

# The Construction Research of Software Engineering Practical Teaching System Based On CDIO

Peng XIE<sup>1,a</sup>, Hongmei ZHANG<sup>1,b</sup>

<sup>1</sup>College of Science, Air Force Engineering University, Xi'an, 710000, China

<sup>a</sup>xpf68@163.com, <sup>b</sup>zhm\_plum@126.com

**Keywords:** CDIO model; Software engineering ability; Ability capability maturity.

**Abstract.** The paper analyzed of CDIO model construction and CMM capability maturity mode and discussed basic connotation of talent training based on CDIO-CMM, including training objective, training requirement, curriculum. The computer science college students training indicated CDIO-CMM training program contributed to form undergraduates engineering ability, and also to improve training program with the thought of “Internet +”.

## 1 Introduction

CDIO Represents conceive、design、implement、operate, and also is the centralized reflection of “learning by doing” and “the education and study based on projects”. Currently, CDIO is a new model of higher engineering education in the world, proposed by Massachusetts institute of technology and the other three universities in switzerland, centralized the wisdom of many engineering education elites in the world, spent millions of dollars. The whole set of engineering education conception and implemental system emphasized training computer science college students master basic engineering theories and specialized knowledge, in which innovation practice and team design throughout entire talent training process, so the excellent computer professional students are trained with good professional skills and good professional quality.

CDIO inspired by products/system life cycle process, which including four processes: conceive、design、implement、operate, abbreviations for CDIO.

CDIO inspired by products/system life cycle process, which including four processes: conceive、design、implement、operate, that abbreviations for CDIO.

CDIO training program divided software engineering ability into four layers: engineering basic knowledge, personal ability, team ability, and engineering system ability, which required software engineering students to achieve by comprehensive training. The subjects organized and excised by Mutual support and interaction. The course reinvest study program supplement of production practice, and also excised by school lessons, modern study with initiative, experiment, and group learning in study room or laboratory room. Though participation, conceive、design, realize personal technology experience, the software engineering students achieve desired goals: skills of construction system, mastery of the engineering fundamental application knowledge.

## 2 The Induction of CDIO-CMM Education Concept

The university construct CDIO-CMM ability capability maturity model—divided engineering ability into four different levels of entry level, basic level, advanced level and professional level according to CDIO engineering education conception.

The entry level usually refers to freshman year. The courses including foundation course, and is also emphasized on college humanistic quality education of feeling, will power, interests, character, idea, belief, strengthened training of research, logical analysis, judgment, emergency management, pay attention to teamwork, professional quality and ability forming and training.

The basic level usually refers to sophomore students, who have basic fundamental knowledge, and initially conceive、design、implement、operate combined with CDIO. In this stage, we can offer CDIO courses, train students' problem-solving ability and creativity, critical thinking.

The advanced level usually refers to junior students, who can good master professional knowledge and familiar with CDIO theory based on program study process, solve specialized knowledge, discover the problems and rules.

The professional level refers to senior students, who have professional CDIO ability, creatively solve practical problems based on CDIO, improve CDIO ability and quality, are high-caliber talent with engineering application skills.

### **3 The disadvantages of traditional software engineering teaching model**

First, theory research and practical application is inconformity. The traditional software teaching usually learned from computer basic courses, C language course, and then database, Jave, computer communication professional knowledge , program design of C、C++、Java、Visual Basic、WEB; VFP, database program design of Visual FoxPro、Access、MySQL,different directions of software engineering, which every subject independent relatively. The traditional teaching mode exposed many problems for example lacking of practice experiences and unable to undertake work, which spend much on training.

Secondly, traditional assessment method is that theory test inconformity with practice test. The assessment method is simple. Emphasizing on result of assessment that leading to won praise and fame.

The software students just should study knowledge points of teaching outline, ignoring cultivating operation ability, leading to knowledge is inconformity with practical ability, so the result of assessment is unfair, and seriously damage to software engineering students and affect their practical enthusiasm.

Thirdly, the software engineering students lack of self-studying, good independent thinking, good team work, interpersonal communication ability in current teaching. Due to computer developing quickly, lead to professional theory falling behind practice, and theory is inconformity with practice. Due to textbook outdate, renew speed falling behind developing, teaching focus on theory, the most of professional teachers have no rich experiences, reluctant to research software engineering students' though and experiences, lack of communication, interaction, teaching in accordance with students' aptitude that also called "spoon-feed", ignore students' self study ability, good independent thinking, good team work, interpersonal communication ability training, and as result, the software students were trained who lacking of professional ethics and responsibilities.

### **4 The construction of software engineering education system based on CDIO-CMM model**

The software engineering education system based on CDIO model emphasized software practice studying by actively exploring knowledge relevance, so I proposed education system reform based on CDIO idea by the example of software engineering major, which implement concept of CDIO idea into teaching and practice.

The software engineering students improve to professional level from entry level with manifesting "software engineering CDIO idea", for the goal of talents training based on CDIO-CMM idea that is fostering the high-quality talents who comprehensively solve problems with specialized knowledge, well-ethical persons with good team work and practice experience.

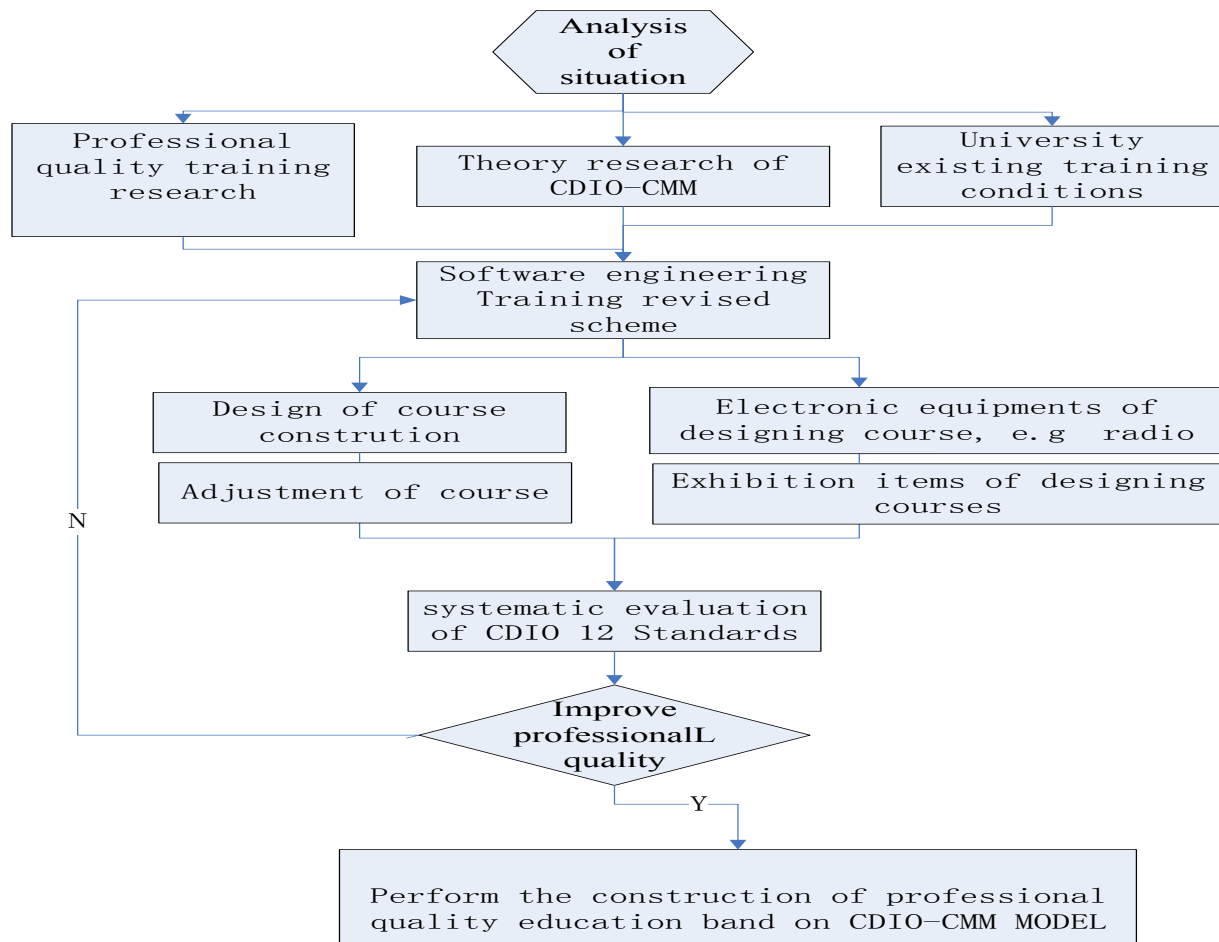


Fig. 1 Frame of software engineering education training system based on CDIO-CMM model

## 5 The concept and attempt of teaching mode reform based on CDIO-CMM idea

The reform of software engineering education refer to “full-around ability cultivating” based on CDIO teaching model implement guiding of training plan, teachers, teaching methods, assessment of software engineering students, study environment, and implement process and twelve standards . The reform of “teaching in the integrated” and “teaching in the program” to realize “learning in practice” “teaching in practice” by the conceive、design、implement、operate (CDIO)whole process.

### 5.1 Set up quality of teaching conception

First, change original teaching method, penetrating CDIO mode in to software engineering teaching and learning. Various teaching methods such as interaction teaching, problem-based teaching, cooperation teaching, cases teaching, mutually combine and flexibly apply, improve teaching quality.

Secondly, established perfect teachers assessment system, strengthen engineering direction, changing the ignoring of teachers’ engineering practical abilities and pay attention to teachers evaluation, employment and main research results. Improve teacher integrated teaching, use active learning method and examine software engineering students’ learning ability.

Thirdly, the teaching based on CDIO-CMM model in software engineering primarily reorganizing teaching content, which taking everything into consideration, distinguishing levels, setting priorities, explaining details and simples, as result the teaching content possessed with practicality and advanced.

Fourthly, further to expand the way and seek a new administration method on subject quality management, combine daily teaching quality management and quality management system, make the good order of planning decision, organization and implement, supervise and inspection, summary and evaluation.

## 5.2 The construction and order of design courses

(1) The curriculum system focus on many research directions, adding to software engineering field new technologies, especially some fundamental courses of DASL technology, combination of software and IT, solar engineer, LED, power management, VISTA、4G network, satellite communication and so on.

(2) Add to practical courses. For example: phased-array radar, 3D image techniques that make software engineering students know antenna with intuitive sense. The core courses guarantee necessary professional theory, make the students obtain basic knowledge with sustainable learning, foster good self-study ability and habits.

## 5.3 The combination of college education and enterprises practice

The idea “design-realization experience” of CDIO-CMM is a model that cultivate engineering ability and educational model guided by engineering program design. Engage excellent software engineering students of enterprise for part-time teacher, teaching their experiences and thought, methods to students, invite technical experts deliver lecture for software students.

Setting reasonable engineering content

The idea “design-realization experience” of CDIO-CMM is a model that cultivate engineering ability and educational model guided by engineering program design.

According to software engineering talents cultivation conception, only organized schools and enterprises mutually, then lead to virtuous circles. The construction of college course practical teaching system is the key to talents training, so establish software engineering factory environment in cooperation enterprise, software engineering develop program, position in turn platform, software engineering produce guidance platform, production operator database, assessment center, configuration management, software engineering production system and so on.

Except that, we should get variety of cooperation, complete the outside school base, improve undergraduates’ practical ability, as a result achieved talents training requirements.

Cultivating “Internet +” thinking

Firstly, broaden the version. “+” is other combine, reform and open, mix together. Broaden students version by the way of “knowledge forum”, “professional party” “association union” and communication between students.

Secondly, drive innovation and play innovation power, reform and revolute with internet thinking. Encourage to ask questions, innovation, and discussion.

Thirdly, respect students, improve self-confidence. Self-confidence is fundamental power of promoting scientific advances, increase economic growth, social progress, culture prosperity.

Establish assessment system based on process

## 6 .Conclusion

The paper discussed the software engineering training and construction of software engineering practical teaching system based on CDIO, and the though of “Internet +”, to improve students to professional level from entry level, adapting to development of times, inspiring the students’ learning interest and enthusiasm.

## References

- [1] Wang Tianbao, Cheng Weidong. The research and practice of innovative talents training model based on CDIO— The reform practice of Chengdu information engineering college [J].Higher engineering education research. 2010(01)
- [2] Hu Zhigang, Jiang Lin, Ren Shengbing. The teachers’CDIO ability assessment and promotion based on CMM [J].Higher engineering education research. 2010(03)
- [3] Li Peigen. The practice consciousness in future engineering education [J].Higher engineering education research. 2010(06)

- [4] Wanghong, Xu daqui The research of high-talents engineering application talents training[J].Higher engineering education research. 2010(06)
- [5] Gu Peihua, Shen Minfen, Li Shengping, zhuan Zhemin, Lu Xiaohua, Xiong Gguangjing. From CDIO to EIP-CDIO— The exploration of Shantou university engineering education and talent cultivation model [J].Higher engineering education research. 2008(01)
- [6] Zha Jianzhong The discussion of “learning from practice” based CDIO mode [J].Higher engineering education research. 2008(03)