

# **The RESEARCH AND PRACTICE OF PERSONNEL TRAINING MODE IN MECHANICAL AND ELECTRONIC ENGINEERING SUBJECT BASED ON CDIO CONCEPTION**

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## **ABSTRACT**

With the increasing demand for high quality engineering talents, it becomes imperative to conduct the reform for engineering talent education mode in the colleges and universities. This article takes the specialty of Mechanical and Electronic Engineering in Yan Shan University as an example, introduces the “Three-level Projects” reform mode integrated within the classroom education. It gives a detailed description for the construction of the system, the formulation of evaluation mechanism, the implementation of project and the final achievement. The article tries to present the reform idea to the readers in a simple and accurate way and hopes to give an example to our counterpart universities for the reform mode of training engineering talents.

## **KEYWORDS**

Three-level projects; CDIO; personnel training mode

## **0 INTRODUCTION**

With the urgent demand for innovative engineering talent, it makes higher education meet the deep reform. Consequently, it is to carry out the reform research of the mode of training engineering talents in local universities and put forward the corresponding reform measures that is the objective demand for current us to implement the scientific development concept, carry out independent innovation and build an innovation- oriented country and achieve the Chinese dream. Mechanical and electronic engineering in Yanshan University based on CDIO engineering education reform put forward the personal training mode which is ability-oriented, uses project as the carrier, think both important on knowledge learning and ability development and explored a new path of innovative talent cultivation.

## **1 THE REFORM OF THE ENGINEERING TALENT EDUCATION MODE BASED ON CDIO CONCEPT AT HOME AND ABROAD**

To focus on Students' learning initiative, Shantou University developed the exploration teaching reform based on CDIO concept which abandoned the traditional mode of students rely too much on teachers and textbooks(Hu Wenlong et al.,2014). Software College of Yunnan University combined the general principles of CDIO with the life cycle of software, which created SE-CDIO course system for the software engineers training(Li Tong et

al.,2014). MIT repaired the original laboratory and established a complex system laboratory. For the whole team collaboration, each link was set to a specific work area in the conception, design, implementation and operation of CDIO life cycle. It fully reflected the convenience on the space. Aviation and vehicle of the Royal Institute of Technology in two different majors customized designing and realizing project. the project members are divided into groups. each member was responsible for not only themselves in charge of technology but also to management and progress of the entire project. it achieved goal that integrate the CDIO concept into designing and realizing project(Edward F.Crawley et al.,2009).

## **2 The establishment of CDIO Three-level Projects system**

Basing on guidance of the CDIO engineering education conception, department of mechanical and electronic engineering of mechanical engineering college in Yanshan University, according to the guiding ideology that both of knowledge learning and capacity building are important, taking the demand of professional competence and industry as the background, Taking the demand of professional competence and industry as the background, construct a integrated curriculum, consisting of theory studying , experiment and practice teaching, the implementation of the project, the organic integration of practice and training. And the system posts technical demand oriented, engineering ability as the goal, the implementation of the project as the main line. The line runs through the integration of curriculum system is these rich and diverse projects.

The whole project system includes three levels of project which are closely related, including the Three-level Projects which take the application of the basic knowledge of the single courses (or two courses combined) as the purpose. Taking many kinds of knowledge as the goal based on the team, the Two-level Projects that can fully embody the Conceive-Design-Implement-Operate of the whole process of Two-level Projects, the One-level Projects with the comprehensive application and innovation of knowledge for the purpose.

Three-level Projects are set in the professional foundation courses or the professional courses, but also can be used as the sub project of the One-level Projects or Two-level Projects. And most of the projects come from the teacher's scientific research projects, aiming to enhance students' understanding and application of the core knowledge or skills of the courses.

The Two-level Projects, aiming to strengthen the cultivation of students' professional core ability, usually combining many professional core curriculums and associated with Three-level Project, are the team projects jointly established by many courses.

Two-level Projects with each related Three-level Projects and have research and design contents, independent node for assessment, assessment standards, and the design reports. Two-level Projects have full time, thus you can construct a series of high level professional research projects based on team. Students can complete the whole or the main process for the Conceive-Design-Implement-Operate (CDIO) in a project.

New training programs include two One-level Projects, namely, innovation and specialty education and graduation design. One-level Projects of the innovation and specialty education is set in the first year. To enable the students to establish the concept of "Mechanical Engineering" and to enhance their interests in engineering; graduation design One-level Projects are to let students participate in teacher's projects of new products for enterprise development and reconstruction of key enterprises, or the next generation of products research and development. The new training programs can bring up students'

comprehensive application of professional knowledge and technology (including social science knowledge and management of Engineering knowledge) engineering problem solving ability and innovation ability, the students' comprehensive ability and quality, as shown in figure 1.

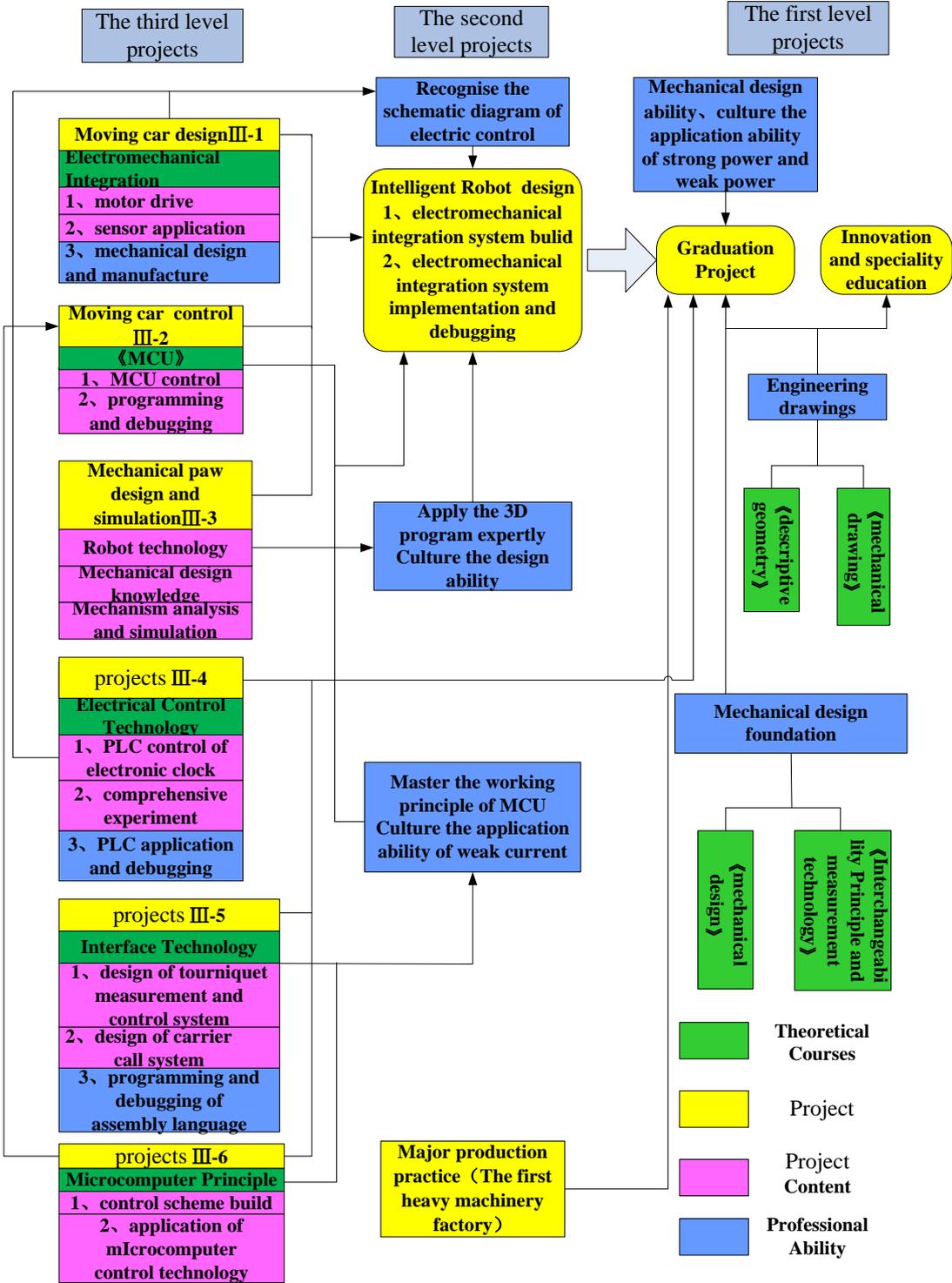


Figure 1. The electronic engineering major projects system diagram

Above-mentioned the three levels of the project are closely related, and all the teaching links are closely linked. The implementation of the whole process of project type system is a process of students' knowledge learning and ability training, extending from the curricular to

extra-curricular, from easy to difficult, from broad to professional level by level, covering the basic specialized knowledge and the core knowledge in professional direction system, as shown in figure 2.

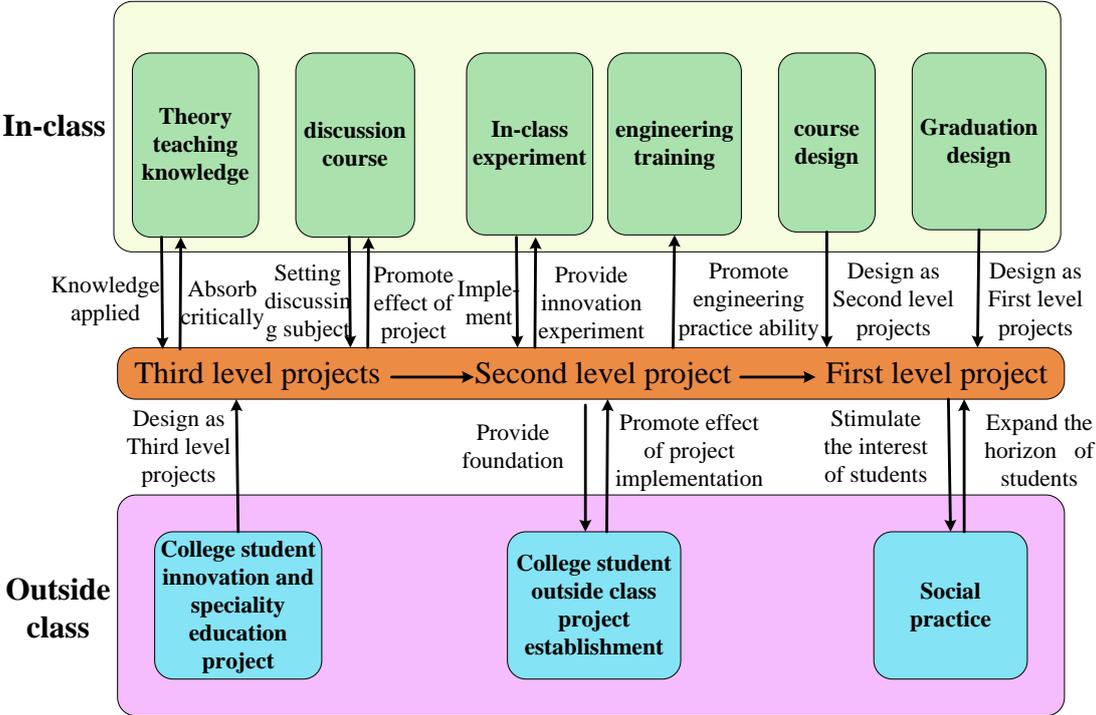


Figure 2. The relationship between three-level projects system and each culture link

All kinds of projects ( especially the integrated project team based on team ) with rich content implementation stimulate the students' enthusiasm, making students more firmly master the basis of professional knowledge and professional knowledge, effectively training engineering practice ability of students, active thinking and exploring ability, innovation consciousness and innovation ability, analysis and problem solving skills, literature retrieval and comprehensive ability, interpersonal communication and thinking skills, teamwork spirit. At the same time, high levels of curriculum projects also provide students a broad space for individual development. Taking the project as a carrier, through the organic combination of teaching, practice teaching and multi-level project, reflects the new ideas of bring up talented person with knowledge, ability and quality of integration for innovation and entrepreneurship. This is the type of engineering education mode of a project through the introduction of digestion and absorption of the independent innovation which explores a new road for the local colleges and universities to cultivate high-level talents for engineering.

**2.2 The Reform Of Evaluation Mechanism**

At the same time, Mechanical and Electronic Engineering has formulated a whole process management course examination evaluation system and mechanism that pays more attention to the process and comprehensive ability quality assessment. It takes many links into course evaluation system and mechanism, such as class attendance, homework, the experimental results, seminar, course project, quiz, class test and so on. In this way, it conducts a comprehensive assessment of students' knowledge, ability and quality and manages the whole process of the learning process.

According to the reformed evaluation mechanism, the total score of a course includes six parts: class attendance, homework, experiment (or computer practice instead), seminar, course project, and class test. The previous five can take a maximum 70% of the total score.

The reform takes students' whole learning process performance and attitude into consideration, impels students to put more effort into the process of learning, and makes a more comprehensive and reasonable assessment of the students' learning attitude, mastery of knowledge and the improvement of ability and quality

Level 3 project acceptance is PPT presentation or written report. Both secondary and primary project acceptances are PPT presentation, written report and assessment of the node. Only in this way, can we ensure that the students complete the project on time according to the project plan, cultivate and assess the students' ability and quality in a scientific, rational and integrated way. Graduation design, for example, the primary project sets up three nodes of assessment. The first node is opening inspection (20%) set in the 4th weekend; the second node is the mid-term examination (30%) set in the tenth weekend; The third node is concluding rejoin examination (50%) set in the 18th weekend. Each node adopts the way of PPT presentation combined with the reports, papers, drawings and other related material to complete comprehensive reply. As a whole process management mode, the node assessment method can not only ensure that students devote themselves into the course throughout the project cycle, but also make scientific and reasonable evaluation on students' ability and quality.

**2.3 The Innovation Of Practice Teaching Mode**

Combined with the actual demands of cultivating innovative entrepreneurial engineering talent and the advanced foreign experience(Yi Jun et al.,2014), according to the characteristics of mechanical electronic engineering itself, we sharply compressed theory teaching period, increased experiments and practice teaching hours and integrated the main experiment or the practice teaching content into the curriculum project. It can not only significantly promote the content and level of the experimental and practice teaching, but also provide valuable period for the implementation of the curriculum project. The curriculum theory teaching was organically integrated with the practice teaching and the experiment through curriculum project. Finally, it formed a "basic experiment, comprehensive experiment, experiment combined with the project, engineering practice " four level, phased step by step practice teaching mode, as shown in figure 3, which is a unique experiment and practice teaching mode.

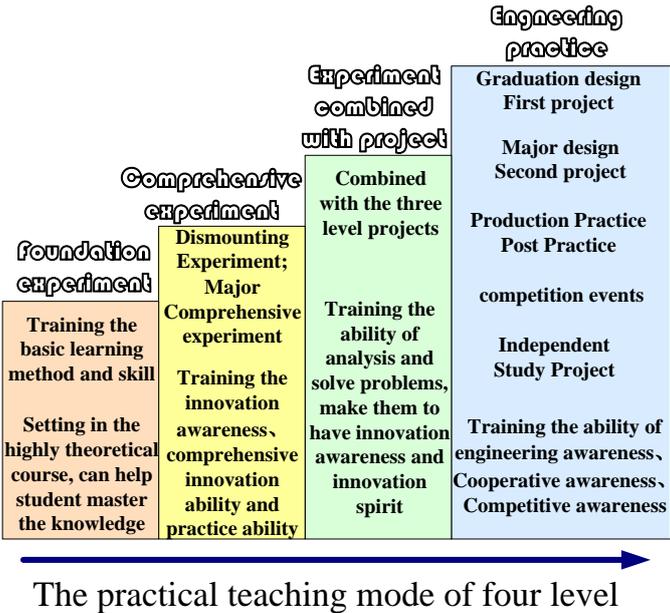


Figure 3. four level、by stages、cyclic and progressive practical teaching mode

The first levels — basic experiments, designed to give the basic experimental training to students, make them grasp the basic methods and skills of experiments. It helps strengthen students' understanding of the content related theory course, consolidate and enhance the teaching effect in theory study, and train student's operational ability;

The second level — comprehensive experiments, designed to cultivate the students' practical ability, innovation consciousness and innovation ability. It mainly includes the comprehensive experiments and design experiments, such as mechanical dismantling internship, professional and comprehensive experiment, etc.;

The third level — experiment combined with project, such experiments are not set up alone, but company with level 3 project or level 2 project, the student design experiment content on their own, apply knowledge to project study, and do research in the laboratory. These experiments are designed to cultivate students' ability to analyze and solve problems;

Level 4 — engineering practice, designed to cultivate students' ability to do innovative design by comprehensively using learned knowledge, train the students' operational ability and communication ability, improve the students' innovation ability and the teaming and collaboration ability, understand the enterprise culture, develop students' engineering quality. Engineering practices includes primary projects which combined with production ,study and research such as engineering training, production practice, enterprise practice, graduation design; comprehensive secondary projects such as professional curriculum design; and all kinds of competitions and extracurricular practice project, etc.

Four levels, phased step by step practice teaching system organically combines the theoretical teaching, experimental teaching, project implementation, training and practice together, and extends to the college students' extracurricular activities of science and technology. Finally,it formed a systematic, holistic, relevance of harmonious and unified great practice teaching mode as it should be.

### **3 CONCLUSION**

Through the teaching of Three-level Projects, the students active thinking ability, exploratory spirit pioneering and innovative ability, the ability of engineering practice, expression of interpersonal communication and thinking ability , and team cooperation spirit are widely improved. At the same time, the high level course can also provide the wide individual free development space for the students that enable them to be more aware of themselves and lay a solid foundation for the future career development. It also provides reference for the reform of the CDIO project of the congeneric academies.

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