Reform of Experimental Teaching of Electronic Technology under the Background of Engineering Education

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ABSTRACT

With the requirement of engineering education professional certification, electronic technology experiment teaching of our school, is based on project teaching mode, takes the students-centered, the problems existing in the original experimental teaching are deeply studied, carries on the reform from three aspects of experimental content, teaching mode and experiment scores evaluation system. In particular, the setting of comprehensive designing experiment, for training the students' innovation ability and the ability of engineering design and comprehensive application, to developing students' practical ability in installation, debugging and practical application, have played an important role.

KEYWORDS
Electronic technology, experimental teaching, engineering education, teaching reform

INTRODUCTION

Professional accreditation of engineering education refers to the special accreditation of professional engineering institutions for the implementation of Engineering Education in higher education institutions. The core of engineering education professional certification is to confirm that the engineering graduates meet the established quality standard requirements of the industry. It is a kind of conformity evaluation based on training objectives and graduation export requirements [1-4]. Since 2013 China formally joined the most authoritative international certification engineer system in the "Washington Accord"[5,6], colleges and universities actively adopt international standards, construction of quality monitoring system of Higher Engineering Education in China, to further improve the level of internationalization of China's higher engineering education and the quality of personnel training[7,8].

The course of electronic technology is an important basic course for mechanical and electrical majors. The course includes the two part content that analog and digital electronic technology, the characteristics of the course is a wide range of knowledge of the course content, information, practicality and applicability, plays a vital role in the whole university stage of learning, is a bridge between basic courses and specialized courses.
The electronic technology course focuses on developing students' ability to spot problems and solve problems. Therefore, the reform of the basic experiment of electronic technology meets the requirements of engineering education.

THE DISADVANTAGES OF THE ORIGINAL EXPERIMENTAL TEACHING SYSTEM

Electronic technology courses are generally set in the second grade or the third grade undergraduate first semester, this stage, students do not get in touch with the specialized courses, electronic technology is a change from basic courses to specialized courses, so this stage of student learning, need to step by step from theory to engineering, not accomplish at one stroke. The experimental courses of electronic technology offered before of our school are many for verification experiments. They operate on the experimental cases according to the instructions of the teachers, observe the experimental phenomena and measure the experimental data. This kind of experiment can make students have a perceptual knowledge of the theoretical knowledge, but there are also serious deficiencies.

From the angle of training applied talents, the shortcomings include: 1. Experiment is the auxiliary link of theory course, teachers and students do not really pay attention to the important role of experimental teaching in the whole teaching system. 2. The content of the experiment is obsolete, the main is confirmatory experiments, comprehensive and design projects accounted for a small proportion, students can’t use knowledge to analyze problems and solve problems, and can’t arouse students' interest in the experiment. 3. In order to train innovative talents, colleges and universities invest a lot of money in the construction of laboratories. However, while upgrading the hardware, the corresponding software facilities have not been updated. 4. The lack of "occupation", the experimental teaching content and the future work has almost no direct contact, resulting in a lot of students after graduation to enter the enterprise is almost from scratch. While many foreign application-oriented universities, the experimental content they provide is always in keeping with the development of science and technology, so that it allows students to quickly become familiar with new fields when they come into their work, and the experimental textbook includes new technology in different fields.

CONTENT OF THE REFORM

In order to meet the requirements of international engineering education accreditation standards, electronic technology reforms the experimental teaching of electronic technology from the aspects of experimental content, experimental teaching mode and evaluation standard of experimental results.

Constructing a Layered Experimental Teaching System.

Students' learning degree and learning ability are uneven, so the experimental setting should adhere to the principle of learn in order to practise. The students with poor foundation should take the verification experiment as the main part, have a good grasp of the lap of the experiment circuit, the use of experimental equipment, the
verification of knowledge points, and have a profound understanding of the relevant theory about the experiment, truly integrating theory with practice. The students with better foundation require flexible use of the knowledge they have already learned to carry out the plan and feasibility studies of the comprehensive and designing experiments, focusing on training students' scientific research accomplishment, knowledge and skills. On a given design topic, students are encouraged to choose different design solutions according to their own abilities and interests. And more capable students, encouraged to carry out depth development, can use the knowledge not learned to design, or increase the difficulty of experiment requirements, put forward higher design requirements.

**Optimization Experiment Project.**

Most of the previous experiments are replication experiments, and the proportion of comprehensive design experiments is very small. The comprehensive design experiment project has the characteristics of research, conformability, openness and extensibility, so in the content settings, we give consideration to the knowledge point’s coverage and expand in the relevant course, the grasp the degree of difficulty, and focus on progress step by step, strive to achieve theory with practice.

Considering the basic experimental skills of sophomore is weak, with little experience, unable to carry out comprehensive experiments directly, we will focus on a number of simple knowledge, set up a simple small projects, such as the design of electronic stopwatch in digital electronic technology, dual phase clock pulse circuit composed of trigger, the design of DC regulated power supply in analog electronic technology, which is convenient for students to start preliminary experiment, and to cultivate students' engineering ability to analyze and solve the problems.

After the completion of the study of analog electronic technology and digital electronic technology, a comprehensive experiment will be set up. Comprehensive experimental selection is critical, not only closely related with the course content, but also expanding space; not only covers some comprehensive problems, but also taking into account the students' level of knowledge, skills and other factors; not only relates to preliminary engineering background, but also can practice in the laboratory; to have a certain interest, but also a ladder-like, from the shallower to the deeper, proceed in an orderly way and step by step. The school adopts the project-based teaching model, which improves the students' comprehensive knowledge and practical ability in engineering.

**Adopt Diversified Teaching Mode.**

The experimental teaching carries out the trinity teaching model of traditional classroom teaching, open teaching and experimental elective. The traditional classroom teaching to enable students to master the experimental skills and basic methods; the open teaching mode is mainly for the comprehensive and designing projects, the teacher issued an assignment book, the student’s access to information, design, simulation, lap circuit, debugging test, or by the students to choose the experimental project and determine the function indexes. To design and implement, this method is more conducive to students' personality; experimental elective courses can make up for the lack of experimental hours and students' knowledge reserve.
Improving Teaching Techniques and Strengthening the Application of Auxiliary Means.

With the continuous development of information technology, most schools have established a relatively complete campus network. On this basis, share with the students, open a variety of teaching resources, for students to learn to provide a good network of learning platform. This course covers course introduction, plan, outline, courseware, video, discussion, component information, instrument direction for use and other components, it provides a very convenient means for students to study autonomously, also provides a new channel for solving the problems encountered in the course of students' learning. In addition, due to the particularity of the comprehensive experiment, after the student selected a subject, the consultation material, the formulation design plan and the simulation may complete in the extracurricular. The lab provides students with Multisim 12.0, Quartus II software platform. The circuit build and debug can be completed in time. The reservation function in our university has played a positive role in standardizing the experimental teaching management, improving the sharing degree of equipment, field and talents, and ensuring the successful implementation of experimental teaching.

Establish a Scientific Experimental Evaluation System.

The evaluation of experimental results is an important part of experimental teaching. The scientific and rational evaluation method is helpful to promote the enthusiasm of students' learning, test the teaching effect objectively and is an important means to promote the students' ability. Score evaluation is based on the characteristics of experimental teaching and teaching requirements, in order to improve students' experimental interest and experimental skills, quantitative evaluation indexes are established and comprehensive assessment system is established.

The replication experiment proved to be the lowest difficulty, with the lowest proportion in the total score; the design experiment is middle, but the comprehensive experiment is the most difficult, and the proportion of total achievement is the biggest. Each of the experimental scores also includes preview, the completion of the experiment and the experimental records and analysis, each part is divided into four grades: excellent, good, medium and passing. During the examination, students should be provided with circuits, simulation results and experimental results. Comprehensive experiment can increase the reply link, and make a comprehensive evaluation according to the experiment difficulty, effect and respondent.

CONCLUSION

In the situation of international engineering education professional certification, the reform of experimental teaching of electronic laboratory teaching, relying on the project, established a system of hierarchical experimental teaching contents, guide students to gradually improve their experimental skills and ability to analyze and solve problems, and gradually establish engineering thinking mode, provide students with a web-based learning platform to increase the flexibility of students learning. Referring to the CDIO engineering education model and making scientific and quantitative
experimental performance evaluation standards, the enthusiasm of students' learning is improved and the students' interest in learning is stimulated. At the same time the implementation of comprehensive design project require that teachers should not only have a solid theoretical knowledge, but also have strong practical ability; not only have the ability to control the selection and organization of teaching, but also has the engineer practice, the ability to solve practical problems. In the course of teaching, teachers are urged to continue to study the teaching methods, to master new knowledge and new techniques, and to meet the needs of professional teaching and skills inheritance.

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