THE LEVEL-2 PROJECTS FOR COURSE CLUSTERS

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ABSTRACT

CDIO educational framework helps students to construct their expandable knowledge, personal, interpersonal and system competencies. We have put in practice the 3 level projects CDIO approach in the College of Engineering, Shantou University. The projects are divided to three Levels: Level-1 projects would be designed to cover the most of the knowledge and competencies of a bachelor program; Level-2 projects are designed to cover the knowledge of a group of the related core courses; Level-3 projects, which are similar to a course designing, are designed to cover a core course. We describe the designation, implementation and evaluation of the Level-2 projects in Computer Science program. The students answer our inquiry to the approach. The inquiry indicates that the level-2 projects are benefit to training students understanding of the project design, team spirit and mode of thinking..

KEYWORDS

EIP-CDIO, Three Level Project, Computer Science Program, Course Cluster.

INTRODUCTION

The CDIO is an innovative educational framework for producing the next generation of engineers. It provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating real-world systems and products. It emphasizes the personal engineering abilities, not only the academic knowledge and skills, but also the hands-on learning of product and system building, disciplinary knowledge, and social learning. Combining the situation of China context, Prof. Gu developed EIP-CDIO (Ethics, Integrity and Professionalism) Engineering education framework. Focus on fostering high lever engineer, EIP-CDIO enhances the amalgamation of the personal character of Ethics, Integrity and Professionalism to the skills of Conceiving, Designing, Implementing and Operating.

EIP-CDIO is an education framework directed by the project design. The goal is training student's ability of engineering. It is the description and brief presentation of "Learning by doing" and "Project based learning." "Learning by doing", "learning by action" or "Experiential learning" is an education principle developed by John Dewey. He pointed out that the Learning by doing is advance than Learning by hearing. "Learning by doing" embodies the combination between learning and doing. It spans the knowledge from the classroom and real word actives. "Project based learning" lets students learning engineering through active and experiential methods. It constructs the relevance between courses. EIP-CDIO tries to

integrate whole course system through project designing process. In the framework, all the knowledge and skills needed learning are set surrounding the project design as a core.

THREE LEVELS PROJECT STRUCTURE

We categorize EIP-CDIO projects into three levels, as illustrated in Figure-1, depended on the size and the range of knowledge covered. Level-1 projects would be designed to cover the most of the knowledge and competencies of a bachelor program; Level-2 projects are designed to cover the knowledge of a group of the related core courses; Level-3 projects, which are similar to a course designing, are designed to cover a core course.
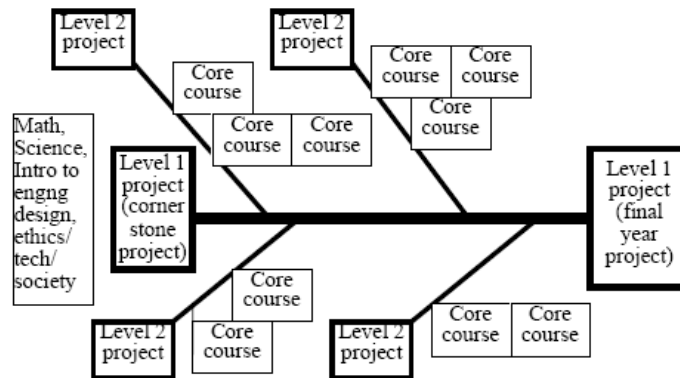

Figure-1. The three levels project structure

Level-1 project spans whole undergraduate program. It trains students in Conceiving, Designing, Implementing and Operating. A student, at least, involves in two Level-1 projects. The first one is the introductory project. Usually, it starts at 2nd or 3rd semester and ends at 6th or 7th semester. Students selected, supervised by teacher, one product as an instance, which covers the basic knowledge and application, to dismantle and analyses for learning its structure and designing thought. So that, students can understands the relation between the core knowledge of the area and real-work products early. Through the project designation, students learn the role of core courses in the area, improve the interesting in studying and create the knowledge structure in the area. The final year project is the second Level-1 project. Two projects connect each other. Through the training of the first project and courses studying, students have mastered the basic knowledge, gained the experience of project design and laid a well foundation for the final project (the second Level-1 project). The goal of the second Level-1 project is to design a real-word product. By Conceiving, Designing, Implementing and Operating the real-world systems and products, students learn how to resolve an engineering problem and know well thinking methods in Engineering.

Level-2 project link individual courses and echo to the issues rising from Level-1 project(s). In general, 3-6 Level-2 projects are involved in the undergraduate program. A project covers the knowledge related to a cluster of core courses in a certain area. As the support to Level-1 project(s), Level-2 project integrate the key knowledge points within related course cluster. In these projects students conceive, design and implement a middle size real-word background project using the knowledge related to the courses cluster. Its aim is training the ability of knowledge integration and application. Additional, as the complement to the classroom teaching, it plays an important role in cultivating the innovation ability and lifelong learning ability. While Level-2 project is the first time to complete a whole project, it is important to train the ability of teamwork, engineering understanding and rising the interesting.

Level-3 project is a project within a core courses. Based on the knowledge of Mathematics, professional background and scientific training, Level-3 project is set in a small size practical

project in a core course, in order to enhance the understanding and application of the content taught in class.

On overview of the 3 levels projects, the Level-1 projects play the role of the backbone in the EIP-CDIO education framework, the Level-1 projects look like the rib bone who supporting the back bone, and the Level-3 projects, which are similar to a course designing, are designed to cover a core course.

THE DESIGNATION OF THE LEVEL-2 PROJECTS IN COMPUTER SCIENCE PROGRAM

We have started to implement EIP-EDIO framework in Computer Science Program at Shantou University from 2007. The first Level-1 project is to develop a Card system used in campus. The system includes the hardware system, which reads and writes the information from (to) card reader; the software system, which processes the data saved in the database that stores the information of students, for example, the score of each course and the personal information; the transformation system, which transfers the information between the above two systems and keeps the information safety. The second Level-1 project (final design) is determined by director teacher. Next, we describe the Level-2 projects in our program.

We design four Level-2 projects are designed in the computer science program. The first one is designed for a group courses related to the basic theory of computer science: Introduce of Computer, Discrete Mathematics, Programming and Data Structure. It covers the knowledge of the physical structure of computer, the programming, the file system, the theory of relation, the mathematical logic, algebra, linear list, the tree structure and algorithm, graph structure and algorithm, search algorithm, sorting algorithm. Considering the support to the Level-1 project, we select the project---"The teaching management system in university". In the system, the knowledge of the group of courses would be used. For the reason, we command the system:

1. The data is stored in documents (not existing database). This let students understand the document system well, specially, the management and operation of binary document, text document and data stream. Developing sorting, ordering programs training the ability of programming.
2. Creating the data structure based on relation system. The relation theory is the basement of modern database system. This work let students understand the importance of "Discrete Mathematics" in computer science program and enhance the connection between courses.
3. Developing data input and output system to connect with public software. Modern software often is a multi-platform. This work let students familiar in transform information with public software.

The second project involves in the courses related to the hardware: Electronic Circuits, Digital Logic, Assembly Language, Computer Organization and Architecture, Microcomputer Principle and Interface Technology. It coves the knowledge of the combination of timing and logic circuits, design of small-scale digital system, the basic methods of hardware description language (VHDL), the usage of the simulation and electronic design automation software (Quartus Ⅱ), the usage of the PLD develop version (DE2), the input and output instructions of Assembly Language, programming of cycle, the delay and keyboard control. For these tasks, in this term, we give four projects to select.

1. Designing a Digital Clock. The Digital Clock has the function of timing, correcting and ringing.
2. Designing a Scare answering devise for four persons. The digital scare answering devise with the function of scare answering, counting down and buzz warning.

3. Traffic light controller. The project needs designing a traffic light model, which simulates the working of a traffic light in a crossroads, with the function both of automatic and manual controlled.
4. Digital Frequency meter. The project needs designing a simple frequency meter with the function of multi-grade measurement, automatic measure grade adaptability and supporting multiple wave inputting.

The third Level-2 project includes a group courses related to advanced software: Principles of Database, Object-Oriented Analysis and Design, and Software Engineering. It covers the knowledge of software developing models, programming, algorithm designation and database designation and management. The project focuses on the large-scale software system designation, application of database and Object-Oriented system analysis and programming. We give the project is "the manage system of student game".

The fourth Level-2 project contains the core courses related operate system and network: Network and Communication, Operate System and Multimedia Technology and Application etc. For these reason, our project is "Real-time communication network platform". Through the project, we propose that the students use the knowledge of network to a real-world and practice the whole procedure of Conceiving, Designing, Implementing and Operating.

THE IMPLEMENTATION AND EVALUATION OF THE LEVEL-2 PROJECT

We have implemented the first 2 Level-2 projects in Shantou University. The students are assigned to teams. Each team contains 5-6 students and a teacher as the couch. Students through concrete projects will be able to learn the professional knowledge and skills, the spirit of teamwork and cooperation, communicate with each other and work together. During the design process, they can take advantage of technology and scientific knowledge, to have innovative thinking and creativity.

When the students finish the project, the instructor team carries out the inspection reports. The inspection follows the steps: 1) the team leader introduces the entire project designation and implementation; 2) group members shows their specific tasks, as well as the development and solution method to the key problems; 3) demonstration their system; 4) the teachers and students ask questions for the project and the group members answer; 5) The instructor team summarize the project and assesses the grade, and pointed out existing problems and give suggestion to improve the project.
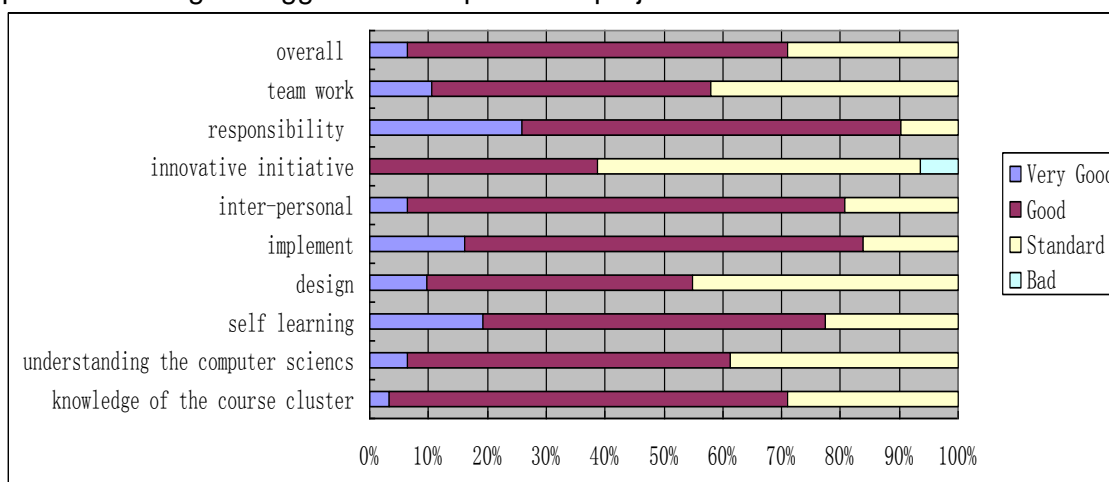

Figure-2. The evaluation of the Level-2 projects

For evaluating the availability of the approach, we inquiry the students (about 60% students attended) with a questionnaire. There are 10 questions in the table and each question has 4

options: Very good, Good, Standard and Bad. There are 6.5% and 64.5% students with Very good and Good to the approach; 25.6% and 64.5% students feel Very good and Good to improve the responsibility; and most questions have got the Very good and Good answers. The Figure-2 indicates the results of the approach.

CONCLUSION

The Level-2 projects are designed to cover the knowledge of a group of the related core courses, as well as cultivate the relevant competency. As the support to Level-1 project, it is an integration of the knowledge points in the related course cluster involved in. This requires students to use the knowledge conceiving, designing, implementing and operating an actual background of the project. Each project is the supplementary to the classroom teaching system, in order to cultivate innovative thinking ability and lifelong learning ability. From the time point, the first Level-2 projects is the first time to complete a full project. Training of his understanding of the project design, team spirit and mode of thinking as an engineer is the main purpose. At the same time, it plays an important role for the interesting to their major learning.

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