

# Construction of EIP-CDIO Quality Assurance System Based on ISO

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## **ABSTRACT**

School of Engineering, Shantou University has been working on EIP-CDIO (Ethics, Integrity, Professionalism, Conceive, Design, Implement, Operate) engineering education and training mode reform since 2005, whose main purpose is to cultivate student's personal ability including self-learning, creation, team work, systematic adaptation and control. In order to guarantee quality of EIP-CDIO education, as well as bring teaching quality control and management in line with international standards step by step, we apply ISO Standards in teaching, administration and student management in our school. Taking our actual situation into consideration, we prepared four manuals: Quality Manual, Administration Manual, Teaching Manual and Student Management Manual. As a result, we were granted ISO19001:2000 (quality management system) and ISO 14001:2004 (environmental management system) certifications by TÜV Rheinland in April 2008. This paper describes how to construct quality assurance system for EIP-CDIO training mode based on ISO. Eight principles of ISO are described in detail in how they are applied in education reform.

## **KEYWORDS**

EIP-CDIO, ISO9000, Quality Management, Practice and Exploration

## **1. Introduction**

CDIO is a training mode for engineering education, originally proposed by several universities such as MIT. It stands for Conceive, Design, Implement and Operate, which covers whole life cycle of product from R&D to running. Carrying this in education, student can not only study in a more active and practical way, but also learn relationships between different courses. Moreover its Quality Syllabus is simple, feasible and applicable, which makes it usable by any program of engineering education.

The philosophy of CDIO was introduced to School of Engineering, Shantou University in 2005. Through years of practice we found that its syllabus details the characteristics of CDIO requirements, however as an evolution for education and reform practice, it needs a normative framework for sustainable improvement. The family of ISO9000 standards provides such a good framework. The family of ISO9000 standards is a series of standards for quality management and quality assurance formulated by the International Organization for Standardization. It is widely recognized as quality assurance system by international certification accreditation bodies because of its strong guiding principles, high practicality and logic in nature. Introducing ISO standards to CDIO is helpful to standardize teaching management and administration, ensure gradual and sustainable improvement of teaching management of CDIO training mode.

## 2. Establishing ISO Management System

Since we establish ISO management system on purpose of guaranteeing education quality of CDIO training mode, the first thing is to make sure systematic character of quality management system, particular environment of department, our management policy and objective, responsibilities or duties of staffs in each level. Then we set up a verification system and improve programs for every education process, through which establish a seamlessly connected management system for continuous improvement.

The establishment of our ISO management system mainly includes 9 stages: summary and investigation, training of standards, determination of objectives for quality management, determination of responsibilities and resource allocation, preparation of management documents, trial running, inner check, third-party certification, continuous improvement and perfection.



Fig. 1. Procedure of establishing ISO management system

In stage summary and investigation, we summarize experiences of education quality management and education administration in a systematic and scientific way, and then draw a picture of whether each education process is up to standard requirements through investigation. In standards training stage, we require administration team to carry out ISO 9000 standards training and every staff to learn ISO 9000 standards. In stage determination of objective for quality management, we set up quality policy in accordance with customer's requirement and education purpose, formulate long-term and annual quality objectives, and clarify internal structures and functions of positions within them. In stage determination of responsibilities and resource allocation, we set up a sound system of personal responsibility and allocate resources accordingly to guarantee effective functioning of the education system. Then we go to the preparation of management documents stage. In this stage we make sure the administration files have great influence on the realization of quality management objectives to overcome arbitrariness, randomness and formalism in education management. In trial running stage, we confirm all kinds of documents in the whole school, through which improve their effectiveness and reliability. In inner check stage, we require all procedures to be implemented in accordance with these documents, and provide corrective and preventive measures if anything improper are found. After all the above steps are done, we can seek for a third-party certification, and finally improve our quality management system constantly through continuous improvement and perfection stage.

To ensure successful implementation of EIP-CDIO, we establish a four-level document system as illustrated in Fig.2. Level 1 is programmatic guiding document, i.e. Quality Manual; level 2 are general specification documents including technology, management norms and procedures; level 3 are program documents including plan programs and measures; level 4 are record and evidence documents including identification and evaluation reports as well as records.

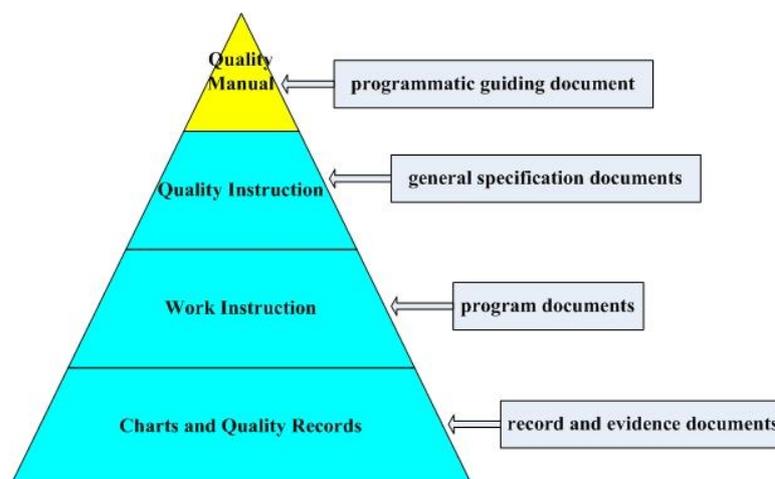


Fig.2 Teaching quality management document system

### **3. Eight principles in the process of CDIO education management**

ISO 9000 standards have an Eight Principles: customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationship. For our CDIO training mode, these 8 principles are not only guiding spirits when setting up education policy, goals and quality documents, but also fundamental basis of planning CDIO education strategy and program.

According to the Eight Principles, CDIO training mode should be built upon involvement of all faculties in the school. ISO emphasizes fundamental effect of every faculty in each position because only through their fully involvement can the organization benefits from their abilities. In the very beginning of the EIP-CDIO education reform, we realized the importance of involving all faculties. First of all, all teachers are required to participate in formulating training plan to make it more reasonable and operable. Secondly, training plan is divided into teaching steps, through which teachers could learn their objectives and importance in it. As a consequence, these objectives can motivate staff to work hard and also can be references of evaluating faculty's performance.

Leadership in the Eight Principles is a key point. ISO 9000 puts great emphasis on devotion and responsibilities of top administrators. We set up "top-leader" responsibilities for education quality control in school and department levels. President of the school and chair of each department are the first ones in responsible in school and department levels, respectively. President and chairs should be planners, leaders and promoters of quality control. There is also a vice president who is responsible for the implementation of teaching procedures. According to ISO 9000 standards, leaders in each level should formulate policy, define objectives and allocate tasks for education quality control. They should play the role of leaders to drive other teachers to practice the principles and policies of EIP-CDIO education. Leaders should also establish a good teaching environment through effective resource allocation and incentives to advocate a common value and set an example for faculty. Great efforts should be paid to create a good working environment for faculty to reflect cares from the school and departments.

Customer focus and continual improvement are two basic points in implementing ISO. Students are direct customers of education management in university, employers and parents of students are indirect customer. In our CDIO training mode, students are the focus of teaching and training in project-oriented learning. We use discussions, inspirations, etc in class teaching, changing the old way in which teachers are players while students are audiences to the new one that students are players while teachers are directors. Through this way, enthusiasm and initiative of students are activated. In the project design, teachers

raise problems, students manage teams themselves to conceive, implement and accomplish the projects. All these activities are to be correspondent with “student focus” principle. We are continue to upgrade our education and teaching to provide better and better education services to students.

In ISO’s point of view, continual improvement is a permanent purpose of an organization. It includes improvements in objectives, objects and approaches. To make sure sustainable development of CDIO training mode, we must transform education quality control from static gate-keeper type to dynamic sustainable-development type, must keep the sustainable development and creativity throughout the whole procedure of education quality control. The processes of education quality control should be carried out in a Plan-Do-Check-Action (PDCA) fashion, sustain continuous and proceed systematically between PDCA cycles to establish a self-diagnosis, self-correctness and self-improvement system. In this way, our long term effectiveness of quality control is guaranteed, education quality is continuously improved. The procedure of PDCA in School of Engineering is shown in Fig.3.

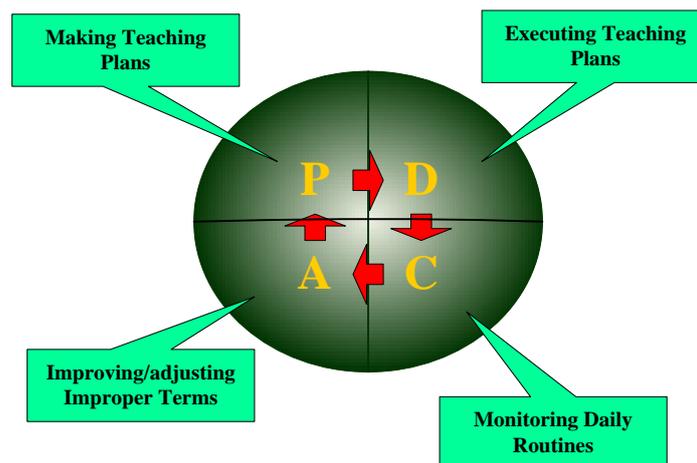


Fig. 3 PDCA cycle in teaching management of School of Engineering

#### 4. Conclusion

The key point of introducing ISO quality control system is to introduce advanced management ideas. ISO 9000 standards emphasize process and putting process under control. We established a management system for education quality to put various teaching process under control, through which education quality is improved steadily and students, parents and employers are satisfied eventually. It is proved from our practice that the introduction of ISO quality management in CDIO teaching practice is effective in guaranteeing reasonable, effective inspection and supervision and normalizing CDIO teaching processes.

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