



A Preliminary Discussion on the Teaching Mode Based on CDIO Engineering Thought

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Abstract. CDIO engineering idea constructs the teaching mode from a macro perspective, pays attention to integrating theory with practice, closely links enterprises, and pays attention to the cultivation of students' comprehensive ability. In the process of localization of CDIO mode, we must combine their own social development, universities, majors and students' characteristics, strengthen exploration from the theoretical and practical aspects, in order to build a positive and effective new teaching mode.

Keywords: CDIO · engineering education · teaching mode

1 Introduction

In October 2000, after four years of in-depth exploration and research, four universities such as Massachusetts Institute of Technology established the CDIO engineering education concept and established the CDIO international cooperation organization. CDIO represents the conception, design, implementation and operation. It takes the life cycle from product development to product operation as the carrier, and lets students learn engineering in an active, practical and organic connection between courses [1]. As an innovative tool for engineering education reform, CDIO framework provides student-oriented education, which emphasizes learning engineering theory and practice in the system and product process of Conceive, Design, Implement, Operate in the real world [2]. Since 2000, the CDIO model has been implemented in dozens of universities around the world led by MIT, and has achieved remarkable results. At present, many universities, including Denmark, Finland, France, South Africa, Singapore and China, have joined the CDIO cooperation plan to jointly develop and improve the CDIO teaching mode.

2 Thinking on the Application of CDIO Engineering Education Model

Engineering and technical talents have been playing a huge role in promoting national economy and scientific and technological progress [3]. Whether there are a large number

of high-quality engineering talents has become an important factor affecting the core competitiveness of a country. With the development of China's society and economy, we now focus not only on the knowledge and experience of individual talents, but also on the cooperation and communication, innovation and decision-making ability of talents. Therefore, reforming the traditional teaching ideas and methods has become an urgent task of teaching reform in colleges and universities. China's engineering education, too much emphasis on theoretical learning, do not attach importance to engineering practice and comprehensive ability, the urgent need for teaching mode reform [4]. CDIO engineering education model is the latest achievement of international engineering education reform in recent years. Its syllabus meets the requirements of engineering education of the National Organization of Vocational Engineers of the Washington Agreement. This paper analyzes and discusses the connotation and characteristics of CDIO and the enlightenment of engineering education reform in China from theory and practice.

2.1 The Big Engineering Concept of CDIO

CDIO model interprets engineering from a broad perspective, in which engineering is no longer limited to technology. Engineering is closely integrated with social development, market rules, management mode, history and culture, values, psychology and aesthetics.

CDIO model constructs the curriculum system according to the concept of a big project. CDIO model trains not only technical experts, but also engineers who can engage in product system development under the modern organizational management mode and market operation mechanism. It is also the creator of socially responsible engineering talents and social civilization with the purpose of human welfare. For example, the training objectives of CDIO involve: clear engineer goals and roles, clear engineer social responsibility; understanding the impact of engineering on the environment, society, knowledge and economic system; understanding the diversity of human society and historical and cultural traditions; understanding contemporary important political, social, legal and environmental issues and values; with a global perspective; aware of the differences between different corporate culture; understand enterprise strategy, objectives and planning; having the awareness of technological entrepreneurship and understanding entrepreneurship financing and organization; understanding the functions of management, understanding the roles and responsibilities within the organization, understanding the changes, dynamic processes and evolution within the organization. CDIO model is to cultivate engineering talents from a systematic macro perspective, from training objectives to curriculum system and teaching mode, all under such a concept.

2.2 Focus on Training Comprehensive Quality

MIT has gradually improved the CDIO model through the investigation and practice of enterprises and stakeholders for several years. According to the needs of society and industry, MIT has formulated the CDIO training goal of comprehensive system. CDIO not only pays attention to professional knowledge and practical ability, but also pays attention to social ability such as cooperation and communication, comprehensive ability such as problem solving, critical innovation, systematic thinking and planning, self-improvement ability such as lifelong learning, and professional attitude such as

good professional ethics. This goal is comprehensive, including not only professional and technical knowledge, but also practical ability, that is, in the social and enterprise environment, the ability to conceive, design, implement and operate products, production processes and engineering systems. At the same time, it also includes personal ability, professional ability and attitude, team work and communication ability, covering all the abilities required to engage in engineering work in the organization.

CDIO model integrates the training objectives into the whole curriculum system, and each ability point should be implemented in the curriculum and extracurricular activities. CDIO provides students with a learning experience and situation, so that students can develop their personal ability, interpersonal skills and product system concept, design, implementation and operation ability while learning subject knowledge.

2.3 Close Connection with Industries

CDIO education model is oriented by industrial demand, teaching content and methods are synchronized with industrial development, and theory and practice are combined to cultivate qualified engineering talents that adapt to industrial development.

2.4 Systematic Engineering Education Reform

CDIO education mode is a systematic engineering education reform. There are 12 standards for evaluating CDIO education mode, including: taking the conception, design, implementation and operation cycle of products and systems as the main line of engineering education; specific training objectives; integrated curriculum plan; introduction to Engineering; design practice; engineering practice place; integrated learning experience; students learn actively; teachers' engineering practice ability; teachers' corresponding teaching ability; assessment methods; professional assessment [5]. Therefore, CDIO model is a comprehensive system of engineering education reform, which covers the concept of engineering education, training objectives, curriculum system, teaching mode, experimental training conditions, teacher standards, student assessment methods, professional assessment and other factors. The implementation of CDIO education model requires close cooperation between schools, society and industry, the active cooperation of all aspects and departments of the school, and a series of specific links from the program to the implementation and evaluation. It is a complex system project.

3 Enlightenment of CDIO on Engineering Education Reform in China

CDIO model has good enlightenment and reference for engineering education in China. Shantou University and Tsinghua University took the lead in carrying out CDIO engineering education reform and achieved good results [6]. At present, more and more universities have participated in CDIO engineering education reform. In learning from CDIO engineering education reform mode, this paper argues that CDIO model is not only a kind of engineering education implementation plan, but also a kind of engineering education concept, we can refer to CDIO model in practice, but also to meet the characteristics of our society and the different characteristics of each school.

3.1 Challenges and Opportunities of CDIO Model

The CDIO model is an impact on China's traditional engineering education concept, and we need to rethink the role and function of an engineer in society. The implementation of CDIO mode has high requirements for teachers. In order to cultivate students' abilities contained in CDIO training objectives, teachers should have these abilities well, have rich engineering experience, cooperate with enterprises in various fields for a long time, and have a profound understanding of CDIO mode. The long-term discipline-based education mode in China has caused the separation of engineering education and practice. Teachers generally have expertise in a discipline field, but often lack comprehensive ability and engineering practice ability training, which is a challenge for us to implement CDIO model.

3.2 Localization of CDIO Model

CDIO model is the product of western social values and management mode. On the one hand, we should learn from the western advanced management concepts, models and values; on the other hand, there is also the localization of CDIO model in the learning process. Due to the differences in Chinese and Western cultures, management modes, and enterprise development, whether the CDIO model is fully suitable for the Chinese society, and whether the engineering talents trained according to the CDIO model are fully in line with the needs of the Chinese society, these issues require further empirical research, in-depth exploration at both theoretical and practical levels, and truly taking the road of localization of the CDIO model.

3.3 Elite and Popularization of CDIO Model

MIT'S CDIO mode is to cultivate world-class top engineering talents, and the CDIO mode reform of Tsinghua University in China is also aimed at the cultivation of top engineering talents. Then there is a problem of elite and popularization of CDIO training mode. CDIO mode is summed up through empirical research and practical exploration. It should not be a fixed and unchanging mode, but should be flexible to build an effective CDIO training mode according to the diverse needs of society, the orientation and characteristics of schools and the characteristics of students. For example, technical application-oriented universities can select some students to set up pilot classes, teach students in accordance with their aptitude, carry out CDIO engineering education reform pilot, and carry out bold exploration according to regional industrial needs.

The purpose of engineering undergraduate education is to cultivate engineers with solid technical foundation, broad professional knowledge, comprehensive engineering system ability and good team cooperation ability. It is the direction of engineering undergraduate education reform in China to change the previous education mode that emphasizes theory and neglects practice, pays attention to individual ability and neglects teamwork, attaches great importance to professional knowledge and neglects innovation ability. We should explore and study the new mode of engineering education in theory and practice according to different social culture, industrial characteristics, school characteristics and students' different situations.

4 Conclusions

Under the support of the reform project of school teaching research, the Web technology course based on Java has carried out exploratory reform on the premise of ensuring the smooth transition of students' knowledge structure, and has achieved certain results. Students master the basic knowledge of the course, have a full understanding of the theoretical knowledge of technology, and can learn independently to solve practical problems, especially the engineering ability and professional ability are improved, cultivate the team consciousness and comprehensive thinking ability, basically reflects the CDIO 'knowledge, ability, quality' trinity teaching goal.

Through the reform, students have been helped to establish systematic thinking, including project development and individual and group learning habits, because the reality of previous students in the course is that a large proportion of students in the classroom and experiment is always in a very passive state, lack of learning initiative and systematic ability to schedule time, do not know or do not think about the solution of the problem. Through the reform, we basically changed the students through rote hardback project training habits, set up the correct engineering thought.

By simulating the 'learning by doing' mode of enterprise projects, the disconnection between theory and practice is eliminated. Their self-learning ability is enhanced, and their self-confidence is improved. They also preliminarily realize the importance of professional ethics and team consciousness in the software industry, and improve interpersonal skills, team cooperation ability and system thinking ability.

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