Project-based Teaching Reform and Practice of "Digital Electronic Technique" Course in Vocational College

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Abstract

The essence of vocational education is to train students into applied technical professionals. This requires that the course system of digital electronic technology must be built with the working process as the guide, the professional ability training as the main line, and the teaching project as the carrier. Project-based teaching method is an important way to promote the maximization of classroom teaching in digital electronic technology course. The application of project-based teaching in the teaching of digital electronic technique course closely combines the teaching process with the development of life and professional ability, which can stimulate students' interest in learning and thus mobilize their enthusiasm and initiative in learning. In the process of completing specific projects, students not only master relevant theoretical knowledge, but also cultivate the sense of innovation and the spirit of innovation, improve the ability of creative thinking, and promote the development of professional ability.

Keywords

Vocational education, digital electronic technology, project-based, teaching reform.

1. Introduction

The future jobs for students majoring in electrical engineering are mainly related to the design, manufacturing, assembly, operation, debugging, maintenance and after-sales technical services of equipment and products, which not only involve a wide range of industries, but also cover a wide range of equipment and products. This requires students to become inter-disciplinary talents who master a variety of skills, have the consciousness of innovation and the ability of innovation, and can not only be competent for front-line positions, but also have a high comprehensive ability. Digital electronic technology is a professional basic course with strong practicality for electrical majors. This course is practical and easy to be combined with engineering practice, which plays an important role in cultivating students' practical working ability and innovation ability [1].

In the traditional teaching method, the course of "digital electronic technology" is organized according to the teaching method of "theory teaching combined with experiment and course design".In the classroom theory teaching, although has used the multimedia technology, the simulation technology, but the student still feels that is difficult to understand difficult to learn, thus produces weariness psychology [2]. In the process of the experiment, the content of the experiment is mostly limited to simple imitation and verification training, lacking of engineering design and production, which cannot be well combined with the actual work process. It is not enough for students to practice, which is not conducive to the cultivation of problem solving ability and innovation ability [3]. And in the course design, because of the large number of knowledge points and poor knowledge system, it is difficult for students to flexibly apply the theoretical knowledge they have learned before [4]. In order to solve the above problems, project teaching mode is introduced into the course of digital electronic technology.

2. Preparation for Project-Based Teaching Reform

2.1. Definition of Project-Based Teaching

Based on the typical professional tasks, the project teaching method constructs the learning content and requires teachers to reasonably design the teaching items from the typical professional tasks according to the knowledge and skills requirements of the professional posts in the teaching activities. Students under the guidance of teachers in accordance with the actual work process of the complete process, the completion of the entire teaching project.Therefore, the implementation of the project-based teaching method in the course of "analog electronic technology" in higher vocational colleges is conducive to the realization of the teaching objective that students obtain the corresponding professional ability and quality requirements of the post.

2.2. Hardware Preparation

Project-based teaching has changed the traditional learning process. It is generally believed that project-based teaching includes four steps: plan, do, evaluation and review.

In order to achieve better results, it is necessary to timely establish a hardware site suitable for project-based teaching -- "learning and doing" classroom. "Learning and doing" classroom is a kind of classroom which is especially suitable for the integration of theory and practice teaching. The classroom is equipped with multimedia teaching equipment, welding and debugging workbench, electronic instruments, desks and chairs. There are also two rows of cabinets for students to store tools and materials, which can accommodate about 50 people to learn at the same time.Teachers should combine theory with skill training in classroom teaching, which is helpful to improve students' theoretical level and practical ability.

2.3. Teaching Project Design

The design of teaching project should be based on the project and realize the integration of theory and practice teaching[5]. And it should consider from the outside to the inside, from the simple to the deep, from the simple to the complex, from the local to the whole, so that students can feel the application of electronic technology, learn professional knowledge in the process of completing the work project, and get the cultivation of professional ability.

3. Design of Teaching Mode

3.1. Overall Teaching Design

The learning content of the course of "digital electronic technology" is as follows: basic logic algebra, combinational logic circuit, trigger, sequential logic circuit, etc. The content is abundant and the knowledge points are scattered[6]. Students often find it difficult to apply the knowledge points in the learning process.Based on the above considerations, the "learning and doing" classroom is used to reform the curriculum.This course takes 6 work items as the core, through the simulation of electronic circuit, practical operation and electronic product simulation production and other activities to organize teaching.In the course of teaching, all related knowledge points and skill points will be connected together, advocating that students learn while doing, integrate learning with doing, combine speaking with practice, and timely test and consolidate.In this way, students' learning ability and professional ability will be cultivated step by step.The course integrates the knowledge into six modules: clock source circuit, eight-digit priority code responder, first signal identification circuit, 60-digit counter and rain alarm.The overall teaching objectives of this course are designed according to 56 teaching hours, as shown in table 1.

Table 1. Overall teaching objectives

Number	Project Title	The capability objectives to be achieved	Result	Learning time
1	Design and implementation of clock source circuit	Learn to use instruments to measure the characteristics of the gate circuit;Understand integrated gate circuits and be able to use them to build circuits	Basic gate logic function test, transmission characteristic test.	12
2	Design and implementation of multiplayer voting circuit	Master the analysis method and design method of combinational logic circuit.Master the logic function of common integrated chips and the method of realizing circuit functions with integrated chips.Able to select components to design simple combinatorial logic circuits, install and debug circuits, and be able to troubleshoot simple circuit faults.	Design and implementation of multiplayer voting circuit.	10
3	Design and manufacture of first signal identification circuit	Master the logic function of trigger with various functions, and skillfully use the function of input and output waveform analysis circuit	Design and implementation of eight-digit priority code responder. Design and manufacture of first signal identification circuit	14
4	Design and manufacture of 60-digit counter	Can analyze timing logic circuit and design simple application circuit with timing logic chip.Can eliminate timing logic circuit fault	The design and realization of Time timing circuit .	12
5	Design and manufacture of rain alarm circuit	A circuit that recognizes the generation and variation of a pulse signal.Can calculate and analyze the resistance and capacitance parameters in the circuit.The timer is applied to generate a pulse signal	Design and implementation of simple electronic organ circuit	8

In terms of teaching methods, the combination of online and offline teaching methods is adopted to guide students to watch video online, complete unit exercises, and conduct concentrated problem explanation offline to improve teaching quality and create an efficient classroom.

3.2. Unit Teaching Design

In the course reform of "digital electronic technology", detailed unit teaching design is carried out for each teaching item, and based on this, students can learn while doing, and teachers can guide, coach, evaluate and summarize.The implementation process of unit teaching project is illustrated by taking the design and production of base 60 counter as an example, as shown table 2.

Table 2. Unit teaching design implementation process

Step	Contents	Teaching method	Student activities	Learning time（hour）
Project introduction and task introduction	Complete the circuit design, manufacture and test of the base 60 counter	Use multimedia courseware to teach and demonstrate the main tasks of this project, and lead students to discuss	discuss	1
circuit Design	Decimal counter design and simulation; Design and simulation of 60 counter	Using multimedia courseware to explain the related knowledge points, using EDA simulation tool to design the circuit principle	Answer questions and practice	6
Accomplishment and test the Circuit	Circuit welding, fabrication and circuit debugging	The teacher explains, the student operates	Production of works	4
summary	Check the physical objects and score, and complete the training report	Through the teacher explains the main points, the student studies independently the way, carries on the appraisal to the student circuit	Summary of production	1

4. Method of Project Implementation

4.1. Establish a Platform for Students to Learn Independently

The course of "digital electronic technology" is rich in theoretical knowledge. The implementation of integrated teaching of theory and practice will often weaken the mastery of basic knowledge. The establishment of a platform for students' independent learning by using online courses can guide students' independent learning and form a necessary supplement to in-class. The content of "digital electronic technology" network course includes discussion, q&a, resources and chat, etc. The course resources include teaching outline, teaching characteristics, electronic teaching plan, multimedia teaching plan, test question bank, study question bank, "learning and doing in one" project, comprehensive practical training project and homework guidance, and so on.

4.2. Open the "Learning and Doing" Classroom After Class

Due to the short class hours and tight task of "digital electronic technology", some students with slow learning progress cannot complete the task in class. After class, the "learning and doing" classroom will be opened to increase students' hands-on opportunities, so that students can have enough time to finish the project, make full debugging, and finally give a satisfactory training report. After school, the "learning and doing" classroom is open twice a week, one afternoon or two classes each time. Two students with good grades and strong ability are responsible for management and guidance. This can not only make students help each other, mutual promotion, but also reduce the burden of teachers.

4.3. Introduction of EDA tools

Due to the knowledge of digital circuits, the knowledge can be well sorted out through project teaching. The use of EDA tools as a project-based teaching supplement, can be a good course of some difficult to understand the knowledge point to the circuit model to simulate, so as to deepen the understanding of the circuit, and make the teaching link more vivid, three-dimensional. Practice has proved that by introducing EDA into "digital electronic technology" course, enrich the teaching contents in several electric, actively to improve the teaching means, make the teaching point of theoretical knowledge showed more thoroughly and the effect of image, experimental and course design are improved significantly, and improve the students' logic circuit analysis and design capabilities.

4.4. Reform of Assessment Methods

For a long time, the test scores of "digital electronic technology" course were determined according to a certain proportion of "final exam + experiment + normal time", and the final exam scores accounted for the largest proportion, which deviated from the requirements of outstanding skills. In the practice of the course reform, skills assessment was highlighted and the proportion of exam results was re-determined, among which the final theoretical examination and daily homework accounted for 50% of the total score, and the assessment results in the actual operation process accounted for 50%. The theory examination is a written examination which assesses students' mastery of knowledge points. The practice assessment is based on the project production process, and tests students' hands-on ability, including circuit installation, welding, debugging ability and practical training report writing ability. Practice has proved that this assessment method is popular among students and can better reflect the training objectives of higher vocational education.

5. Teaching Reflection

After two years of trial and popularization of the course teaching reform of digital electronic technology, some main problems exposed in the course teaching before the reform have been effectively solved. Through the analysis of a large number of teaching quality evaluation feedback information, such as students' online evaluation of teaching, enterprise experts' on-site evaluation of teaching, teachers' listening and evaluation of teaching, the effect of teaching reform of "digital electronic technology" course has been fully affirmed by all aspects. At the same time, it is also found that there are some questions about the requirements for the teaching results of the "materialization" project of the course, which are worth our further thinking.

One question is that some students think that the requirements of teaching results of "materialization" project need to occupy more extracurricular time, which may affect the learning of other courses. At present, the solution of our college is to carry out hierarchical teaching according to students' interests and abilities, and flexibly adjust the number of teaching items for students of different levels.

The other question is that some teachers think that the requirement of "materialization" project teaching results increases their teaching burden, especially in the debugging stage of the project physical circuit needs to invest a lot of time and energy. In view of this problem, our approach is to fully carry out the mentoring activity of "taking care of the new with the old" among the students, and select "teaching assistant" for the teacher among the students with excellent grades of senior students, especially among the students participating in various electronic contests, to assist the teacher in practical guidance.

6. Conclusion

Although the project-based teaching of "digital electronic technology" has achieved results, there are still some problems that need to be overcome and improved in the future teaching practice. For example, the lack of teaching materials matching project-based teaching will bring great inconvenience to both teaching and learning and affect the further improvement of teaching quality. In the future, more efforts will be devoted to the development of project-oriented teaching materials.

The implementation of project-based teaching in the course of "digital electronic technology" in higher vocational colleges is an effective exploration of the teaching reform of electrical and electronic specialty courses. Through project-based teaching, the traditional teaching method that separates theory from practice is reformed, so that students can learn by doing and integrate learning with doing, which is conducive to improving students' practical ability and solving practical problems. The project-based teaching reform of the course of "digital electronic technology" is an effective exploration of the teaching reform of the course of electrical and electronic specialty. Through project-based teaching, the traditional teaching method that separates theory from practice is reformed, so that students can learn by doing and integrate learning with doing, which is conducive to improving students' practical ability and solving practical problems.

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