

Research on the Reform of Material Forming and Controlling Engineering Major on the Basis of CDIO

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Abstract. The idea and scheme of project teaching reform was put forward based on CDIO to change the low practical abilities of material forming and controlling engineering undergraduates. On the basis of the teaching characteristics of material forming and controlling engineering major in Qingdao Technological University, third level projects and second level projects were set up to support the subject teaching around the core curriculums and core curriculum group, in order to enhance students' practical abilities, and to reduce the separation between different courses in previous teaching. Furthermore, first level project was established, to cultivate the students' abilities of using professional knowledge comprehensively. This teaching pattern is an effective attempt to reform undergraduate teaching quality and it could be used as a reference for the similar majors.

Introduction

Material forming and controlling engineering major is a multidisciplinary engineering technology major, comprising mechanical engineering major and material science and engineering major. It is one of the most important applicant basic major in modern manufacturing industry. Due to the different historical origin, personnel training directions and emphasis are different in various universities that set up this major. Material forming and controlling engineering major of Qingdao Technological University orients material forming industry and trains advanced engineering technology and management personnel of the whole industry chain, with the capabilities of process and equipment developing, mold design and manufacturing, forming process controlling and enterprise management. So far, it has become an important training base for mold design and manufacturing talents in the blue and yellow economic zone.

Material forming and controlling engineering major require students possess good basic theory of mechanics and materials, and have strong practical ability and experience. In recent years, there are some problems in students during teaching process: They are short on enthusiasm in classroom learning; They have the drawback of poor manual dexterity and insufficient design ability, and just imitate engineering drawings in the process of course design and graduation design; They are lack of practical experience in modern mold manufacturing equipment and lack of understanding of the manufacturing process; They have almost no personal use of molding equipment, and have not enough understanding of the actual forming

process. In addition, similar phenomena occur in the graduate design of senior high school graduates. All of these affect personnel training quality, and cause some students to spend massive time on returning to learn after they entered production enterprises. It is urgency to strengthen the cultivation of students' practical ability.

In 2005, Gu [1-3] introduced the concept of CDIO (Conceive, Design, Implement, Operate) teaching in china for the first time. At present, more than 60 colleges and universities have run pilot in mechanics, electrics and other specialties in China. Among them, Yanshan University, Xi'an Polytechnic University [4; 5], Heilongjiang Institute of Technology [6; 7], and other colleges and universities have introduced the education concept of CDIO into the material forming and controlling major, and carried out the reform and practice of new personnel training model, which have achieved good teaching effect.

Because personnel training objectives and curriculum of material forming and controlling engineering major are different in different universities, it is not rational to adopt the professional training programs of others' directly. This paper is devoted to put forward a new model of material forming and controlling engineering major based on CDIO, aiming at the problems existing in the development of material forming and controlling engineering major in our university, by combining CDIO engineering teaching concept and the teaching experience. The work above could provide a strong reference for the professional reform of engineering colleges and universities.

CDIO Process

CDIO represents Conceive, Design, Implement and Operate. CDIO embodies the basic ability that modern engineers should possess to serve the whole process of modern industrial products from conception, design, implementation and operation, with product research and development to the life cycle of product operation as the carrier [1; 2; 8; 9]. CDIO education model requires university engineering education to break through the previous teaching concept. It constructs the science major theory and the practice curriculum system, by taking the ability training as the main line. In the process of implementation, it takes Project as the carrier, and focuses on the improvement of practical engineering abilities, especially on the training of project organization, design, development and implementation capacity, combined with production practice. According to the professional ability and knowledge requirement of the professional training target, in the light of the project settings and hierarchy in CDIO model, new teaching mode and curriculum system were constructed with projected oriented by combining CDIO engineering teaching idea with material forming and controlling engineering teaching experience, to avoid the fragmentation of the course. It focuses on practice and avoids the practical aspects of a mere formality, such as curriculum design, graduation design. It will be propitious to cultivate application type, compound type, innovative talents with the basic knowledge and comprehensive application ability, mastering modern technology and forming method, being capable of modern industrial production, completing forming process analysis, mold and equipment design and manufacturing, and production organization and management by using material forming technology, mold technology and related knowledge.

The overall level of project teaching is divided into three layers, as shown in Fig.1. Curriculum knowledge could be applied comprehensively, with the students as the main body, the classroom teaching and self-study as the foundation, the core curriculum third level projects as the driving, combining with the practice link, such as homework, practice. Based on third

level projects, second level projects would be built, according to several closely related courses. Through the implementation of two projects, many disciplines of knowledge is organic integrated, which will enhance students' practical abilities and fully understanding of the relationship between courses. Based on these second level projects, first level project will be built, which could embody the training purpose of the professional core competence. Through the project implementation, the graduates will be developed to have the abilities of comprehensive using the knowledge of mold design, analyzing, manufacturing and forming, and possess team consciousness communication and innovation.

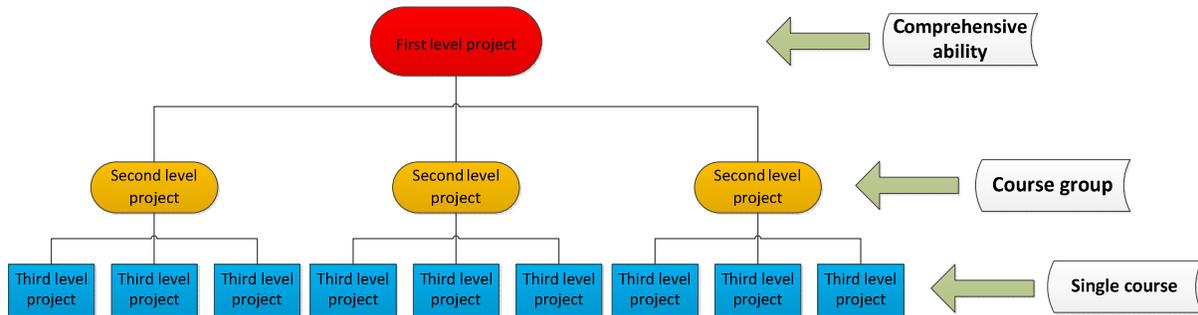


Figure 1. Schematic of different project.

Specific Plan

The core courses of material forming and controlling engineering in Qingdao Technological University mainly include “stamping process and die design”, “plastic molding process and mold design”, “forging process and die design”, “mold manufacturing technology”, “metal plastic forming principle”, “polymer materials” and “material forming equipment”. Especially “stamping process and die design”, “plastic molding process and mold design” and “forging process and die design” are more important in teaching process, and cultivate students' ability of design moderate complex mold independently.

Setting Scheme of Third Level Project

Third level projects are built according to the core content of the three most important core courses mentioned above, as shown in Fig.2. The implementation of third level projects ensure students have the capabilities of 3D design, process design and process analysis capabilities on stamping, plastic and forging respectively. It could also enhance practical ability, and achieve better teaching goals.

Setting Scheme of Second Level Project

Second level projects are built according to the three professional core curriculum groups, shown as Fig.3.

Through the implementation of second level projects, students could understand the relationship and association between the core curriculums of “stamping process and die design”, “plastic molding process and mold design”, “forging process and die design” and other curriculums of “polymer materials”, “metal plastic forming principle”, “mold CAD/CAM”, “material forming equipment” and “mold manufacturing technology”, and could master mold

design and manufacturing, processing and molding technology comprehensively. This method could also avoid the drawbacks that appear when every course was learned individually, and achieve the purpose of understanding and mastering knowledge comprehensively.

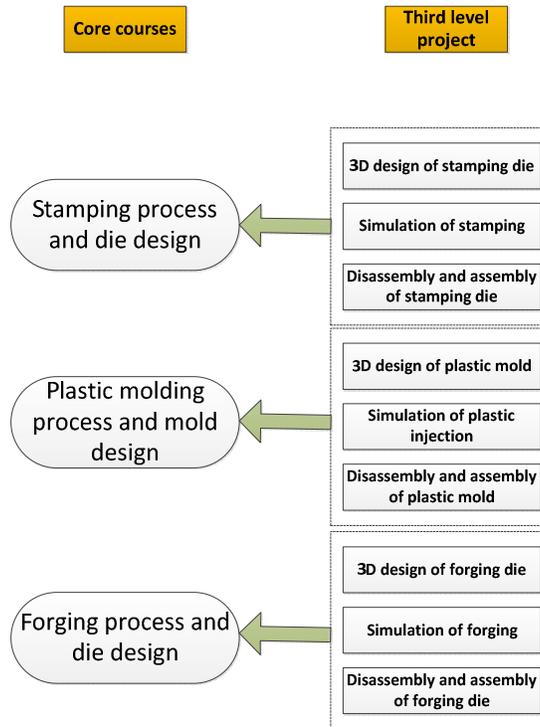


Figure 2. Plan of third level project.

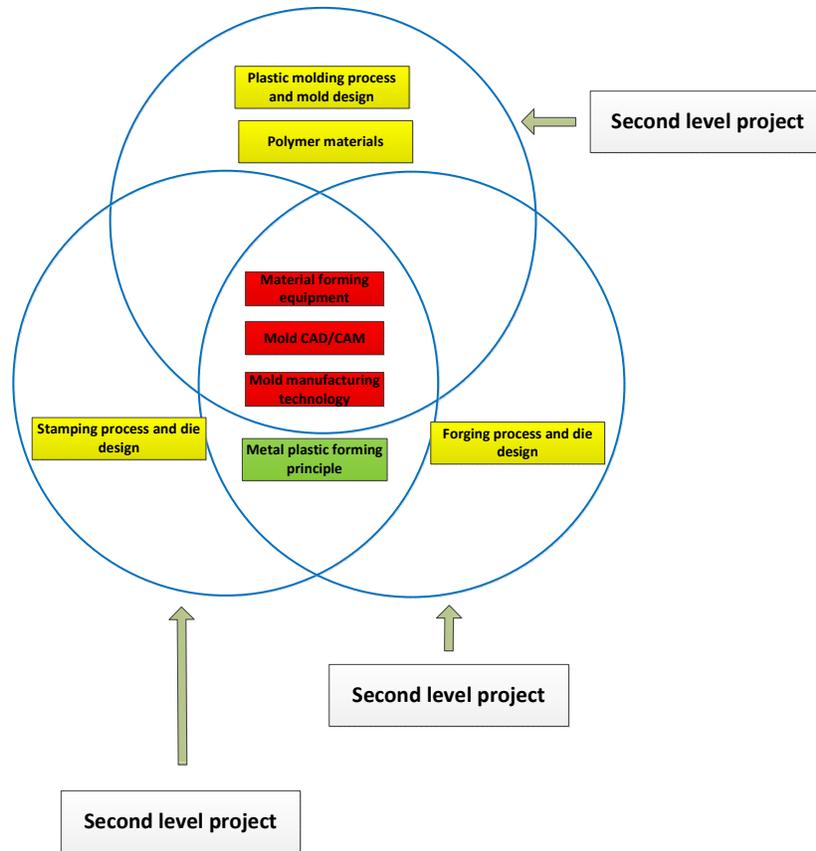


Figure 3. Plan of second level project.

Setting Scheme of First Level Project

In first level project, students would be divided into groups of 4-6 to simulate the complete production development process. The whole process is shown in Fig.4. Through the implementation of the first level project, students could experience the various linkage of the work ahead of real working. It could also train students' skills of communication, writing, comprehensive using of the professional knowledge, and enhance their team awareness.

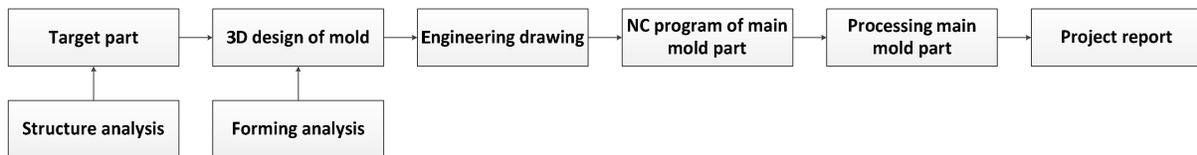


Figure 4. Plan of first level project.

Conclusion

In order to enhance the practical ability of students on materials forming and controlling engineering, the new teaching mode of professional teaching was put forward based on the concept of CDIO Project Teaching: Around the core curriculum, core curriculum groups were established and second level project was set up correspondingly. First level project was also

built on the basis of third level projects and second level projects. By project based teaching reform, students' practical capacities would be enhanced. It could avoid the drawbacks that appear when every course was learned individually. It's also an effective attempt to reform the major.

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