Reform and Practice of Electronic System Design Course Based on CDIO Educational Philosophy

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Keywords: Teaching research, Engineering ability, CDIO, Electronic system design.

Abstract. With the advantages of the integration of the arts and technology of BIFT, this paper discussed how to Introduce CDIO engineering quality education model into electronic system design teaching and practice teaching system in order to promote the "problem-based learning, project-based learning, case-based learning" and other research learning methods. At the same time, pay attention to "engineering practice ability, engineering design ability and engineering innovation ability" of students. With the development of discipline competition and a variety of extracurricular scientific and technological activities, the mutual promotion between professional teaching and subject competition should be strengthened, so as to realize all-round training of students' theory, practice and engineering ability in the design of electronic systems.

Introduction

Ministry of Education, Higher Education Teaching Committee on how to cultivate the application of talent, pointed out that to cultivate suitable for social development of high-quality composite application talents, must be combined with the actual development situation of universities, and make full use of their own advantages, and accurate prediction of social needs to adapt Information Age Social Development.

With the rapid development of electronic technology, the electronic system is developing towards fast, low power consumption, small volume, lightweight and high level of integration. The function of the electronic products is becoming more and more diversified. The traditional design methods cannot meet the needs of the modern electronic products, and unprecedented challenges at the same time.

The Objectives of Reform

With the development of science and technology, especially the rapid development of information technology, the demand for the knowledge and skills of the students in the electronic information specialty is in constant change, which requires the professional theory and practical teaching system to adjust with the progress of technology and the needs of the society.

The objectives of higher education and cultivate talent was clearly stated in National Medium and Long Term Education Reform and Development Plan (2010-2020) and Medium and long - term talent development plan (2010-2020) of China\textsuperscript{[1]}. The Core target is “Oriented to the industry, facing the world, facing the future, cultivating a number of innovative ability to adapt to the needs of economic and social development of high-quality various types of engineering and technical personnel for the construction of innovative countries, and building an innovative country, achieving industrialization and modernization to lay a solid human resources advantages, and enhance core competitiveness and comprehensive national strength in our country\textsuperscript{[2]}.

The teaching team of electronic system design has discussed, which determine the actual needs of the community as the target, the application of professional skills training as the main line, according
to the general requirements which focus on the cultivation of the students' theoretical foundation, practical ability, innovative spirit and comprehensive quality. Highlighting the practice teaching system of electronic system, treat the improvements of practice ability, design ability and innovation ability in engineering as the core feature of engineering quality and innovation ability training\(^{[3-4]}\).

During the implementation process of teaching reform, the teaching team discussed and reached a consensus on the following three points. First of all, pay attention to students’ capacity training in the practice of engineering. Engineering training is not only equivalent to the cultivation of engineering quality in cultivate the application of talent. Not only to pay attention to the students a wide range of engineering knowledge quality, good thinking quality, skilled engineering practice ability to develop, and communication and team work requires the application of technical knowledge and expression. Thus the technical exchange capacity, teamwork ability, problem solving ability, professional ethics and so should belong to engineering ability. Secondly, in the teaching practice, we should pay attention to the cultivation of students' creative ability and not just increase the learning content. Adhering to the idea of Constructivism education ambitions, take the students as the main part, construct the students' knowledge system with a marvelous and rich learning experience, to achieve the integration training of knowledge and ability, we must create and provide students with opportunities for self-reflection, communication and teamwork. The cultivation of these abilities is the best way through practice, repetition and feedback, other than using the teaching psychology and sociology principles. Finally, focus on strengthening the overall ability of students to develop, rather than add a single ability or skills training courses. Take the whole life cycle as the carrier to organize the curriculum, and establish the relevance of it, through the study and the completion of the project to train the students to acquire knowledge (self-study), application of knowledge (to solve problems), sharing knowledge (team cooperation), found knowledge (technology innovation) and communication skills (communication), so as to exercise personal and interpersonal skills in practice. Electronic system design ability is the method of application and expression of technical knowledge, engineering ability should be cultivated in such a technology environment.

**Reform Measures in Electronic System Design Course**

**Relying on the Advantages of the Integration of Art and Technology of Our College, CDIO Engineering Quality Education Training Mode Is Introduced.**

CDIO is a classic model of engineering education in Massachusetts Institute of Technology. The model emphasizes that engineering education should focus on practice, technology-based, the education process in the product, the system life cycle of the specific situation, to cultivate a new generation of high-level engineers as the goal\(^{[5]}\). CDIO engineering education model is the latest achievements in international engineering education reform in recent years. It takes the life cycle of engineering product, production process and production system into four stages: conception, design, implementation and operation. Using the life cycle which from research to development as the carrier, and then make the students in active and practical way to study engineering, and treat strengthen engineering practice ability, engineering design ability and engineering innovation ability as the core\(^{[6]}\).

Electronic system design is a course with very practical, which requires students to acquire both theoretical knowledge, but also have a strong practical ability. In the course of teaching, the introduction of CDIO engineering education mode and concept, planning curriculum system and teaching content, strive to promote the research-oriented learning method based on the problem, the project and the cases, strengthen the training of students' innovation ability. Strengthen students' professional knowledge and skills, meanwhile, take the textile and apparel industry as the background. We use field observation, field teaching and other forms to lead students into the field of textile and garment production, learning to master the electronic system design methods and the application of electronic information technology in the textile industry.
In the teaching practice of specific projects, we need to pay attention to cultivate students' engineering reasoning and analysis ability as well as the ability to solve practical problems.

- Adhere to the "project oriented" and "task driven" teaching method, in the electronic design related courses, introducing at least one specific design and research project.
- The students are divided into small teams of 4-6 people, each team has a project, and team members complete the entire process from design to manufacture.
- The implementation of the project and the task is to use the means which will make teaching and doing, practice and learning at the same time. During the course, the teachers should teach the necessary skills to students, then lead to the case as well as the key points and difficult points to be summarized and analyzed, so that the students can expand and develop themselves on this basis.
- No longer treat the "examination" as the unique evaluation method, and in order to avoid high marks but low ability, it will combine the subjective and substantial measures to measure student achievement.

Teaching Content Attaches Importance to the Introduction of Cutting-Edge Technology, Teaching Methods Highlight the "Project-Oriented Teaching" Concept.

The application of project-based teaching method to the cultivation of innovative talents of electronic specialty was an exploration of both theoretical and practical significance. In drawing on foreign experience and learn from the domestic university electronics professional training model based on the essence, teaching team set up a "creative electronic project practice" course in the electronic information engineering professional training program. In order to better cultivate the innovative ability of electronic information engineering students, so that students can have a stronger engineering practice ability. The course used Arduino or Microduino electronic building blocks to build electronic systems, and completed a comprehensive practice project.

In the implementation process of the course, we used the project team to complete the basic teaching requirements of the entire course. This method of teaching reflected the transition from the center of the teacher to the student center, from the center of the textbook to the project center, from the classroom center to the actual experience of the center of the change. This teaching model allowed students to deeply understand where the knowledge was applied, the combination of theoretical knowledge and practical application, in the project development and design process to develop students' "knowledge application ability" and "innovation ability". Because each project had a certain degree of integrity in the function, at the same time there was a certain level of promotion between the projects, so that students in the process of deepening, deepen the understanding of theoretical knowledge, thereby enhancing the interest in learning.

Needing to Build a Systematic Competition and Training System through the Guiding Role of the Professional Discipline Competition on the Practical Teaching

The students' test information will feedback to the specific teaching practice through the discipline competition, then we can form a virtuous circle pattern which professional teaching and subject competition to promote each other.

Taking the professional discipline competition as the carrier, we treat how to cultivate students' innovative ability, spirit of cooperation, theory with practical learning style, the practical problem of electronic design and production of engineering practice ability as the specific target, feedback the test for the quality of talent to the specific teaching reform through the competition, look forward that will promote the comprehensive quality of the electronic information students who study in our college effectively, and the promotion of quality education process to promote the role of a certain, and will play a certain positive role in the promotion of the quality education.

In addition, in the 2016 ~ 2017 school year, the teaching team for electronic information engineering and automation professional in two semesters had opened electronic system design and application (I), (II) public elective courses (the first class), to solve the existing undergraduate
teaching links "Heavy theory to teach light design applications" problem, play extracurricular elective and in-class curriculum benign complement effect.

Electronic system design and application (I) - In the field of analog electronic technology, focusing on the application of operational amplifiers (conventional and special) and system power (switch mode) design and application, aimed at strengthening students to master the content of electronic technology extracurricular content. Electronic system design and application (II) - In the micro-controller technology, increased TI MSP430 series of ultra-low power MCU teaching and application, highlighting the characteristics of the series MCU, and strengthen the student's program design and system debugging capabilities.

**Constructing the Teaching System of Three-Dimensional, Innovative and Practical, to Realize the Full Range of Training for the Students' Electronic System Design Theory, Practice, Engineering Ability.**

It is the key link of the teaching mode reform, through this teaching system, it will realize the full range of training for the students' Comprehensive, practical, engineering ability during the undergraduate course.

- The students' innovative practice can be promoted through the integrated auto adaptive training platform. Adhere to the practice oriented, through improving the incentive system, optimize the practice of environmental measures, to instill practical ideas, to motivate the enthusiasm of the practice, to provide all the conditions for the students to promote their own practice, to enhance students' comprehensive innovation ability.

- We can implement the internal and external integration of innovative practice, building a three-dimensional practical teaching system. In order to meet the needs of the curriculum reform, building the three levels of practical teaching mode which include basic practice, comprehensive practice and innovative practice. The students carry out scientific training plan, discipline competitions and other activities in the form of students' self-organizing academic community, made the extracurricular and curricular practice a mutual promotion, to maximize the practical investment time of students', training students' comprehensive practical ability.

- With the domestic and foreign companies and enterprises to build joint laboratories and off-campus practice training base, hire outside the experts and industry technical staff to school and student exchanges for the students to create quality training facilities to facilitate the conditions. From the beginning of 2012, our institute had jointly established Altera EDA / SOC Joint Laboratory, Cypress PSoC Joint Laboratory, TI DSP and MCU Joint Laboratory, Altium Electronic System Design Laboratory and Xilinx FPGA joint with international well-known industry enterprises laboratory.

- Taking advantage of resources of 985 or 211 colleges and universities in the Beijing area, and strengthen exchanges and cooperation, learn from each other, sharing of resources to achieve quality education.

**Summary**

According to the Beijing Institute of Fashion Technology innovative art integration of personnel training system, adhere to and improve the "art integration" school philosophy, and actively promote the "undergraduate teaching quality engineering" construction of the development strategy, the teaching team proposed to engineering quality and innovation ability training as the goal. Highlight the product design to "technology" and "fashion" cross-integration characterized by electronic product design around the direction of professional teaching reform and practice.

Teaching reform of electronic system design, based on the original teaching system to highlight training of the students' engineering practice ability, engineering design ability and engineering innovation ability, through the establishment of systematic and efficient three-dimensional personnel training practice teaching system, it will achieve the students undergraduate electronic system design
theory, practice, engineering ability, this will foster students of design theory, practice, engineering ability during the whole range of undergraduate stage. Through the reform of the teaching method, the students in our college have achieved good results in recent years. Take the national and Beijing college electronic design as an example, recent 3 years, the undergraduate students of our college who majored in electronic information engineering and automation, there are 60 students divided into 25 groups to participate in the competition. Students' enthusiasm is very high. Two team (6 students) were awarded the first prize of Beijing, ten team (25 students) were awarded the second prize of Beijing, six team (18 students) were awarded the third prize of Beijing award winning ratio has up to 75%.

Acknowledgement

This research was financially supported by the 2017 Beijing Institute of Fashion Technology Teaching quota Item-Practice Teaching Innovation Team Construction Item-NHFZ20170078/001/007, and University Student Subject Competition Item-NHFZ20170061/001.

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