaching progress, so as to visually present the content that is difficult to be described in words. On this basis, teachers can edit experimental teaching pictures and key points, create high-quality micro-class experiment videos, and upload the videos to the teaching website, so that students can make full use of a few minutes outside class to watch micro-class auxiliary videos, quickly understand the basic requirements and key points of the experiment, and lay a foundation for exploratory and innovative experiments in class. Secondly, according to the experimental teaching content of electronic circuit course, teachers can reasonably develop self-preview micro-lessons and carry out flipped classroom experimental teaching activities. In online activities, teachers can push micro-class experiment resources, assign independent investigation and design tasks, let students use extracurricular time to watch the experiment background and requirements in micro-class in advance, use the Internet to investigate related circuit diagrams and parameters, carefully use theoretical calculus, and encourage students to try to design circuit frames and circuit diagrams. To bring practical, reasonable and feasible circuit schemes into the class. In offline experiment activities, teachers can organize students to introduce the overall design scheme, guide them to analyze small functional modules, judge whether the parameter configuration of each circuit component is reasonable, and carry out cooperative exploration activities along the trend to help students adjust the design block diagram and design a scientific and stable circuit. In the micro-lesson and flipped classroom mode, students can observe the prominent micro-lesson content, preview the experimental learning content in an orderly manner, sort out the experimental operation process, make sufficient preparation for investigation and research, and improve the preview effect.

2. Design stratified curriculum experiments to exercise practical and innovative ability

The experimental teaching effect of electronic circuit course is closely related to the teaching form of teachers. Teachers should break through the teaching mode of teaching + demonstration, design stratified and scientific experiment activities, assign verification experiment tasks, comprehensive design experiment tasks and open experiment activities. First of all, teachers should design confirmatory experimental activities according to students' needs of consolidating theoretical knowledge and training basic experimental ability, focusing on leading students to understand the use of experimental instruments and cultivating their interest in experimental operation. In the teaching of confirmatory experiments, teachers can give full play to the advantages of micro-class resources and Internet platform, publicly display the standard use methods, experimental skills and experimental processes of experimental instruments, let students learn and explore the way of circuit connection, complete the simulation and practical training tasks, verify the experimental conclusions, and make them deeply understand the theoretical knowledge. Secondly, for the students who successfully complete the verification task, the teacher can publish the comprehensive design experiment task, so that the students can contact the circuit knowledge principle and experimental method, and learn to design the circuit. In the comprehensive design experiment teaching, teachers can adopt the project-driven experiment teaching mode, combine the experimental requirements and experimental materials, lead out the experimental operation project, and require students to analyze, think and undertake the project task in the form of a two-person team, and cooperate to complete the circuit design, experimental steps, experimental phenomenon record and other tasks. In the process of exploring and designing the circuit, students can actively exert their subjective initiative, explore the circuit diagram design method with their peers, repeatedly verify the rationality of the circuit design, and exercise their practical ability and theoretical application ability. In addition, teachers can design open and innovative experiment activities, rely on university experiment projects, carry out electronic design competitions, and guide students to research and explore electronic circuit application methods. In the implementation process, teachers can make use of school and social resources to guide students to choose interesting project research topics, carry out innovative experiment activities individually or as a team, and cultivate their

comprehensive design ability and innovation ability.

3. The introduction of virtual simulation training to ease the pressure of practical funds

In the era of rapid development of information technology, virtual simulation software and platform have been used in engineering experiment teaching. With the help of virtual simulation software and system, teachers can break through the restrictions of fixed hardware resources and site conditions, organize virtual simulation practical training activities, so that every student can participate in the experiment activities, and use the process recording function of virtual platform to guide everyone to observe and reflect on their own experiment process. In the experimental teaching of electronic circuit courses, teachers can introduce professional virtual simulation software and simulation experiment workbench, so that students can use the virtual software function, freely use a variety of components, and drag the components on the test circuit board. In the simulation operation, students only need to gently click out the table, they can obtain the connection of each circuit component, simulate the circuit situation consistent with the physical object, and intuitively understand the circuit characteristics and data. In the specific teaching process, the teacher should systematically explain the experiment requirements, content and principle, so that students are familiar with the basic theory and the function of virtual simulation software; Second, to guide students in the use of virtual software, according to the idea in mind, design virtual circuit, and according to the problems encountered in the experiment, repeatedly debug the virtual circuit; Third, students should complete the hardware design and welding experiment tasks according to the simulation experiment results. Under the virtual simulation training environment, teachers can not only lead students to complete the experiment tasks with long period, high danger and complexity, but also enable students to actively interact with the virtual software, discover and solve circuit problems in time, cultivate their scientific and rigorous experimental attitude, and save experimental teaching resources.

4. Optimize the experimental teaching assessment and improve the comprehensive practical ability

In order to comprehensively test the experimental teaching effect of electronic circuit courses, teachers should establish a process experiment management system and a diversified assessment system, from tracking students' experimental preview to evaluating the final experimental results, so as to arouse students' attention to experimental learning and experimental process. In the electronic circuit experiment assessment results, teachers can design daily teaching assessment and experiment assessment results, the ratio of the two is 3:7, the former assessment indicators include online preview, student attendance, experiment design, experiment summary, etc., the latter includes the application and arrangement of experimental instruments, circuit design, troubleshooting and so on. In the experiment assessment, teachers can design selective and extractive circuit experiment tasks according to students' conditions, requiring students to select experiment numbers by themselves or randomly, and complete the experiment operation independently. On this basis, teachers can guide students to participate in the campus project, robot competition, electronic design competition, etc., the results of extracurricular practical projects into the assessment system, and comprehensively improve students' comprehensive practical ability.

III. Concluding Remarks

To sum up, the promotion of experimental teaching reform of electronic circuit courses is related to students' ability to transform theory into practice, the cultivation of scientific rigorous experimental attitude and basic practical skills, and the development of innovative ability. Therefore, teachers should combine the requirements of new engineering for electronic talents with the characteristics of electronic circuit courses, innovate the organization of experimental teaching by developing experimental videos for lesson preparation, designing layered experiments in courses, introducing virtual simulation practical training, optimizing experimental teaching assessment, etc., stimulate students' enthusiasm for experimental learning and scientific inquiry, and cultivate their awareness of experimental inquiry and comprehensive practical ability. To improve the experimental teaching quality of electronic circuit courses.

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