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Construction and Exploration of University Software Engineering Teaching System Based on CDIO Educational Concept

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ABSTRACT. *In recent years, with the increasing call for reform of China's software engineering education model, the CDIO engineering education model has gradually been widely respected by domestic engineering colleges. The purpose of this article is to discuss the software engineering education in colleges and universities under the CDIO engineering education model in order to improve the quality of engineering talents in China. This article mainly adopts literature analysis, case analysis, and questionnaire survey to carry out research. Taking the software engineering major of University A as an example, the questionnaire survey is conducted on the major students, from the aspects of course teaching, course design and ability development. analysis. It is concluded that project-based curriculum design methods and problem-driven teaching methods have a very good effect on improving students' abilities. Among them, 82. 80% of the students are satisfied with the problem-driven theory teaching method; 96. 0% of students think that the curriculum design has greatly improved the comprehensive programming ability. This paper is based on the CDIO software engineering teaching training method and model is feasible, and it has a certain reference value to promote the implementation of the CDIO engineering education model in Chinese universities.*

KEYWORDS: *CDIO educational philosophy, Software engineering, Teaching system, Way to build*

1. Introduction

At present, although many universities have established a teaching quality guarantee system, there are many problems in the teaching quality guarantee system. First of all, most of these teaching quality assurance systems are macro-level systems at the school level, and it is obviously not reasonable to adopt the same set of quality assurance systems for different disciplines [1-2]. Some colleges and universities unilaterally believe that the teaching quality guarantee system is the monitoring of the teaching process, which dampens the enthusiasm and creativity of teachers and students. At the same time, some colleges and universities only focus on redundant system construction, ignoring the management of teaching quality improvement process, resulting in low participation of teachers and students. The professional course system cannot dynamically adapt to the market demand. There is a disconnect between the course teaching and the market demand, and the teaching content lags behind.

Students lack practical skills in software engineering. Can not adapt to changes in the market demand for software talents [3-4].

Training a qualified engineer requires three stages: learning of scientific knowledge, engineering practice and practical work experience. The software engineering teaching system in colleges and universities is a combination of theory and practice on the content level, and the two are closely linked [5-6]. However, at the level of teaching execution, the teachers of theoretical teaching and experimental teaching in colleges and universities are independent of each other, and present the current situation of over-emphasis on theoretical teaching [7-8]. As the latest engineering education model in the world, CDIO has been adopted by engineering education in many countries, which has played a positive role in improving the quality of engineering talents. With the reform of the teaching system of the integrated CDIO course in engineering majors in many universities, it has been unanimously recognized by students, employers and society [9-10]. The CDIO model with operability and testability is bound to become a research hotspot in colleges and universities.

This article takes the software engineering major of University A as an example, conducts a questionnaire survey on the major students, and analyzes it from the aspects of course teaching, course design and ability development. Practice has proved that the training method and model of software engineering teaching based on CDIO is effective, and it has certain reference value for the implementation of the CDIO engineering education

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model in Chinese universities.

2. Method

2.1 Problems Existing in the Teaching of Software Engineering Courses

The traditional training of software engineering talents generally emphasizes theory rather than practice, and the students are often lack of engineering practice ability. And the software engineering major's biggest characteristic is the practice is strong, should be in “do” middle school. Therefore, such a teaching mode is not conducive to students' mastery of knowledge. Failure to solve these problems for a long time will make students gradually lose interest in their major; On the other hand, theory and practice are not closely combined, and the training process is seriously derailed from the needs of enterprises. The teaching link of practice course is weak. Due to the limitation of teachers and experimental conditions, the practice teaching of software engineering major is basically some small verification experiments closely combined with classroom knowledge, and most students lack the systematic concept of project implementation. Specifically, it is lack of understanding of the importance of demand analysis and the basic ability to analyze problems. When doing summary design, disjointed and simple with demand analysis; Detailed design is very simple, even without doing detailed design to start coding; The test section is too simple or has no test design and documentation. Therefore, inevitably lead to done for requirements and design disconnect work practical difference, popularization and application value is not high.

2.2 CDIO Engineering Education Mode

CDIO stands for conception, design, implementation and operation, emphasizing the ability cultivation as the center. Students learn and acquire engineering ability through active and practical methods, so as to realize the goal of talent cultivation. The CDIO engineering education mode in this article is within the field of higher education, the cultivation of engineering education covers the whole process of engineering activities, including conception, design, implementation and operation of the whole cycle. To make the students not only have solid in complex engineering environment now have basic engineering knowledge, but also with the actual engineering activities in the environment of system construction ability, can do real work environment engineering activity each link of the task, to train the talents can adapt to engineering activities of the complete cycle of a kind of education mode. All links of teaching activities and teaching design should pay attention to the integrated design and construction, so that all links of teaching process and talent training should realize systematic and periodic goals.

3. Experiment

This article mainly adopts literature analysis method, case analysis method and questionnaire survey method to conduct research. By sorting and analyzing some policy texts and literatures in higher education, industrial development and other fields, as well as important documents such as monographs, papers, webpage materials, conference proceedings. Drawing on the implementation strategies of CDIO engineering education model at home and abroad, to find out their common characteristics and advantages, and to explore the areas that need to be improved in the implementation of talent training model in China, to explore the construction of software engineering teaching system in colleges and universities under the CDIO engineering education model. Combined with the specific conditions of universities in China, the application of localization is implemented so as to better recommend the implementation of CDIO engineering education in China. Taking the software engineering major of University A as an example, a questionnaire survey was conducted on a total of 153 students in the 17th, 18th, and 19th levels of the major, and analyzed from the aspects of course teaching, course design, and ability development to provide reference for other universities. Thinking.

4. Discussion

4.1 Construction of Practical Teaching System

(1) Update teaching concept

For software engineering, CDIO is the latest educational concept. Advocate in “doing middle school” and

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"project-based education and learning", let students learn in a proactive, practical, organic connection between courses, with the goal of training students' engineering practice ability. In this regard, it is proposed that: closely integrate with social needs, learn theoretical knowledge in "analyze and solve problems"; learn practical teaching ideas for engineering project development in "do".

(2) Promote problems and case-driven models

It is the essence of C (Conceive) and D (Design) in CDIO to adopt the teaching method of theoretical courses driven by problems and cases. Therefore, how to select cases and conceive design issues is the key to problem- and case-driven teaching methods. The selection of the case is either an actual engineering project or a practical application background; The selected or designed case should include multiple functional modules, or it can be decomposed into a series of problems; The case must be strong and easy to use in classroom teaching; the case must be representative. The structural design problems originate from the selected cases as much as possible; The questions designed are easy to understand and easy for students to understand; The problem cannot be solved or not well solved with the learned knowledge; Can solve this problem well with the knowledge to be learned.

(3) Hierarchical and systematic curriculum design

A hierarchical three-level curriculum design is proposed for professional courses and courses. The three-level curriculum design CDIO education concept advocates for students to "do" middle school, and in the process of "doing", take the life cycle of engineering projects from research and development to operation as the carrier. The three-level hierarchical block-based course design based on the project is a progressive relationship. The training objectives of each level of course design are different, and the requirements are also different.

(4) Establish an appropriate evaluation system

In order to reasonably assess the effect of curriculum design on improving the ability of students and further reform practical teaching, curriculum design specifies a set of evaluation factors, and different weights are given according to the importance. The CDIO model emphasizes the monitoring of the teaching practice process and the evaluation of the teaching effect. After adopting the staged practice model, it focuses on the supervision and inspection of the implementation and feedback of each link of the teaching. Of course, the design factors and weights of different levels and different courses need to be adjusted appropriately.

4.2 Analysis of Practice Results

In recent years, major domestic engineering colleges have actively explored the teaching reform of software engineering courses based on CDIO. This paper takes the software engineering major of University A as an example, through a questionnaire survey of 153 students in software engineering 10, 11 and 12 In the investigation, 151 cases were recovered. The statistical results of the survey are shown in Table 1 and Figure 1.

Table 1 Statistical Results of Questionnaires on Curriculum Teaching, Curriculum Design and Ability Development

Course design improves ability	Very large (%)	Average (%)	No(%)
Improve reading ability	72.80%	26.50%	0.70%
Comprehensive programming ability improved	96.00%	4.00%	0
Improved ability to analyze and solve problems	86.10%	13.20%	0.70%
Improved ability to innovate	74.80%	13.90%	11.30%
Improved collaboration	96.70%	3.30%	0
Problem-driven theory teaching method	82. 80%	13.90%	3.30%

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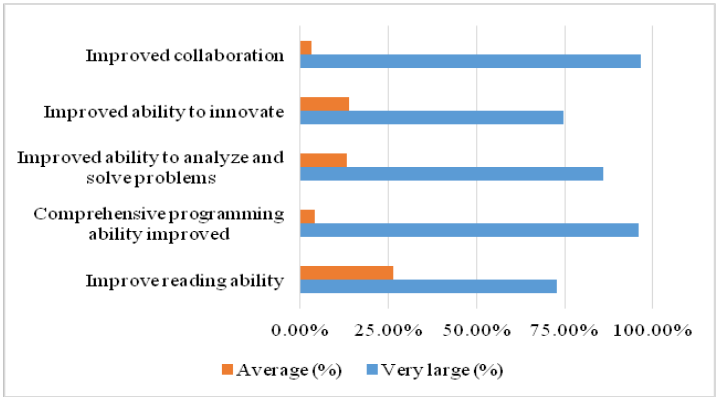

Fig.1 Survey Results of Curriculum Design and Ability Development

It can be seen that the problem-driven teaching method and the project-based course design method have a very good effect on students' knowledge acquisition and ability cultivation. 82. 80% of the students are satisfied with the problem-driven theory teaching method; 96.70% of students believe that the course design has improved the ability to collaborate; 96. 0% of students think that the curriculum design has greatly improved the comprehensive programming ability. But there are a few students who think the effect is average, and a few think it is not feasible. In this regard, further communicate with students, find out the reasons, further improve teaching methods, and continuously improve the teaching quality of software engineering. At the same time, according to the survey statistics of the employment situation of the undergraduate software engineering graduates of A school, it can be seen that the employment rate of this major reaches 95.5% (including graduate students). From the perspective of employment, the training methods and models of software engineering teaching based on CDIO are feasible and effective.

5. Conclusion

Cultivating engineering talents that meet international standards and requirements is an inevitable requirement for the internationalization of engineering education and better adaptability to globalization trends. In recent years, we have continuously carried out reform and exploration in the course of teaching software engineering courses, and achieved good teaching results. The employment situation of the software engineering profession is very good, but because the CDIO talent training model itself has a very complicated system, it has not been practiced in China for a long time, and there are still many ways to improve and explore. How to further improve the teaching level and the quality of employment is the direction of our continued efforts and the unshirkable responsibility.

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