

Conception of Mechanical Engineering Personnel Training System by Trinity of Engineering Project, Workplace Environment and Industry-university Cooperation

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Keywords: CDIO, Trinity, Training system, Conception

Abstract. Based on the CDIO international engineering education philosophy, the level design and conception of mechanical engineering professional training system is constructed for a more detailed, the problems of the teaching process is analyzed, and the knowledge, ability and quality that students should have is described. The implementation method of trinity of engineering project, workplace environment and industry-university cooperation is discussed.

Introduction

Zhejiang University City College (ZUCC), was jointly founded by Hangzhou Municipal People's Government and Zhejiang University, it offers full-time undergraduate programs. Supported by Zhejiang University's Learning Foundation branch, the college has established majors and specializations in accordance with the changing demands of social and economic development, as well as the latest trends in science and technology. According to the characteristics of independent college students, there is an urgent need to study and explore the set of the teaching system to adapt to the training requirements of independent college.

The Problems of Teaching Process

Training Objectives: The specific objectives of personnel training and requirements are not clearly, the key features are not prominent. Especially, the developing ability of students is more abstract, there are no clear objectives, requirements, methods, and assessment.

Teaching Model: Contrary to training objectives, engineering properties. The main reason is the use of the system and mode of science education to train the engineering students, science instead of technology, and science instead of engineering.

Curriculum System: The targeted for culturing application students is weakly, the relationship between the Curriculum System and the students' ability to achieve is macro, lack of correlation, configuration imbalance of theoretical & practical teaching, the lack of engineering and applied.

Practical Teaching: Practice and innovation in the education is weak. The lack of engineering components and hands-on opportunities in practice teaching, then the students will lack of perceptual knowledge, practice experience, hands-on practical ability, technical ability and sense of innovation.

Analysis of Knowledge, Quality and Ability

According to the features of mechanical engineering and the requirements of industrial development, the students should have the following knowledge, qualities and abilities after the graduation.

Knowledge Structure. To master the natural sciences related mechanical engineering; to master basic theoretical of mechanical engineering, including: Engineering Graphics, Mechanics, Mechanical, Electrical, Computer Technology, Engineering Materials, Mechanical Design, CNC, CAD/CAM, Fluid Power Transmission and Control; familiar with the technical standards, policies and regulations related the mechanical engineering.

Basic Quality. With patriotism, collectivism, socialist moral character; with positive outlook on life and values, with a sense of responsibility and sense of social responsibility; with aggressive and

optimistic and healthy attitude; With rigorous scholarship, pragmatic, quality of collaboration, good psychological quality and professional ethics; With a certain degree of cultural taste, aesthetic taste, and humanities.

Basic Ability. Students should have good study habits, a certain degree of abstract thinking ability, strong reading comprehension skills, information access and information gathering capabilities; with writing skills, language skills and image communication skills; With the professional skill to use 2D and 3D software to analyze and design of the project; Students must have a ability of engineering practice to be able to use equipment to process the parts; have the ability of observation, found and analyze problems and apply the knowledge creatively to solve the problem.

Conceiving & Thinking

Design and manufacturing is the core of the engineering, the ability of engineering practice is the soul of Mechanical Engineering Education. Educational reform of applied, complex, innovative student cultivation mode should be able to cultivate students that in order to adapt even able to guide the development of engineering, with solid foundation, extensive knowledge and high-quality engineering and technical. Use the project throughout the curriculum system to strengthen curriculum integration, and to give students CDIO international engineering education philosophy. Encourage students to the enterprise or institution to practice, aided the students to carry out innovative activities.

Guiding by CDIO, deepen the reform of the personnel training mode. The main line of training system was engineering ability trained, two wings were international education and innovation ability training. Based on CDIO standards, the capacity-building spectrum between training programs and syllabus was designed, the capacity-building chain that syllabus to teaching implementation was designed, the capacity-building point of specific teaching implementation was also designed(show in Figure 1). Based on CDIO outline, compatible to the professional certification standards and industry professionals require docking, highlighting the ability feature of mechanical engineering talent, the sort of talent connotation context, to solve the top defects that general training requirements are usually broad, capacity requirements are vague, engineering characteristics are not distinctive.

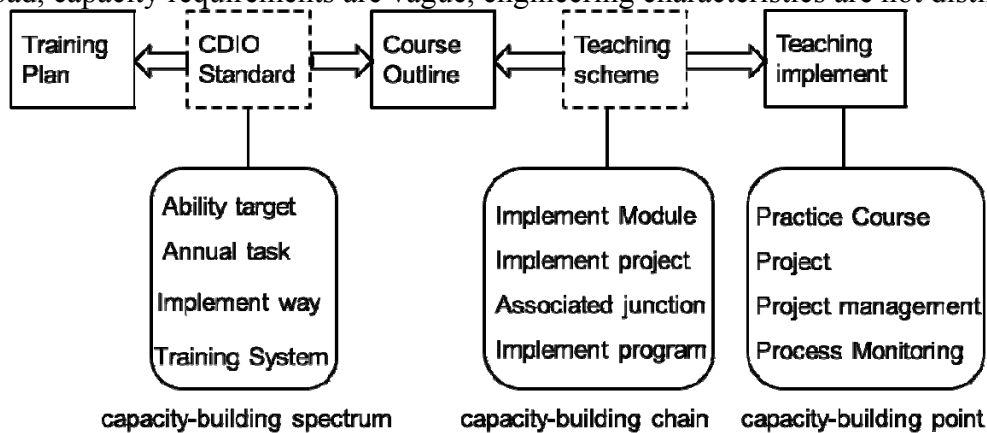


Fig. 1 Competency training system and embodiments

Strengthen curriculum integration, build three levels projects throughout the curriculum system. The final stay point of the training mode reform was curriculum system's built and reform, this was also the focus of educational reform and difficult. People-oriented and capacity-building oriented, strengthen professional core courses group construction, Select a comprehensive typical machinery, through curriculum group secondary professional competence training programs and courses tertiary basic ability training program to form the integration of the teaching system and the ability to train teaching chain, to build one level innovative practice training programs throughout the professional training system(Figure 2).Strengthen the relation of logic and structure between courses. Explore and implement three teaching changes that mainly on teaching change to studying, mainly

classroom teaching change to combine the inside and outside studying, mainly results of the evaluation to the results and process evaluation combined.

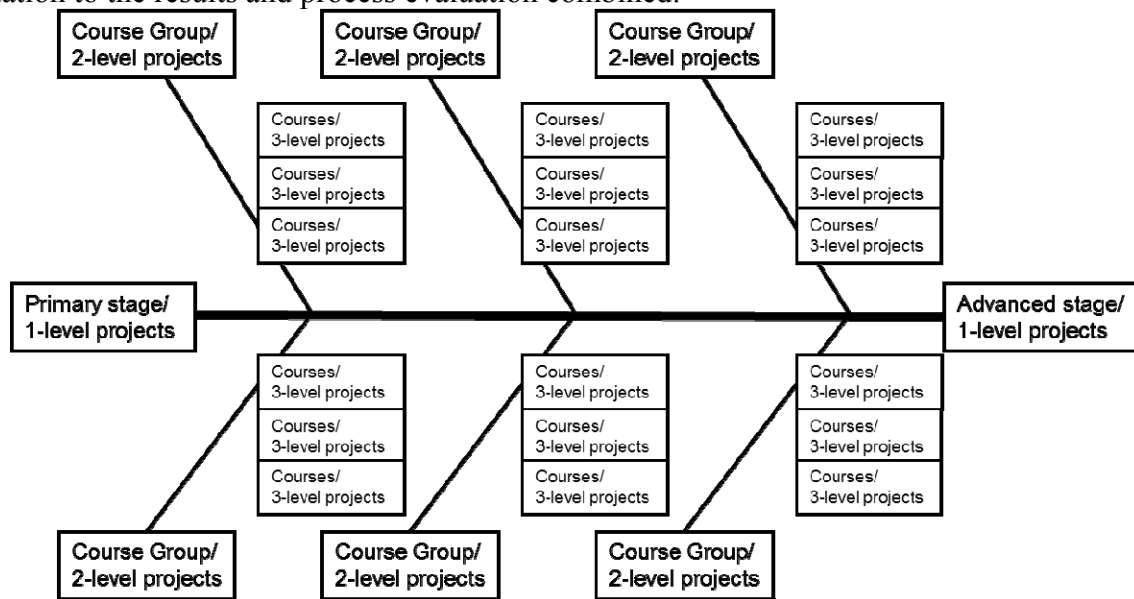


Fig. 2 Structure of curriculum system tertiary projects

Strengthen “Government-Industry-University–Research” cooperation, workplace environment into the teaching process and improve the existing practice base. In order to ensure the implementation of project, we have taken full advantage of industrial center, innovation practice base and specialized laboratories, and we have encourage students to take full advantage of equipment to create a good atmosphere and conditions of the engineering education. Strengthen the “Government-Industry-University-Research” cooperation and introduce the workplace environment. According to the development characteristics of mechanical engineering, building a certain number of off-campus practice bases, engineering education expert steering committee has been established according to basic principles of mutual benefit to guide the construction of major and personnel training, at same time to provide excellent quality engineering and technical personnel for industry.

Implementing Method

(1) Based on the full life cycle of the projects to strengthen engineering practice ability

Design of engineering projects. Students used the professional knowledge to design the project, including the design of principles, mechanical and project sample. In the implementation process, we were fully in accordance with the practical requirements of engineering to develop students' awareness of large projects. Technical analysis reports and demonstration program will regularly carry out during this period.

Manufacturing of engineering projects. We required students to complete the process design of parts in accordance with the actual situation of project, and then completed the process plan of parts, components process analysis and design capabilities and the practical ability of students to be trained. This stage of practical courses based on curriculum design of mechanical manufacturing engineering.

Assembly, testing, costing and marketing of projects. Students formulated the assembly process program according to project requirements, and then completed assembly and testing of the projects. They could write costing books and marketing analysis reports to develop their awareness of market economy and product sales.

(2) Outstanding professional ethics and social responsibility, throughout the humanistic quality education

“Two design”. Prominent humanistic quality training to strengthen the students professional ethics and social responsibility, education of professional ethics, integrity and ideals and beliefs through and penetrate into the professional courses, while using the “Expert Forum”, “College Students' Development Forum”, “Engineering Quality Development Training” and a variety of platforms to

design these two aspects. Train students how to plan for life, how to practice the ideal, how to cultivate self-confidence, teamwork and social responsibility, and to train the professional engineers that with a healthy personality, excellent work ethic, integrity and high degree of social responsibility.

Training the workplace quality. Hire professional trainer for workplace training, to cultivate the students' teamwork, professional conduct and professional ethics, feel the atmosphere of the project team, and develop students' mutual trust and coordinated awareness in work and life.

(3) Implementation of innovative quality training, subject contest and innovative practice training to strengthen the quality of innovation culture

Innovation theory and innovation skills training. Combination of classroom teaching and lectures, reports, seminars, exhibitions, demonstrations, consultation and visits to help students to deepen the understanding of innovation theory, stimulate students' enthusiasm for innovation, while create innovation relevant courses to broaden students' knowledge and horizons.

Innovation quality training in project implementation. In the implementation of projects, we could actively encourage students use by learning professional knowledge, innovation theory and innovation skills to carry out theory and structural innovation.

Encourage students to participate in various academic competitions. There are many contests, such as “Zhejiang Province Mechanical Design Contest”, “Zhejiang University Weifang Diesel Vehicle Design and Innovation Contest”, “National CAD Design Contest”. In the contest to stimulate students' creative potential and apply the knowledge learned in the actual project.

(4) Standardized operation of the project to strengthen relation between students and industry

The project implementation used the research mode: topics→literature review→determine design→design calculation→development / implementation of program →analysis summary (paper/patent)→design drawings→reply→manufacturing→rating→reward →teacher reviews.

We actively promoted the students come to practice base, so that students have early exposure to practical engineering problems. We create a wide range engineering practice, each base arrangement about 3 students to test results of engineering education, and lay a good foundation for students' employment, thus promoting the work of employment.

Summary

Overall quality of students training is a systematic project, in terms of the arrangements and implementation of teaching programs, or the actual environment of the building must be a tremendous effort that requires the coordination of all aspects and need the support of social enterprises, so in order to create a good inside and outside the education environment and keep the social output of high-quality applied students.

Acknowledgements

This work was supported by Zhejiang New Century Higher Education Reform Research Project.

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