Research on Curriculum Construction and Teaching Reform of Digital Electronic Technology

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Abstract: Digital electronic technology is a basic course for the majors of electronic information engineering, electrical engineering and automation, communication engineering, computer science and technology in the school of information and engineering of our university. It is also an important part of the three electricity courses (circuit analysis, analog electronic technology, digital electronic technology). The project is mainly based on project-based teaching, which is divided into basic projects, verification projects and design innovation projects. Specific requirements are put forward for project principle design, software simulation, physical welding, physical measurement and commissioning, etc, integrating EDA technology into theory teaching, flipped classroom (student lecture, student evaluation, student lecturer evaluation), process assessment methods, so that students have the basic knowledge and operation skills of digital electronic technology.

Keywords: Project Teaching; Software Simulation; Flipping Classroom; Process Assessment

1. Introduction

Electronic technology as a whole is divided into two categories: analog electricity and digital electricity. Analog electricity is mainly composed of discrete components, while digital circuits are mainly composed of integrated chips. In the process of learning, students should pay attention to practical application and design methods of digital circuits on the basis of understanding principles and concepts.

2. Research status and significance

At present, Digital Electronic Technology is a professional compulsory course and degree course in various engineering colleges. Its prerequisite courses include Circuit Analysis, Analog Electronic Technology, etc., and its follow-up courses include Motion Control System, Microcomputer Principle, etc. Students in our school have some difficulties in learning. It is embodied in the following aspects: ① The course is highly theoretical and requires students to have a good learning foundation. ② Compared with circuit analysis and analog electricity, the course has strong practicality and application. Based on students’ learning characteristics, the project-based teaching is proposed this time, which can stimulate students’ interest in learning. In addition, we will reform the teaching content, teaching means and assessment methods of the course.

3. Research objectives and contents

The course Fundamentals of Digital Electronic Technology has established the idea of taking the cultivation of applied talents as the goal, paying equal attention to theoretical and practical teaching, and combining in-class teaching with in-school competition activities. According to the characteristics of the students, the class hours of the curriculum and...
the teaching objectives of the university, the contents of the teaching chapters are adjusted to enable the students to sort out the knowledge they have learned from passive learning to active learning.

The primary task of curriculum reform is to revise the curriculum syllabus and write the curriculum teaching plan of project-based teaching. Under the background of project-based teaching, students can master basic skills and practice the application and practicality of the curriculum under the guidance of teachers. Teachers should give consideration to the comprehensiveness of teaching content and the systematicness of the curriculum in the teaching process, and highlight the key points and difficulties, in order to reasonably integrate and optimize the teaching content.

4. Teaching problems to be solved and methods to be adopted

The traditional teaching mode is to adopt the teaching method of theory before experiment. This teaching reform uses project-based teaching, designs teaching contents at multiple levels, and always runs through project-based teaching in the process of theory teaching. At each stage of the course, teachers give project tasks and put forward project functions, problems and requirements. Students learn and understand the method and process of project implementation through online course resources and offline course learning, in order to analyze and evaluate students' learning in the teaching process, and adjust the course in time.

The key points and difficulties of the course are carried out in a way that is easy to understand, step by step, from easy to difficult, and broken through one by one. We should make use of students’ enthusiasm for new things, integrate EDA technology into theory teaching, and optimize and integrate it. We should also establish an independent and cooperative exploration mechanism. In project-based teaching, 2-3 members of a project team need to be careful, division of labor and full cooperation, from schematic design to simulation software verification of design scheme, so as to purchase physical electronic components, build actual circuits, debug and test circuits to realize project functions, and finally to writing project reports. We should let students feel the sense of achievement of acquiring knowledge and ability in the process of project-based teaching, and maintain students’ enthusiasm and motivation to explore new knowledge. At the same time, based on project-based teaching, excellent students are selected to form members of the core competition class, so that they can practice from small projects and make full preparations for provincial and national electronic design competitions.

In addition, this teaching reform has also made some attempts at the reform of theoretical teaching methods, using classroom flipping. Similarly, 2-3 people are a project team. Teachers assign teaching tasks in advance, and the project team prepares for discussion after class, including making course PPT through self-study of online course resources, and combining online learning content with project tasks. Members discuss with each other to determine the design scheme, explain the defense, simulation demonstration or physical demonstration in class, and present the design results in the form of student explanation, student evaluation and scoring, and teacher evaluation and scoring, so as to give full play to the student-centered teaching idea, effectively cultivate students’ learning subjective initiative, teamwork ability and innovative ideas, and enable students to establish a correct scientific view.

The teaching reform relies on the knowledge that students must master, introduces basic projects, verification projects and design projects, and organizes teaching in combination with specific projects. On the premise of stimulating students' interest, we should optimize the teaching content with the specific tasks proposed by the project, guide the teaching process by the project tasks, and take teachers as the leading role, while students as the main body and projects as the guidance, reform the theoretical and practical teaching methods, and optimize and improve the training mode of applied talents in our university.

The following is one of the designed teaching projects:

Design and manufacture of 8-channel digital responder

Design task: complete a digital responder, which can be used for eight contestants to compete.

(1) Basic functions of responder:
1) The eight contestants are numbered 1-8 and equipped with 8 emergency response buttons.
2) The responder has the functions of clearing and starting.
3) The responder has the functions of display and alarm. After the rush answer, if a contestant presses the rush answer button, the number of contestants 1-8 will be displayed, and the speaker will give an alarm sound signal. After the contestant answers, other contestants are not allowed to answer again.
4) The responder has a timed responder function. When a contestant presses the responder, it will immediately start the countdown of 60 seconds and display the countdown time.
5) When the responder has a contestant to answer, the alarm circuit will send out a prompt sound; When the countdown of 60 seconds ends, the alarm circuit sends an alarm sound signal.

(2) Extended function of responder:
1) Implement the scoring circuit of the player.
2) Four pattern lantern controller, when a contestant answers, the lantern will be on and off, move from left to right, and then go out one by one.

(3) Design tools:
Computer, Multisim Simulation Software.

(4) Workload requirements:
1) Circuit principle design.
2) Circuit simulation and debugging.
3) Actual circuit construction and debugging.
4) Defense of design.
5) Write design report.

The simulation diagram is shown in Figure 1:
In order to conduct a comprehensive, fair and impartial assessment of students, we should focus on the learning process and supplemented by the examination results. The final score assessment is: 70 points for learning process assessment + 30 points for written examination and closed book examination. Among them, the process assessment is based on the software simulation, physical welding, physical debugging measurement, project defense, scoring (student lecture, student evaluation, student lecturer evaluation), class arrival rate, after-school homework, classroom questions, classroom tests, etc., in a certain proportion, so that the project-based teaching is implemented, and the written examination is given by the closed book examination results. Through this reform, students’ learning ability can be improved, theoretical knowledge can be applied to practical projects, and real digital circuits can be realized.

5. Conclusion

Through the reform of project-based teaching, flipped classroom and evaluation system, students have formed an effective teaching mode scheme of team learning, and stimulated students’ learning enthusiasm and learning motivation, in order to improve students’ practical ability, students’ awareness of division of labor and cooperation and team cooperation, and lay a certain foundation for their subsequent senior graduation project or graduate study.

References