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Research on the Reform of the Course of Digital Electronics Technology

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Abstract

Digital electronics course is an important professional foundation course for electronics majors, curriculum reform is a subject of inquiry for educators, the author explored the teaching content, teaching mode, teaching organization, teaching activities, learning assessment and evaluation, etc., and received good results.

Keywords

Digital Electronics; Curriculum Reform; Research.

1. Introduction

The course "Digital Electronics" is an important professional foundation course for electronics and communication majors, which is a practical and application-oriented course. It is based on "circuit analysis" and is the basis for electronic information students to learn "intelligent electronic circuit design and practice", "microcontroller principles and applications" and other follow-up courses and graduation design.

2. The Teaching Status of Digital Electronic Technology Courses in Higher Education

The traditional digital electronic technology course is mainly based on theoretical teaching, supplemented by practical teaching, with a single form of classroom organization, lack of student participation and interaction between teachers and students in the teaching process, the main position of students is not fully played, students only mechanical application and simple repetition, lack of observation, analysis, thinking, induction skills. Modern teaching methods and software are not fully used so students' enthusiasm for learning will be affected. Practical teaching is disconnected from production, scientific research, and vocational skills. The practice is mainly the verification of logic function, which is not conducive to the combination of theory and practice, the cultivation of students' comprehensive quality, and the improvement of students' professional application ability and comprehensive ability. Therefore, it is imperative to reform the higher vocational digital electronic technology curriculum.

3. Integration of Teaching Content

This course follows the reform idea of "quality-based, employment-oriented, ability-based, student-oriented", combined with the characteristics of the "digital electronics" course, with practical ability as the main line, work tasks as the center, the relevant knowledge points into It emphasizes the combination of theory and practice, enables students to master knowledge in practical activities, and comprehensively cultivates students' professional ability, methodical ability, social ability, and other comprehensive vocational ability. Theoretical knowledge is based on the principle of "necessary and sufficient", with the application as the purpose,

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integrating "teaching, learning and doing", truly reflecting the curriculum reform concept of "learning by doing and doing by learning". Digital electronics technology course teaching content according to the following organization and arrangement: to determine the job demand-oriented vocational ability; from the professional talent training objectives to determine the course content; to set the technical application of the background of the project, module, and work tasks. This course has 7 projects, they are the production of a door control alarm circuit, the production of a coding display circuit, the production of the snatcher composed of a flip-flop, the production of a car tail light control circuit, the production of an electronic doorbell circuit, the production of digital voltmeter, the production of flowing light control circuit. These projects come from real life and are familiar to students. The circuits not only contain knowledge points in digital circuits such as gate circuits, flip-flops, counters, and decoding displays, but also involve knowledge of light-emitting diodes, crystal oscillators, testing of electronic components, and the use of common instruments. At the same time, Multisim circuit simulation practical training is added to facilitate students' practice after class. The design of the teaching content is detailed in the following table.

Table 1. The design of the teaching content

Serial number	Work Tasks	Key Learning Objectives
1	Production of door control alarm circuit	Master the number system and code and basic logic relationship, logic function simplification, integrated logic gate circuit use
2	Fabrication of coding display circuit	Master the analysis and design methods of combinational logic circuits and the functions and applications of encoders, decoders, adders, and numerical comparators
3	The creation of a snatcher composed of a trigger	Master the circuit composition, trigger mode, logic function, and interconversion of basic, synchronous, and edge flip-flop
4	The production of automobile tail light control circuit	Master the working principle and application of register, the function and application of counter, and the design method of arbitrary counter
5	The production of electronic doorbell circuit	Master the working principle and function of the 555 timers and the working principle and application of the Schmitt trigger, monostable trigger, and multi-harmonic oscillator
6	Production of digital voltmeter	Master the principle of A/D and D/A conversion, typical circuits, main parameters, and indicators
7	The production of a flowing light control circuit	Understand the concept of read-only, random access memory, characteristics, large-scale integrated combinational logic circuit structure, and operating principles

4. Innovative Teaching Mode

4.1. Implementation of Curriculum Thinking Politics

To implement the fundamental task of establishing moral education, sort out the elements of Civic Education contained in the curriculum, integrate them into classroom teaching, and realize the organic unity of Civic Education and knowledge and skill education. The following table shows the Civic Education of the curriculum.

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Table 2. Civic Education of the curriculum

Work Tasks	Curriculum Civics
Production of door control alarm circuit	We will explain the origin of traditional culture and binary from the "eight trigrams" and "beacon and fire" of ancient people.
Fabrication of coding display circuit	From the traditional virtues such as "Confucius gives up the pear" and the traffic signal "no rule is perfect", we will explain the concept of priority in the encoder and the application of the display decoder respectively.
The creation of a snatcher composed of a trigger	Watch the process of chip "intellectual manufacturing" and integrated circuits to guide students to uphold the rigor and excellence of craftsmanship.
The production of automobile tail light control circuit	To understand the learning process from a dialectical materialist perspective, to master the laws of nature and history through what we learn in books, and to use them for innovative transformation.
The production of electronic doorbell circuit	"Always feel shallow on paper, and know the matter by heart", to achieve the unity of knowledge and action, in-depth study, to meet the difficulties.
Production of digital voltmeter	Correctly view the relationship between the individual and the whole, and cultivate the virtue of unity, cooperation, and common progress.
The production of a flowing light control circuit	Huawei Kirin cell phone chips achieve high performance and long battery life breakthroughs, etc., encouraging students to be brave enough to open the door to innovation.

4.2. To Develop Independent Learning Skills

In the teaching of the "Digital Electronics" course, the case is the center of learning and the study guide is the tool, so that students can find out the problems in the project practice, explore to find the knowledge in the study guide, figure out the working principle of the circuit, the role of each part, etc., provide help for the learning of "Digital Electronics" course, and more importantly, to cultivate students' independent learning ability.

4.3. To Improve the Ability to Integrate

In the process of assembly and debugging of the project, students learn and use the knowledge of analog electronics, electronic components assembly process, computer application fundamentals, and other courses, which can consolidate, digest, and apply the knowledge learned, and achieve a close combination of theory and practice, which is an important innovation of the curriculum reform.

5. To Reform of Teaching Organization

The course is designed with practical circuits as the carrier of teaching content. Through the decomposition of large projects, students can complete this course from shallow to deep. The selection of teaching content follows the principle of "necessary and sufficient" to meet the theoretical and practical knowledge required by subsequent courses and work positions.

In the specific implementation, learning exchanges and discussions are carried out in the form of questioning and group collaboration. In terms of teaching methods, the combination of online and offline methods, self-study before class, classroom lectures, regular quizzes, hands-on practice after class, and other teaching forms are used to carry out teaching activities through online teaching carriers such as the online teaching platform and Love Course website. In classroom teaching, the application of inquiry-based classroom teaching mode is implemented to make students learn to learn by taking students as the main body. Through practical teaching, students can master skills and develop good professionalism at the same time.

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6. To Improve Teaching Activities

The teacher determines the important and difficult points of the class lecture and the teaching activities in the class based on the information such as the problems of students' learning before the class and the feedback of online learning, and the teacher tests summarize, summarize, and evaluates at the right time. Through the combination of online learning and classroom teaching, we explore online and offline hybrid teaching.

Specifically: according to the requirements of the course syllabus, corresponding course tasks are set for each class. Before class, we set up learning tasks (including relevant knowledge, skills, and course thinking and political content), follow up on students' learning, collect learning problems and adjust teaching activities in class; students learn independently online according to the learning tasks, complete online tests, answer questions and discuss online, and submit homework and corrections online before class. The teacher designs the teaching activities in class around the problems of students in completing the tasks before class and fully mobilizes students' learning enthusiasm. Finally, the teacher explains and summarizes the key points and difficulties of the class, designs accompanying quizzes, and assigns post-class homework to help students consolidate what they have learned. The course teaching evaluation explores value-added evaluation and establishes a combination of process evaluation, result evaluation, and value-added evaluation. When the course was completely switched to online teaching due to the epidemic, the following strategies were applied to ensure teaching effectiveness. First, in the online classroom, students were guaranteed to watch the teaching micro-lessons. Second, strengthen the discussion function to break through the important and difficult points. Discussion topics are set for the important and difficult points of teaching. Third, pay attention to formative assessment and get timely learning feedback. Fourth, increase communication and interaction between teachers and students, so that students can feel the teacher's attention and gain encouragement and confidence.

7. To Reform Assessment and Evaluation

To assess students comprehensively, the course assessment uses a combination of online and offline assessments. Offline learning assessment includes homework completion, attendance, class attendance, and final exam (of which course Civics questions account for 10 points). Online learning assessment includes unit assignments, unit quizzes, course discussions, comprehensive tests, etc. The semester grade of the course offline learning accounts for 50% and online learning accounts for 50%.

8. Conclusion

Through the reform of the digital electronics curriculum, students' autonomy of learning has been significantly improved, and their hands-on ability, comprehensive application ability, teamwork ability, self-inquiry ability, and creativity have been continuously improved. Teachers have accumulated rich experience in curriculum reform, and the teaching quality of the course has steadily improved.

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