



Research Article

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Study on teaching mode of electronic technology experimental curriculum based on interdisciplinary perspective

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ABSTRACT

This paper discusses some problems existing in the interdisciplinary electronic technology experimental teaching of some common local undergraduate colleges, explores teaching reform aiming at teaching content, teaching methods and evaluation mechanisms, and summarizes some feasible countermeasures. By taking the designing and guiding process of experimental project "Manufacturing and Debugging of DC Stabilized Power Supply" as an example, this paper specifically illustrates how to develop and implement experimental teaching method of project leading mode by applying simulation technology, to improve the cultivation quality of technical talents, and improve students' thinking innovative spirit and practical ability.

Key words: Electronic technology, interdisciplinary, experimental teaching, project leading mode

INTRODUCTION

With the development of science and technology, China has put forward new demands for high-tech industrial upgrading. The decision of the State Council on accelerating the development of modern vocational education points out that we should guide a number of common undergraduate colleges to transform into applied technology colleges, and focus on organizing undergraduate vocational education. Current local governments, educational administrative departments, industries and enterprises, universities and research institutions have reached broad consensus on the transformation development of local undergraduate colleges, which requires that the local undergraduate colleges should pay more attention to the cultivation of innovative and practical talents. In accordance with the deepening reform of universities and the requirements of developing the transformation to application university, conducting teaching reform, research and innovation toward the application method of interdisciplinary penetration and overlap have become an inevitable trend, so the construction and development planning of experimental teaching must also conform to and serve this trend. When planning an experimental project, how to reasonably and effectively transform the superior resources of multiple disciplines and academic achievements into teaching resources of undergraduates, to contribute to the cultivation of inter-disciplinary undergraduate talents has become a problem to be faced for experimental and teaching staff. Electronic technology is the foundation course to cultivate talents on mechanical and electric. Electronic technology experiment is a training means to impart basic knowledge related to electronic technology and theory and technique related to electronic engineering, thus having important significance on cultivating the basic qualities and innovative ability of students^[1]. By taking the designing and guiding process of electronic technology experimental project as an example, this paper specifies how should laboratory integrate interdisciplinary advantages, combine electronic technology resources and deepen teaching reform to make an attempt on improving the cultivation quality of technical talents.

PROBLEMS EXISTING IN THE EXPERIMENTAL TEACHING OF INTERDISCIPLINARY ELECTRONIC TECHNOLOGY

2.1 Numerous Majors Facing Students, Large Differences Among Majors, Lack of Theoretical Basis
Experimental teaching of electronic technology is not only closely related to the mechanical and electrical majors,

but also plays an important role in improving the overall quality of students who do not major in electric. Electronic technology experimental teaching of common local undergraduate colleges not just includes all electrical majors, but also face many non-electrical majors, such as computer science and technology, applied chemistry, physical education, historic culture, life science, music, art, Chinese literature and so on. Even electric involving majors also have a slightly different professional basis, however, non-electrical majors have even greater differences, among which the school bases are not the same. Therefore, the same teaching methods are insignificant for the students of electric involving majors, but have obvious differences for the students of non-electrical majors. For the same teaching methods, some students of non-electrical majors collectively express that there are difficulties, which reduce the participation enthusiasm of some students for experimental curriculum[2].

Some students of non-electrical majors, at the beginning of electronic technology curriculum, lack relevant theoretical basis, and cannot fully understand the principles of electronic technology experimental projects, increasing the difficulty of completing the experimental project. Especially for students of non-electric majors, their courses of electric type are reduced, and theoretical chapters related to experiment almost have no explanation, which greatly affects the process of electronic technology experiment. What's more, process of electronic technology experiment cannot be explained in the first few theory introductory lessons.

2.2 Experimental Teaching Process Lacks Differentiated Education Mode

The purpose of electronic technology experiment is to establish students' engineering quality foundation and cultivate students' innovation ability. For the students of same electric majors, there are also differences in their ability and their self-learning enthusiasm, but the teaching mode of current electronic technology experiment is limited to a few basic items, such as single-stage common-emitter amplifier, emitter follower, differential amplifier, negative feedback amplifier circuit, integral and differential circuit, basic operational amplifier, power amplifier and some other regular projects, to meet the basic teaching of a majority of students. A small number of students with ability do not have more choices, limiting the cultivation of innovative talents.

2.3 Backward Experimental Evaluation Mode

In the current experimental teaching evaluation of electronic technology, teachers mainly apply the mode of checking experimental circuit, experimental works and lab reports, and of course attendance record also occupies a certain proportion. However, there is a serious shortcoming of this evaluation mode. Due to higher number of people conducting experiments, teachers cannot take the specific circumstances of each student's experiment into account, leading to the frequent occurrence of students working for each other. In addition, the early failure of electronic components as well as the occurrence of some causal factors cause differences in the function of experimental work, resulting in students' query on the fairness and objectivity of scoring for the experimental process

REFORM OF INTERDISCIPLINARY ELECTRONIC TECHNOLOGY EXPERIMENTAL TEACHING MODE

To solve the problems found in the earlier stage of the experimental teaching reform of electronic technology, a series of targeted methods are applied. For too many students in the experiment and the complicated situation, reform of teaching content is carried out, improved and innovative experimental projects are introduced into the curriculum system of electric involving training and the training classes of electric involving majors are increased. For students of non-electrical majors, the training content mainly focuses on basic or even science-type projects, and the training time is controlled within 20 hours on the premise of guaranteeing the basic practical teaching tasks. And this is consistent with the training objective of the two categories of students, and also ensures the teaching time of large-scale training.

3.1 Simulation Technology

Simulation technology is to solve problems of relevant theoretical basis, and to make teaching content fuller and more vivid. Modern technology and advanced teaching and experimental methods are applied, information education technology and network resources are fully applied, computer-aided experimental teaching software and multimedia experimental teaching courseware are used, experimental techniques like virtual simulation are promoted to application, experimental time and space are expanded, and a virtual platform is introduced as preview assistance at the earlier stage of experiment. EWB is introduced as simulation platform, simulation software and tutorials to create a virtual circuit are copied to the students receiving training before the experiment. Through the earlier stage of simulation process, students can better understand the principles and the matters needing attention of training projects, which greatly reduces the component losses in the training process, but also improves students' interest in learning and self-learning ability^[3].

3.2 Project leading Mode

The curriculum applies the teaching method of "Project Leading Mode" which breaks the past traditional teaching

mode. In the implementation of project leading mode, the design of teaching process cannot just focus on knowledge, but conduct project planning and management by combining the characteristics of students^[4]. The entire process of teaching is to have students completing specific project tasks as teaching center, to make teaching target more clear-cut, to train the students' divergent thinking, to help attract students to actively participate in the design exploration, and to have a wider range of topics. Students can propose the ideas and programs to complete the project under the leading of the motivation to complete project tasks and through the analysis and discussion on project tasks. And students can collaborate with each other, conduct exploration and complete the project under the guidance of teachers. Thus, students are given more responsibility in the learning process, prompting them to focus on their success of study and work. In the exploring process of solutions to problems, students' ability to work and ability to solve practical difficulties are improved.

TEACHING CASE

4.1 Manufacturing and Debugging of DC Stabilized Power Supply

The basic task of DC stabilized power supply is to transform the power grid AC voltage into the stable DC supply voltage required by electronic equipment. DC stabilized power supply is widely applied in electronic products, and the design of the project can be close to the students life. The DC stabilized power supply products debugged can be given to students as prizes, to stimulate their interest and desire for knowledge^[5].

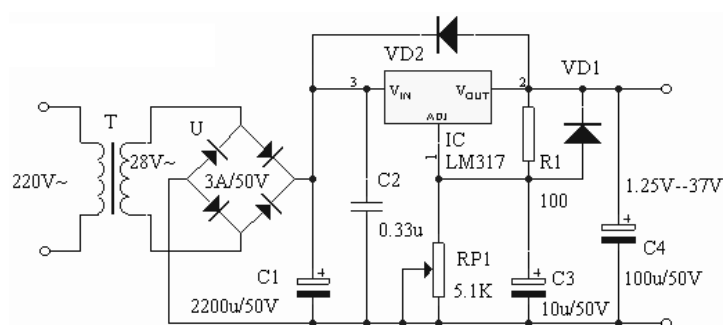


Fig. 1 Adjustable DC Stabilized Power Supply

First phase, in order to complete project tasks, students must learn to see DC stabilized power supply circuit diagram shown in Figure 1, grasp the basic concepts of current and voltage, master the features and basic applications of some common components like resistors, capacitors, inductors, transistors, three-terminal regulator module (LM317) and so on, skillfully use welding technology, and use common instruments^[6]. Teachers and students together complete the testing and evaluation of task, and analyze and manage the problems arising. Second phase, to draw a block diagram through task analysis and student data, and design the following electronic circuit according to the technical specifications and requirements of the DC stabilized power supply: transformer T is used to isolate 220V AC and lower it to low voltage, followed by bridge rectifier circuit combined by four diodes, the one-way electrical conductivity of diode is used to transform low-voltage alternating current into unidirectional pulsating DC, and then the features that the voltage of the two sides of capacitor C1 cannot change abruptly, block DC and run AC are used to filter AC components in unidirectional pulsating DC, and finally three-terminal regulator module (LM317) is used to stabilize the output voltage variation caused by power grid voltage fluctuations and load variations. Third phase, EWB simulation platform is used to conduct simulation experiments for DC stabilized power supply circuit, and the experiments are simulation testing experiment of transformer voltage lowering, simulation testing experiment of full-wave bridge rectifier circuit, simulation testing experiment of capacitor filter circuit, and simulation testing experiment of adjustable voltage regulator circuit respectively. Through the earlier stage of simulation process, students can better understand the principles and matters needing attention of training projects, which greatly reduces the component losses in the training process, but also improves students' interest in learning and self-learning ability. Fourth phrase, making PCB board by hands, and install adjustable DC stabilized power supply. Fifth phrase, debugging adjustable DC stabilized power supply, and excluding the failure of adjustable DC stabilized power supply.

4.2 Experimental Evaluation

This case can complete the teaching task perfectly, and the teaching effects are good. Applying experimental teaching method of project leading mode can firstly let the students' interest and motivation be significantly improved, and students can conduct learning while practicing in the task completing process to play their initiative; secondly, to enhance students' subject consciousness, and their comprehensive application ability and creativity get a very good development, and also conduct self-exploration.

Project leading experiment applies performance assessment method to evaluate the experimental ability of students; experimental teaching process based on performance assessment, in the experimental teaching process of project leading mode, through the experimental operation of manufacturing and debugging of DC stabilized power supply, observes students' performance, and knows whether students' learning level can meet the learning outcomes that the teacher expects, while this judgment also provides help for teachers to adjust teaching strategies and optimize teaching process. Applying performance assessment, the students are considered as participants in the construction of meaning, rather than the recipients of dispersed knowledge, which helps improve students' practical skills. In the implementation process of project design, the implementation progress of various groups, individual related reports, the overall level achieved by analysis team and the role played by individual members in the course of project implementing are evaluated, combined with the results completed by the project, the realization level of each student can be scored more objectively, and the achievement of students with positive performance and good ability will be more prominent.

CONCLUSION

Electronic technology experiments are both the basis to cultivate electric involving talents and one of main ways to improve the engineering talent of non-electrical talents. We summarize the problems arising in electronic technology experimental teaching, propose a series of methods including reforming teaching content, introducing a virtual platform, using project leading experimental teaching method and improving the assessment mechanism to effectively solve some problems before, and provide a new way of thinking for the teaching reform of cultivating interdisciplinary and compound undergraduate technical talents

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