Experimental teaching reform of digital electronic technology course in local colleges and universities under the construction of new engineering

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Abstract: The proposal of "new engineering" is to guide colleges and universities to set up and build engineering disciplines and specialties that face the future development, meet the needs of industry and serve the national development strategy, and cultivate a group of innovative and composite excellent engineering talents. Based on the background of the construction of "new engineering", the teaching reform of engineering experiment courses in local colleges and universities has been constantly promoted, which helps the construction of "new engineering" from the aspects of experiment content and experimental teaching methods, and helps students develop the ability of innovation and entrepreneurship and interdisciplinary integration. Taking the digital electronic technology course of local colleges and universities as an example, this paper discusses the experimental teaching reform of digital electronic technology course under the background of new engineering construction, and puts forward several teaching reform strategies, hoping to provide some effective ideas for promoting the subject construction and experimental teaching reform of local colleges and universities.

Key words: new engineering; Digital electronic technology; Teaching reform; Strategy analysis

Digital electronic technology is a basic course for electronic and information majors. The teaching goal of this course is to enable students to master the basic principles, analysis and design methods and basic experimental skills of digital circuits, and to apply the professional theoretical knowledge to solve practical engineering problems through relevant experimental courses, so that students can master the theoretical knowledge and practical skills of digital electronics. To serve the development of the electrical information industry. The course of digital Electronic technology has the characteristics of many formulas, circuits, logic, engineering and practicability, fast technology update, etc. In the past experimental courses, the verification experiment is mainly, the teaching is difficult to change one-way transmission, students tend to take the experimental course as a burden, guide teachers to follow the old fashioned, follow the script, and students learn passively. Lack of thinking, according to the steps in the textbook to go through the process of the problem is more serious. The experimental teaching method is single, the teaching innovation is insufficient, the teaching effect is not good, the students' learning interest is difficult to form, and the experimental teaching effect is not ideal. How to optimize the experimental teaching of this course and realize the cultivation goal of innovation and entrepreneurship and interdisciplinary integration ability proposed by the construction of "new engineering" still needs further exploration by teachers.

1. The establishment of hierarchical modular practical training curriculum system

In the past, the practical training system did not reflect the characteristics of modularity, which would lead to the lack of certain logic in the implementation of curriculum arrangements, resulting in the repetition of curriculum Settings, lack of knowledge coherence and so on. The goal of the construction of "new engineering" is to promote the integration of science, humanities, engineering, management and other disciplines, in order to cultivate new engineering talents with innovative ability. In this context, the construction of modular practical training curriculum system, so that students in the modular practical training system will effectively link theory and experiment, through the module to discover the connection between knowledge, the practical skills to link together.

The theoretical module is divided into: 1. Module, port and basic description mode, basic grammar rules, arithmetic and logic operators, operation order, keywords. 2. Use Verilog HDL to describe sequential logic circuits. 3. Use Verilog HDL to describe combinatorial logic circuits: gate level description (simple), signal flow description (simple) and behavior description (emphasis); if, the use of case statements; Encoder, decoder, data selector, real decoder behavior description.

The experimental module is divided into: 1. Logic gate test and SSI design; 2. Medium scale combinatorial logic circuit design (traditional 74 series: data selector and 3-8 decoder application circuit design, product grade indicating circuit, unlocking alarm circuit); 3. Hardware description language design of data selector and display decoder (Verilog HDL); 4.3. The use of Quartus II software: the way of drawing schematic diagram, hardware description language, schematic file design, compilation, pin allocation, download; 5. shift register and counter design; 6.555 timer application.

Based on the teaching objectives of the course, the practical training course system is reorganized, and the top-down, systematic, logical and hierarchical practical training courses are constructed in combination with the content of the practical training direction planning and design. Each module of the practical training course corresponds to a special practical skill training goal, which makes the experimental teaching more clear. Modular experimental teaching is helpful for students to carry out comprehensive experimental inquiry, which is of great significance for students to develop innovative thinking and inquiry ability.

2. Organize students to conduct independent experimental exploration and abandon the traditional one-way course assessment mode

For local colleges and universities, the basic goal of talent training is to cultivate application-oriented talents who can solve complex digital electronic engineering problems. Digital electronic technology is an emerging technology that is developing vigorously. The fundamental driving force for its development lies in Internet technology and innovative thinking. Under the background of new engineering, local colleges and universities need to change the traditional teaching mode, establish a model oriented by students' independent learning and develop students' innovative thinking. The OBE education concept focuses on students' ability to solve problems and innovate independently. Under the guidance of OBE education concept, students set up study groups to explore the learning projects provided by teachers, and work out the project implementation plan together to complete the learning projects. Students are guided to consult materials, explore and think independently, while teachers mainly guide students and provide timely help to students. In the independent experiment, the teacher releases the experimental projects and learning tasks before class, and allows the students to consult the materials and think independently, discuss the experimental scheme, analyze the experimental results and verify the experimental conjecture in the group. Especially for the exploratory digital electronic technology, the introduction of abundant teaching resources and demonstration of experimental process will better lay a good foundation for promoting the development of students' innovative thinking.

Under the guidance of the OBE education concept, the experimental course not only pays attention to students' completion of the experiment, but also pays attention to students' innovation in the experiment process, classroom interaction, comprehensiveness of knowledge, and integrity of the experiment design. After the end of the course, comprehensive evaluation is carried out based on students' classroom performance, homework completion, experiment operation, experiment report and other aspects through quantitative assessment, effectively combining process evaluation and summative evaluation. Through the process evaluation method, teachers can more accurately discover students' learning characteristics and learning rules, and judge whether the teaching goal is achieved. Through the analysis of learning problems, students' learning rules can be found out, and then teachers can formulate targeted intervention measures. On the basis of the precise teaching model, based on the analysis of students' historical learning data, students are guided to reorganize the curriculum knowledge system and explain the forgotten and difficult knowledge once again.

3. Strengthen the construction of laboratory through the cooperation of school and enterprise

Because digital electronic technology is in the stage of exploration and development, with broad prospects for development, the demand for talents is relatively large, so the supporting talent training system is also slightly developed and mature, in the teachers, training platform construction, practical teaching resources construction and other aspects need to be improved. The development of digital electronic technology in China started late, because of its short development and construction time, and the professional knowledge involved is relatively complex. Local institutions of higher learning need to face up to the current development of digital electronic technology and related problems in personnel training work, optimize the conditions of personnel training, and provide a good foundation for personnel training work. Local institutions of higher learning can explore school-enterprise cooperation training mode, introduce capital, technology and talents from enterprises, build digital electronic laboratories together with enterprises, and enhance the quality and scale of laboratory construction and experimental curriculum construction. In terms of teachers, strengthen the implementation of the "engineers into the campus" plan, build a team of part-time teachers with solid digital electronic practical technology and advanced professional vision, and hire powerful engineers from enterprises to be part-time teachers in the school to undertake part of the teaching tasks of curriculum construction and practical training guidance. Local colleges and universities also need to further strengthen market research and adjust their curriculum system based on the requirements of ability literacy of mechanical and electrical related positions. It is possible to build a course system that links with specific industries and enterprises, and cultivate students' ability of timely job application, multi-job migration and sustainable development through industrial cooperation and school-enterprise cooperation. By providing students with in-depth opportunities for electrical information post practice, students can understand the application and development of digital electronic technology in the field of practice, develop advanced professional vision, and promote the development of students' comprehensive ability.

4. The construction of modern simulation software to assist the experimental classroom teaching

In recent years, the popularization and application of simulation software in experimental teaching has promoted the development of experimental teaching. The high definition images presented by virtual simulation technology and the infectious situations created optimize the students' learning experience, make the original boring experiment operation and experiment theory become lively, help students understand professional knowledge, and effectively improve students' learning interest and enthusiasm. Simulation software is the key to student-centered specialized experimental learning. It creates an active experimental learning atmosphere through human-computer interaction, data analysis and other technologies, and promotes students to change from passive learning to independent learning. In the simulation software, students operate the experiment and analyze the phenomena and results in the experiment operation.

Based on the simulation software, students can basically realize that no one can operate the experiment by themselves. The students form a study group and carry out experimental exploration in the group. The group constantly optimizes the experimental method and adjusts the experimental ideas according to the experimental results fed back by the system, and re-validates the experiment in the system. After repeated experimental design and operation verification, the students' ability to analyze and understand the experiment has been

continuously enhanced. For example, in the functional department of digital circuits, students carry out simulation practical training through the Multisim software. In the simulation software, students draw circuit diagram, connect the circuit through the logic converter in the virtual instrument list, get the combined logic circuit, open the logic analyzer, use the function button on the instrument to get the truth table and logic expression (the simplest form). And then determine its circuit function. In the Multisim simulation software system, students experience the whole analysis step of combinatorial logic circuit, from combinatorial logic circuit to determining circuit function, to enhance the understanding and mastery of this part of knowledge.

Based on the simulation software, many comprehensive experiments can be introduced into the classroom, and some time-consuming and dangerous comprehensive experiments can be realized through the simulation software. Students can systematically carry out experiment design, experiment accuracy in the early stage, experiment pretreatment, etc., and participate in the whole process of the experiment, instead of the traditional experiment teaching, students can only participate in the operation of the experiment in the later stage. Through this mode, students can strengthen their ability of experiment design and analysis, help them develop their innovation consciousness and operation ability, and promote their comprehensive development.

Under the background of new engineering, local colleges and universities need to strengthen the construction of simulation software, effectively combine simulation software with experiment teaching, and guide students to apply theoretical knowledge in experiments and solve practical problems through the virtual situation of simulation software. The application of virtual simulation technology to create real situation can deepen students' impression of experimental courses, enhance their learning effect, and then ensure that students can flexibly apply textbook theoretical knowledge, integrate and apply the theory to the experiment, and improve students' practical ability.

5. Conclusion

Based on the plan of cultivating innovative and composite excellent engineering talents in "new engineering", this paper puts forward some reform strategies, such as building modular experimental courses, organizing students to carry out independent experimental exploration, optimizing experimental assessment methods, building laboratories and teaching staff in cooperation with university and enterprise, and building modern simulation test system. These reform strategies are based on the talent training objectives of "new engineering", fully consider the characteristics of digital electronic technology experiment courses, and also have certain reference significance for the construction and reform of other experimental courses under the background of "new engineering".

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