

Research on “Communication Principles” Course Reform and Exploration Based on CDIO

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ABSTRACT “Communication Principles” is a core course of communication engineering. Under the background of new engineering education, we have carried out active reform and exploration on “Communication Principles” in order to cultivate applied talents with innovation ability. In this paper, CDIO concept is introduced into the reform and exploration of “Communication Principles”. CDIO represents Conceive, Design, Implement and Operate. In the classroom and experimental courses of “Communication Principles”, exploration and improvement are proposed to deepen students’ interest and arouse students’ enthusiasm. It can achieve a good learning effect. And through CDIO, the project plan, organization, coordination, communication and other comprehensive quality abilities have also been greatly improved.

1. INTRODUCTION

The purpose of engineering education[1] is to train engineering students to meet the needs of the society. That is to say, students have good engineering ability and deep technical knowledge before they take up their careers.

Therefore, it’s important to carry out educational and teaching activities in a purposeful, planned, organized and targeted way. Through the study of professional technology, social consciousness and innovative spirit, students can achieve the expected knowledge, skills and attitudes to meet the needs of modern engineering.

CDIO[2] engineering education mode is the latest achievements of international engineering education reform in recent years. It takes the life cycle from product development to product operation as the carrier. Based on this mode, it allows students to study engineering in an active, practical, and organic connection way. More importantly, it systematically puts forward the standard of ability training with operability and comprehensive implementation.

Under the new engineering background, students need to master the ability of independent self-study, independent thinking, independent analysis, problem solving, and continuous learning[3].

Hence, more and more teachers cultivate students' engineering practice ability in combination with CDIO innovation and engineering practice courses. Through project-based teaching, the cross-learning of interdisciplinary and industry leading edge knowledge is enhanced. It combines general education with professional education. New technology, principles and methods are integrated into Professional education curriculum system[4,5]. This pattern promotes the updating of curriculum and teaching materials. Through this training model, students and teachers team are competent for the construction of new engineering majors, and are capable of using multidisciplinary knowledge, principles and methods to solve complex engineering problems and future problems[6].

The “Communication Principles” are as the core course of communication engineering major. It is very important for the students majoring in communication. In fact, there are many shortcomings in studying the “Communication Principles” in the current teaching [7-9].

Hence, based on the new engineering background and the CDIO concept, it is of great significance to innovate and reform the teaching mode of “Communication Principles” to meet the demand for engineering innovative talents in today's society.

In this paper, research and the exploration are proposed on this point. The structure of this paper is as follows. Section 2 describes CDIO. Based on CDIO, the “Communication Principles” reform is analyzed in section 3. Finally, Section 4 concludes this paper.

2. CDIO

CDIO lays the foundation for the systematic development of engineering education. By combining the experience and lessons of engineering education reform at home and abroad, researchers analyze and study the connotation, characteristics, laws and development trends of the new engineering. CDIO is proposed as the new idea of engineering education reform and innovation. It plays an active role in deepening the reform of engineering education and promoting the construction and development of new engineering.

CDIO is in line with the concept of integrated product development (IPD) adopted by large international enterprises.

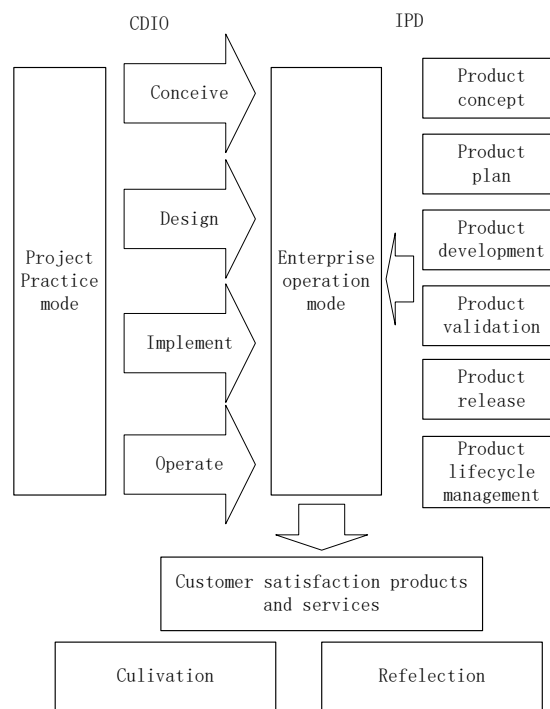


Figure 1 CDIO and IPD

Based on CDIO, the engineering practice is combined with the course of engineering foundation, professional foundation, professional integration and professional innovation. Knowledge learning, course offering, project practice and ability training should be combined. In this way, we can effectively promote the system of training the practical ability of engineering students.

3. Reform Based on CDIO

3.1. Teaching content and method

In the teaching mode, the traditional mode is teacher-centered. And the whole teaching process is based on the mode that teachers teach and students accept. This process is only the transfer of knowledge, completely ignoring the existence of students as learning subjects. As a result, students are only accept knowledge and don't think independently.

Meanwhile, this course is characterized by many concepts, knowledge points, mathematical formulas and mathematical derivation, large course capacity, relatively abstract, and high basic requirements on mathematics.

Based on CDIO, teachers firstly focus on the understanding and application of concepts. And then they analyse curriculum framework to further understand the function of each part of the communication system. Finally they explain in detail what each part does.

In teaching methods, teachers should no longer give priority to teaching. They should guide students to study in the form of asking questions. Through these methods, they cultivate students' self-study ability, thinking ability and improve students' learning enthusiasm. There are many ways to achieve this effect.

For example, teachers can be problem oriented, set up teaching situations, design problems, and solve problems by students' team discussion. Meanwhile, Teachers should learn about students' mastery of basic knowledge in advance and conduct teaching with a definite goal in mind, so as to improve teaching efficiency and achieve better teaching effect.

In terms of teaching content, teachers should not only pay attention to the knowledge of "Communication Principles", but also introduce cutting-edge communication technology.

Due to the rapid development of communication technology, the content of communication theory in "Communication Principles" is far behind the development of technology.

Therefore, it is necessary to introduce new theories and technologies about communication in the teaching process. On the one hand, it can also attract students' attention, arouse students' interest in learning and motivate them to explore new knowledge in communication theory. On the other hand, it can make students understand the latest development and application status about communication technology.

Teachers can introduce cutting-edge communication technology to students in the form of "special lectures" or "special classes". Such as, the internet of things, 5G(The fifth generation mobile communication system) technology.

Finally, Teachers should pay attention to the combination of teaching content and engineering practice. The traditional teaching lay emphasis on the theoretical analysis of "Communication Principles". In the background of engineering education, Teachers need to consider how to cultivate students to become qualified engineers. Therefore, it is not complete that teachers emphasize the theoretical analysis of "Communication Principles". If teachers can explain the theoretical knowledge in combination with the engineering realization, students can more quickly adapt to the development of enterprise engineering project after graduation.

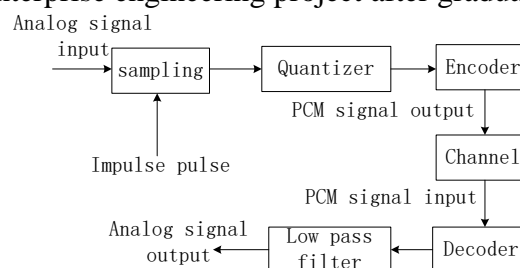


Figure 2 PCM

For instance, when teachers explain compression coding theory, they interpret this theory combining with the PCM (Pulse Code Modulation). Students' ability about understand and engineering practice will be improved base on this mode.

3.2. Experiment course

Because the course of "Communication Principles" is very practical, the experiment curriculum is important in this course. Experiment teaching and content play a prominent role in studying this course.

In the traditional experiment, the "Communication Principles" experiments are mainly used for verification. Most of the experimental modules are realized by integrated circuits and the functions

are fixed. In the experiment process, students are lack of analysis and thinking. They just complete the experiment. It is difficult to achieve the effect of the experiment.

According to CDIO, the "Communication Principles" experiment is not just based on the experiment boxes. In these boxes, they mainly complete the theoretical verification. By connecting the circuit in the experiment box and debugging the measurement instrument, students can observe the waveform changes in the signal transmission process. They analyze the reasons for the waveform changes to deepen their understanding relevant theoretical knowledge. Then they will be better able to grasp and use the knowledge.

Meanwhile, teachers should add system level of comprehensive experiments, which is from source to host. System level experiments can help students to master and apply the knowledge in the textbooks. They can effectively improve students' ability to solve practical problems. Because these experiments require students have higher understanding of the functions of each part of the communication system. Students also are encouraged to choose communication systems for simulation. Through these simulation experiments, students can establish system level concepts.

Lastly, Students can also design, implement and debug an actual communication device by themselves in the form of groups. Such as digital band pass transmission system. Students analyze and evaluate the performance of the communication system. In this process, it gives full play to the ability of students design, execution and debugging.

At the same time, the group format also teaches students about collaboration and division of labor.

3.3. Course extension content

Course practice should be open to students. And they are encouraged to carry out innovative development experiments, and expand the content of course learning. Students can execute experimental projects of innovative development in experimental practice bases such as "university student innovation laboratory". They exploit the system with software and hardware.

In the field of communication technology, the latest technologies of enterprise should be introduced to the teaching content and practice case. These technologies certainly stimulate student to learn more about system. In this process of learning and understanding technologies, students cultivate this experience, which deepen the learning technical foundation and strengthen the practical ability. Later, they will be able to grow into innovative engineering and technical engineer with good engineering ability and profound technical knowledge.

As mentioned before, students are also divided into different groups. They accomplish these technologies depend on their own group. Based on team work, students are more likely to find out which job they would like to do.

Because their special abilities and interests will be found out through CDIO. The general abilities required by all job types are included: engineering ratiocination and problem solving ability, personal ability and attitude, professional ability and attitude, team work, communication, communication in a foreign language, external and social environment. Depending on students' individual abilities and interests, they can pursue at least five different types of careers.

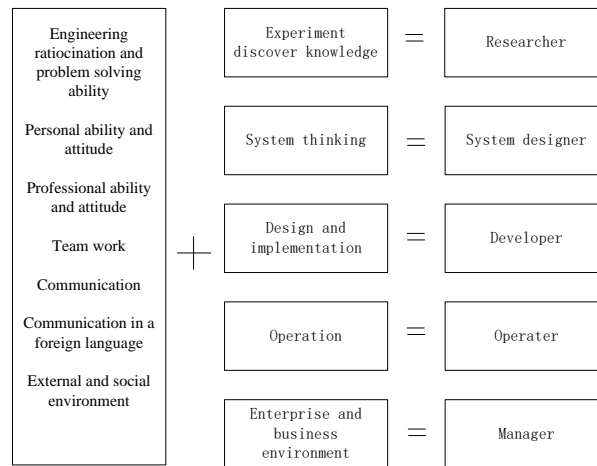


Figure 3 The career development

4. Conclusion

It is a long term process that we construct the “Communication Principles”. In this paper, the teaching contents, teaching methods, teaching modes are respectively proposed based on CDIO. All of these not only give students the interest and enthusiasm in the study of “Communication Principles”, but also further improve their self-learning ability, practical ability, innovation ability. In “Communication Principles” course, CDIO innovation and engineering practice are combined with students' project practice ability training. Through this mode, the latest technologies, principles and methods of the communications industry are integrated into the curriculum of professional education. It promotes the updating of “Communication Principles” course. Based on the problem, the project and the case, students can get better learning effect and more practical abilities.

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