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IERI Procedia 2 (2012) 299 – 302

Procedia IERI

www.elsevier.com/locate/procedia

2012 International Conference on Future Computer Supported Education

# The C/C++ Integrative Teaching Based on CDIO Education Model

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**Abstract**

In view of the curriculum characteristic of the C/C++ language, a new idea about teaching reform based on CDIO is proposed in this paper. In everyday teaching, the teaching link, which centers on cases and for the purpose of program design skills to improve can effectively improve the ability of students to solve real application problems.



*Keywords:* CDIO, C language, integrative teaching ;

## 1. Introduction

With the rapid development of our economy, many applied talents are needed, who can not only apply flexibly the latest theories result to solve specific problems in the production practices, but also have ability of sustainable development. Our traditional education emphasis on discipline knowledge, but has many defects in practice ability and innovation ability education. According to a study by the consulting firm McKinsey, only about 10 percent of Chinese engineering graduates are qualified for work at multinational companies. [1] Under the background of global economic integration. Chinese existing engineering education pattern must be adapted to the rapidly evolving technologies, and the reform and practice to meet the international standards in

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 doi:10.1016/j.ieri.2012.06.092

engineering education should be carried out as soon as possible. In 2010, to implement "the national medium and long-term program for educational reform and development (2010-2020)" and "the national medium and long-term plan for talent development (2010-2020)", the Ministry of Education worked out a excellent engineer education training plan to further promote the reform and innovation of engineering education.

CDIO, the full name is Conceive-Design-Implement-Operate, engineering education pattern was founded by four universities such as Massachusetts Institute of Technology and the Royal Swedish Academy of Sciences and etc. It is the latest result in the international engineering education reform in recent years. The CDIO education pattern takes the life cycle from product development to product operation as the carrier and makes students learn project in the active, practical, organically connective ways among courses based on the method of comprehensive management.[2] For the full implementation of the spirit of the Ministry of Education on the implementation of the undergraduate teaching quality and teaching reform project, some higher level university of engineering and technology have already started to have the teaching reform based on the CDIO educational idea and get a satisfactory result in recent years.

The C language and C++ language are compulsory courses for computer major or relevant majors in Chinese universities. The teaching of Structured programming and object oriented programming have strongly theoretical and practical operational. Mastering the C language and C++ language theory and programming skills plays an important role for follow-up professional course learning for the students. In view of the need that C/C++ language teaching trains analysis, problem-solving ability, according to the CDIO engineering education idea, this paper put forward a teaching plan of the integration of theory and practice. The plan merges C language and C++ language teaching as a unity.

## 2. The design of integration teaching scheme for C/C++

Because of the inherent continuity and relevance of C and C++ language, we specially set up the C/C++ course group to constitute the C and C++ language teaching content into a complete teaching system. In the teaching system, on the one hand, our teaching content continues two threads, where the data structure is from the simple to the complex, while the complexity and the difficulty of the application problems gradually deepen. On the other hand, in each teaching session we take the solving process of the practical problems as the guide, and the structured, modular, object-oriented teaching method as a core, focusing on the program analysis, design, testing, debugging and programming error analysis and other relevant knowledge and methods，and also pay attention to the software engineering thought and method to improve the students' programming regularity.

At the same time, in the C/C++ curriculum planning, we break the previous curriculum design concept, which is mainly based on theory, and supplemented by practice. Whereas we strengthen the practical teaching and increase the open experiment course. Though the daily teaching, the teachers and the students focus the teaching and learning on the core problem that is the programming design practice. The teaching begins with the practice of the programming design and method, at the same time, the C language and the C++ language grammar are organically combined with the programming teaching cases. Thus the C/C++ language finally comes back to the essence of the engineering practice.

## 3. The reform design of C/C++ language teaching method

C/C++ is a powerful tool for computer and related professional students to learn the professional follow-up courses. With it students will initially contact and understand of the computer professional terminology, concepts. At the same time, it enables students to master common programming and debugging program means and cultivates students with strict logical thought and work style. Therefore, this course is practical and

with strong skills, which requires that we must be based on the CDIO talent cultivation, study all aspects of the teaching and reform to improve the quality of teaching when we implement the C/C++ course integration teaching plan.[3,4]

### *3.1. Teaching content organization emphasized the professional characteristics*

We give teachers so sufficient teaching freedom under the uniform teaching planning that each teacher can organize teaching content according to themselves Professional characteristics, and such a method can give fully dynamic activity to teachers. Through the teaching process, students can enhance the understanding of the teachers, which can give a hand to the follow-up related to professional learning and professional tutorial system. We demand that when the teachers prepare lessons they must thoroughly understand the course content and also emphasize on the teaching clarity and the systematicness and scientificity of teaching content. When teaching, teachers truly achieve exquisite selecting and teaching and truly bring out problem-solving ideas, methods and steps so that students can learn how to analyze and solve problems and how to gradually develop the correct mode of thinking in the program designing.

### *3.2. Stereo Class Teaching*

To cultivate students' interest in classroom teaching, teachers should be more effort in the teaching method and means. We adopt many various and flexible methods to organize teaching content and also handle correctly the relationship between traditional teaching method and modern teaching technology. On the one hand we organize the teaching content with the modern information technology, and the multimedia courseware, network platform, the text the writing on the blackboard and teacher-professor consist of an organic effective stereoscopic teaching system. We emphasize the teaching methods' integrated application and also pay attention to the teaching process' gradual way on the process of teaching. We usually cut into the teaching topic through many interesting and practical teaching examples, such as "rabbit", "narcissus number", and "Tower of Hanoi" and so on. Some grammar's explains are embedded into these instances to avoid the stiff preach. At the same time, we pay more attention to the program case's instant demo, and this intuitive presentation can improve students' learning interest and mobilize students' learning initiative. At the end of a teaching case, according to progress of teaching and teaching design thinking subject, and to provide expanded learning materials by teachers, we guide the students to learn actively out of class.

### *3.3. Rich in supporting teaching resources*

In order to achieve the prospective teaching effectiveness, course group constructs the rich teaching resources through various efforts. Firstly we propose the construction of C/C++ program design classification database according to the basic knowledge of programming, and program designing is divided into 3 levels of difficulty from simpleness to difficulty: Level 1, the subject is in relation to the basic knowledge of language, which is basically about debugging and running of a given program. Level 2, the subject is in relation to the basic training of the program design, which is basically about filling in the blanks and simple program designing. Level 3, the subject focuses on improving the train of the program designing. The classification database is available to the students who can use it to self-study and self-examine.

Task driven collaborative learning is a good way to learn C/C++ language courses, so teachers in the teaching practice for students create a collaborative learning environment to discover problems in time and provide guidance. In this respect we have established the C/C++ language learning website to support and promote the teaching. In this platform, we allow teachers to publish teaching materials according to the

teaching schedule and teaching materials can be shared between the teachers of the course group. It has established a good teaching communication channels. At the same time, we organize force to establish the course forum and use QQ and other instant messaging tools for students to provide online Q&A.

### *3.4. For the purpose of application to the reform of curriculum practice*

To learn a language in addition to understanding the grammar rules and mastering the algorithm thinking, the most important is a thing that we must develop students' practical ability. It requires that the students must program, debug and experiment on the machine. For this, we built a system of courses practice that it contains course experiment, open experiment and concentrated practice for the purpose of application. With the help of the experiment students master the basic grammar rules. On the basis of this by offering the creation of the chosen topic of open experiment we could strengthen the students' basic training. On the other hand, we conducted the contents of the Windows interface programming, Standard Template Library and other development training finally for the centralized practice link, we have designed a comprehensive application subject and students are required to establish the project team. As a group we do the experiment management unit. In initial implementation process we convey to the student the software engineering and project management theory.

## 4. Summary

The C/C++ language is a very practical level computer programming language. Mastering the C/C++ programming language programming technology for computer and related professional students' follow-up courses to study and work has very important significance. According to the CDIO concept, we are taking ability development as the main line and competency training for the axis. We will combine with the training needs of different professional direction and the combination of different students' individual learning needs to improve engineering practice teaching that they are based on the curriculum experiment, opening experiment and centralized practice. In the form of project practice we will be the specific theoretical teaching and experimental teaching integration into the overall and the introduction of project management is the implementation of the teaching process quality control. This can realize the flexibility of the course structure and adapt to the requirements of personalized curriculum, so that C/C++ curriculum teaching will be more efficient.

## Acknowledgements

This research was supported by the Education Research Foundation of Shijiazhuang Tiedao University under No. 110219.

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