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A Practical Analysis of the Teaching Reform of Digital Logic Course in the Transformation and Development of Local Undergraduate Universities

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Abstract: On May 2, 2014, The State Council issued the "Decision on Accelerating the Development of Modern Vocational Education", which proposed to guide a number of ordinary undergraduate colleges and universities to transform into applied technology colleges and universities, focusing on undergraduate vocational education. On March 5, 2016, the government Work report clearly proposed to "promote the transformation of qualified ordinary undergraduate universities into application-oriented universities". Based on this background, this paper makes an in-depth analysis of the teaching reform of digital logic course in the transformation and development of local undergraduate colleges and universities, puts forward specific measures such as optimizing course content, improving teaching methods, and strengthening school-enterprise cooperation, and discusses the specific implementation path and effect of digital logic course teaching reform through case analysis, aiming to provide reference for the teaching reform of local undergraduate colleges and universities.

Keywords: Local undergraduate universities; Digital logic course; Reformation

Introduction:

The course of digital logic is a course with strong engineering practice. According to the content and characteristics of curriculum teaching, the reform of teaching mode, teaching method and teaching means is emphatically studied. These reform explorations are not only conducive to improving classroom quality, but also can further promote the transformation and development of local undergraduate universities.

1. Objectives of digital logic course teaching reform

1.1 Improve students' practical ability

In the transformation of local undergraduate colleges and universities, digital logic courses can be designed to combine theoretical knowledge with practical operation, so that students can deeply understand and master the principles of digital logic in hands-on operation. For example, advanced experimental tools such as FPGA (field programmable gate array) and logic analyzer are introduced in the course to help students design and debug digital circuits and improve their practical skills. At the same time, the construction and improvement of digital logic laboratory, to provide students with a good practical operating environment.

In addition, we can also try to introduce practical engineering projects based on the project-driven approach, so that students can exercise practical skills in the process of solving practical problems. Through team work to complete projects, students' collaborative spirit and project management ability are cultivated [1].

1.2 Enhance students' innovative thinking

In terms of enhancing students' innovative thinking, the development of college expertise based on digital logic courses can introduce the latest technology and cutting-edge knowledge into teaching through the optimization of course content, and stimulate students' interest and thirst for knowledge. Combined with practical application cases, the innovative application of digital logic in different fields is demonstrated, so that students can understand its broad development prospects and innovation potential.

Innovative teaching methods, such as flipped classroom and project-based learning, enable students to develop innovative thinking in independent learning and exploration. In the flipped classroom mode, students master basic concepts and principles by previewing videos and materials, and then discuss and practice in class to solve more challenging problems. Project-based learning encourages students to propose innovative solutions through the design and implementation of practical projects, and cultivates their creative thinking and problem-solving abilities.

1.3 Adapt to the needs of industrial development

By introducing new technologies, new tools and new methods, students can master the most cutting-edge digital logic design technology [2]. First of all, the course content should keep up with the technological development trend of the industry, and timely update the teaching syllabus to ensure that the knowledge and skills taught meet the actual needs of the current industry.

Secondly, strengthen school-enterprise cooperation and invite enterprise experts to participate in course design and teaching process. Corporate experts can bring the latest industry developments and practical cases to help students understand industry needs and work environments. By keeping up with the development trend of the industry, strengthening the cooperation between schools and enterprises, promoting the combination of production, learning and research, cultivating professional quality and establishing a dynamic feedback mechanism, the teaching reform of digital logic course can effectively adapt to the needs of industrial development and provide a solid guarantee for the career development of students and the progress of the industry.

2. Specific measures of teaching reform

2.1 Optimize the course content

2.1.1 Basic theory courses

In Basic theory courses, teachers will explain in detail the basic concepts of logical algebra and Boolean operations, including logical variables, logical operations, logic gates, and simplification of Boolean expressions. Through these basic knowledge, students can understand the basic principles of digital circuits and lay a solid theoretical foundation for subsequent courses.

After the basic explanation, students are taught how to design and analyze combinational logic circuits, including common logic circuits such as adders, subtracters, encoders, decoders, and multiplexers. Students will learn how to use truth tables, Carnaugh diagrams, and other methods to optimize logical expressions and implement them into actual circuits.

For example, sequential logic Circuit design will introduce the basic concepts and working principles of sequential logic circuits, including the design and analysis of triggers, registers, counters and state machines. Through these contents, students can understand the dynamic behavior of sequential logic circuits, master the application of clock signals and the design methods of sequential circuits [3].

2.1.2 Experimental course

First, basic experiments involve building simple logic gates, where students will use logic gates containing 2 to 8 inputs (such as AND, OR, NOT, XOR gates) to implement basic logic functions. In addition, experiments involve the use of truth tables to verify the correctness of logic circuits, such as verifying that the output of the 4-input AND gate is only 1 if all inputs are 1.

Secondly, in the advanced experiment, more complex digital circuit design needs to be introduced, for example, the 4-bit binary adder is implemented through the experimental board and digital simulation software. In this experiment, students need to use at least 16 logic gates AND 4 half adders (each half adder consists of 1 XOR gate and 2 AND gates). Students will learn how to put multiple components together to build a complete number system.

Finally, the lab course also introduces the use of field programmable gate arrays (FPgas), allowing students to design and implement a small counter project through practical programming. In this experiment, students will use Verilog or VHDL hardware description languages to describe digital logic and implement and test it on an FPGA board with at least 1000 logical units.

2.2 Improve teaching methods

In terms of improving teaching methods, flipped classroom is proposed for this course. This teaching mode can combine knowledge imparted in traditional classes with independent learning after class to improve students' learning effect. In the digital logic course, the application of flipped classroom can effectively improve students' participation and self-learning ability.

First, in the flipped classroom mode, the teacher will pre-record videos explaining basic knowledge, such as logic gates, Boolean algebra and combinatorial logic circuits, and the length of each video is limited to 10 to 15 minutes to ensure that students can effectively master the basic concepts and principles before class. Here teachers can release this video and related learning materials (such as 20 pages of PDF handout, 10 exercises) to students through the learning management system one week in advance.

Secondly, in class time, the teaching activities are mainly practical operation and discussion. Students will be divided into groups of 5 and work on specific experiments and project designs. For example, when designing a 4-bit binary adder, each group of students was required to use a circuit containing 16 logic gates and 4 half adders, verify the correctness of their design, and measure the accuracy and stability of the output signal in nanoseconds (ns) through a logic analyzer. Teachers provide guidance and answer questions during the process to help students solve practical problems. Through this teaching mode, students can learn theoretical knowledge independently before class, and they can also have in-depth interaction and practical operation in class to further consolidate and apply what they have learned. In addition, teachers can evaluate students' learning through weekly quizzes (10 multiple choice questions, 20 minutes long) and lab reports (about 1,000 words), and constantly adjust teaching strategies based on feedback.

2.3 Strengthen school-enterprise cooperation

By cooperating with leading technology enterprises, the school can introduce advanced equipment and technical resources, such as equipment such as FPGA development platform and logic analyzer worth 500,000 yuan.

On this basis, the school can sign cooperation agreements with a number of enterprises, and provide enterprise internship opportunities for at least 30 students each year, the internship cycle is 6 months. During this period, students will be involved in the development of practical projects in enterprises, such as designing and debugging digital circuit systems, using tools including hardware description languages such as Verilog/VHDL and EDA (Electronic Design Automation) tools. Through practice in a real work environment, students can gain valuable experience, understand industry standards and processes, and enhance their professionalism and competitiveness.

Conclusion:

In summary, based on the curriculum reform under the background of transformation and development, it is necessary to start from optimizing the curriculum content, gradually improve and improve the educational methods, and further strengthen the cooperation between schools and enterprises, so as to enhance the practical ability of students and ensure the close combination of teaching content and industrial demand. In the actual implementation process, it is necessary to constantly sum up the experience and adjust the reform strategy in time to ensure the continuous promotion of teaching reform.

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