Research on Teaching Reform of Electronic Information Technology Courses in Vocational and Technical Education Based on CDIO Concept and Virtual Simulation Technology

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Abstract. In order to change the current situation that the teaching theory and practice of electronic technology course in vocational and technical education are disconnected, and improve students' practical ability and engineering thinking ability. The teaching reform focuses on the demand design of the course group, comprehensively reforming several closely connected courses, building an electronic technology course group with demand driven projects as the integration, taking projects as the implementation carrier of the course group, creating CDIO teaching organization form according to the scale and content of the project tasks, and integrating virtual simulation technology to enable students to master professional practical skills and highlight the "learning" centered teaching practice, Make students become the main body of learning.

Keywords: CDIO · Vocational and technical education · Electronic information technology courses · Virtual Simulation Technology

1 Introduction

Vocational and technical education is an important part of China's national education system. It is the main position for cultivating high-tech applied talents in the front line of production, construction, management and service. It plays an important role in China's economic and social development. Vocational education is different from higher education. Its main feature is practical teaching, that is, every link of teaching must be combined with production practice. The teaching content of each course must be driven by completing a practical task, action-oriented and application-oriented, so that the whole teaching process can be carried out in the combination of work and learning, learning and doing, and highlight the cultivation of students' practical ability.

Electronic technology courses are the main compulsory courses for science and technology majors in Vocational and technical education. They play a role of basic support and professional service in the talent training system. The characteristics of such courses

D. Kumar et al. (Eds.): IEIT 2023, AHSSEH 10, pp. 20–27, 2023.
https://doi.org/10.2991/978-94-6463-230-9_4

are: a wide range of disciplines, including electronic science, computer science and technology, modern electronic production technology; It involves many categories, including circuit foundation, electrical technology, analog electronic technology and digital electronic technology; Strong engineering practice requires students to have superb practical operation ability.

However, in the teaching of electronic technology courses in Vocational Colleges in China, the principle of "integrating theory with practice" has not been really implemented. The current practical teaching mode is composed of experiment in the course and whole week training of professional courses [1, 2]. The important feature of this practical teaching mode is that the practical teaching starts independently or as an independent link; The prominent disadvantage of this model lies in the disconnection between theoretical teaching and practical teaching, which makes it difficult to digest theoretical knowledge in time, operation training could not limited. Although students have been tested or trained for many times, they still could not master operation skills, and the benefit of practical teaching is poor. At the same time, there are problems in the learning process of theoretical courses, which are often concentrated in the end. There is a great lag in teaching timeliness.

Therefore, in order to change the current situation of CDIO vocational education and technology teaching, this paper puts forward that CDIO courses are highly compatible with the current situation of electronic technology teaching, and can improve students' thinking and practical ability in electronic technology education.

2 Constructing Curriculum Group

This part will focus on the objectives of electronic technology courses, combined with the teaching concept of CDIO, optimize and integrate the contents of electronic technology courses by studying the connection between electronic technology courses and subsequent professional courses: enhance the connection and connection between knowledge, delete redundant course contents, and comprehensively transform several closely related courses to form a new group of electronic technology courses. Electronic technology courses include many courses. Courses are set from three levels, from simple to difficult. Courses with weak correlation are removed and the course group is reconstructed. The hierarchical structure of the course group is shown in Fig. 1.

3 Design the CDIO Ability Training Scheme for Teachers and Students

The four levels of CDIO, which reflect different levels of students' learning ability and application ability, are integrated into different levels of basic education and research, and reflect different levels of students' learning ability in different levels of CDIO [3–5]. Freshmen improve their practical ability and basic operation skills through teaching activities such as basic experiment and confirmatory experiment; Second grade students cultivate their basic practical skills through comprehensive experiments and simulation training on the basis of basic skills; Third grade students should cultivate their engineering system ability through graduation practice, graduation thesis (Design) and other activities.

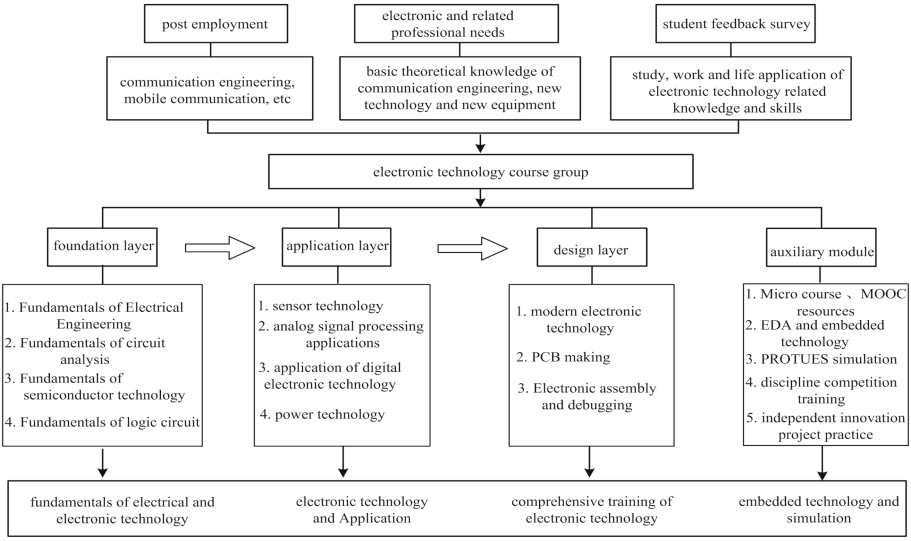

Fig. 1. Design of electronic technology basic course group system

Similarly, teachers should have solid theoretical knowledge and good engineering knowledge. Teachers should also be graded and continuously improve the operation mechanism, so as to scientifically, standardized and effectively improve teachers' CDIO ability and have strong operability.

4 Construction of a Three-Level Project of CDIO Engineering Electronic Technology Course Group

According to the CDIO teaching concept and taking the experimental project as the main line, the training objectives such as the knowledge, ability and quality required for electronic technology courses are integrated into the experimental teaching process. Mining and selecting projects suitable for teaching practice from real projects, and refining them into teaching practice projects with typical significance as the carrier of curriculum group implementation [6–9]. Build first-class projects for posts and majors, second-class projects for course groups, and several separate third-class projects for a knowledge point of a single course. The current specific conceptual design is shown in Fig. 2.

5 Three Forms of Teaching Organization and Implementation

In order to enable students to "learn by doing", "learn by doing", improve their engineering awareness, and achieve the purpose of applying what they have learned, we will implement three kinds of teaching organization forms based on CDIO's teaching philosophy, progressive curriculum groups, the scale and nature of three-level experimental projects, and combined with virtual simulation technology.

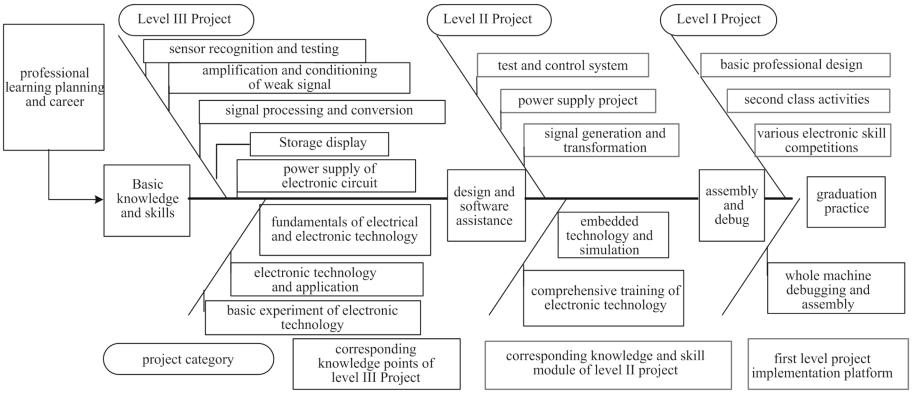

Fig. 2. Fishbone diagram of the corresponding relationship between curriculum group and project level based on demand traction project integration

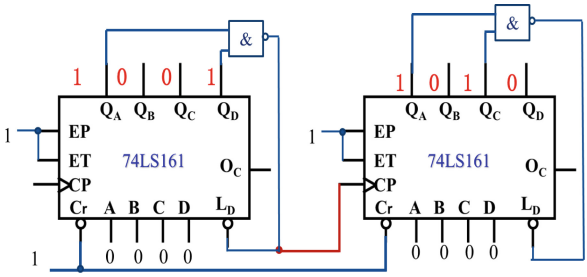

Fig. 3. Computer circuits

5.1 CDIO Teaching Mode Integrating Theory and Practice

For the teaching content with too much theory and too little practice, the CDIO teaching mode integrating learning with practice is adopted. This kind of teaching content usually corresponds to a three-level project. For this kind of teaching content, students can learn while doing. It is usually divided into four steps: first step is to construct (C), second step is to design (D), draw a circuit diagram and carry out virtual simulation, and check whether the function can be completed according to the simulation results, Then, in the third step (I), build a physical map in the classroom, and in the fourth part, run (O) and evaluate. For example, the circuit diagram and virtual simulation of the 60 base counter are designed and implemented. As shown in Fig. 3 and Fig. 4.

5.2 CDIO Teaching Mode of Segmented Production Chain and Double Line Linkage

For the application function modules whose contents are relatively independent and focus on the use of various components in the circuit system and the improvement of the system expansion design ability, the corresponding projects of this part are relatively large and

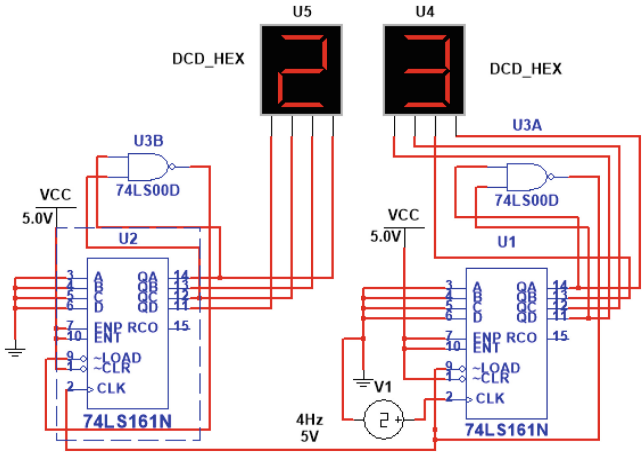

Fig. 4. Virtual Simulation of Calculator Circuits

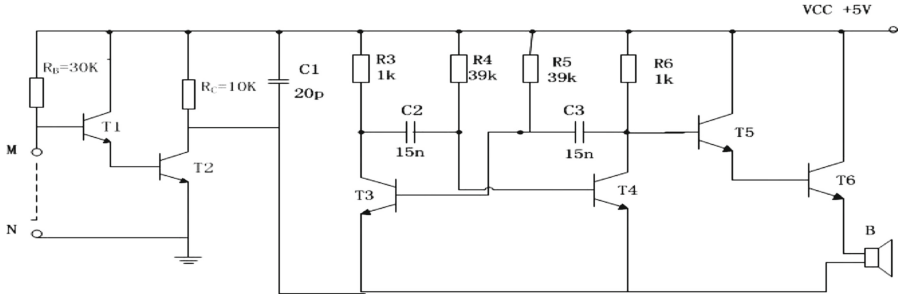

Fig. 5. Design and Implementation of Warning Circuit

complex, usually secondary projects. The projects focus on the cultivation of students' "D-design" and "I-realization" abilities. Students need to spend more, which will lead to contradictions between the teaching content and the limited classroom teaching time and resources, In order to solve this contradiction, we will try the CDIO teaching mode of segmented production chain and double line linkage. For example, the design project of warning line alarm circuit is relatively complex. Before class, the project is introduced through micro class or other online forms to enable students to learn online. At the same time, students are asked to put "C - conception" and "D - design" on the line, and put "I - realization" and "O - operation" offline, that is, in the classroom. The circuit diagram is shown in Fig. 5.

5.3 Project Decomposition Task Driven CDIO Teaching Mode

For those projects that are difficult for students to independently realize the project design, lack of foundation, or have never encountered new problems, usually corresponding to the first level project, the project introduction task driven teaching mode will be adopted. During the teaching process, the project will be used to introduce new knowledge, and the project will be divided into multiple sub projects or sub modules, and

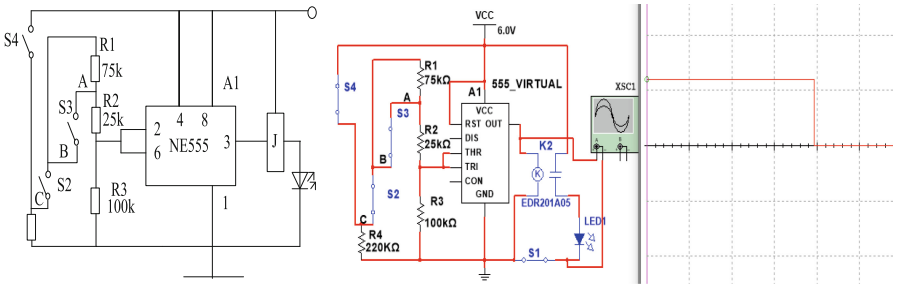

Fig. 6. Control circuit and its virtual simulation

then each sub project or sub module will be divided into several tasks that are easier to master and achieve. For example, the design and implementation of water level control and alarm circuits, the project is divided into three easy to achieve tasks, namely, control circuit, timing circuit and alarm circuit, as shown in Fig. 6, Fig. 7 and Fig. 8. Through the completion of these "tasks" one by one to achieve the overall expected teaching objectives. In the process of completing the task, we also use the four step teaching of CDIO to enable students to further store and understand new knowledge in the process of "learning", master the basic skills required, reach a certain level of knowledge ability, and then integrate the task into a more difficult project, so that students can skillfully use theoretical knowledge and skill levels to analyze and solve problems through integration.

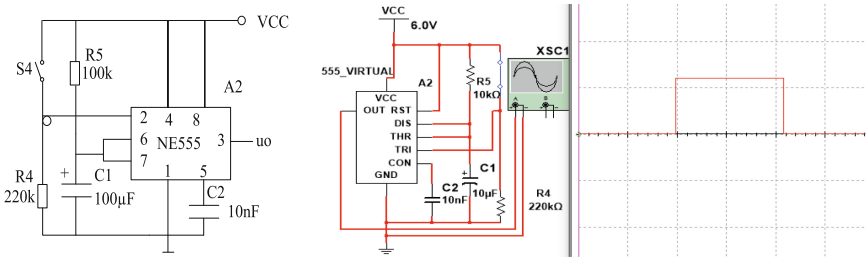

Fig. 7. Timing circuit and its virtual simulation

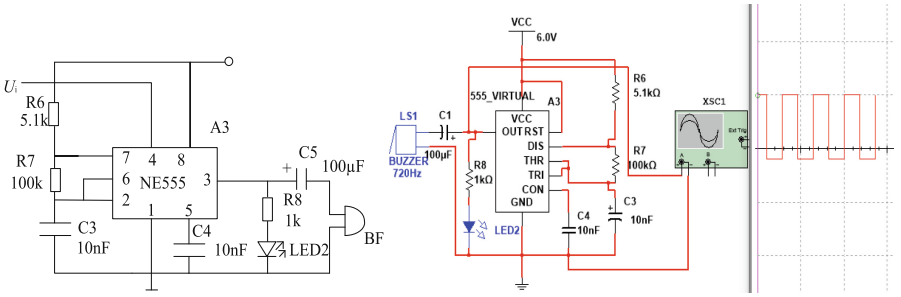

Fig. 8. Alarm circuit and its virtual simulation

6 Conclusion

This paper discusses the application of CDIO teaching concept in the teaching reform of electronic technology courses. Through strengthening the design of course groups, integrating virtual simulation technology, changing the teaching mode of courses and other aspects, practical teaching reform is carried out to improve students' practical application and innovation ability, develop teachers' personal business, and enhance vocational colleges' service ability to social enterprises. In the specific implementation process, we also need to strengthen the coordination and communication with the teaching management department and other teaching units. At the same time, we need to further explore how the practice of teaching reform can fully penetrate into students' daily teaching activities.

Acknowledgement. Teaching Reform of Higher Education in Hunan Province, China: CDIO Teaching Reform of Electronic technology Courses in Vocational and Technical Education Project No. Hnjg-2020–0019.

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