

Research on the Reform of ID Course under the Background of 3E

—A Case Study of ID in Sichuan Normal University

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Abstract—At present, the advantage of industrial design based on mechanical engineering in China is not obvious. Based on the mechanical knowledge, this paper aims to explore the teaching reform of ID major in engineering college, as well as construct the ID education which meets the company demand. By study of students' practice, core courses of mechanical structure, mechanical check, materials and forming, this research tries to form a new teaching plan with engineering students in course training, design competition, scientific research, and products designing with more innovative practical significance that meet the demand in real enterprise work. This research also tries to let employers discover the advantages of structural design ability for ID students with engineering background.

Keywords—Industrial design; teaching reform; engineering; mechanical

I. INTRODUCTION

This work was supported by the Teaching quality engineering reform project of Sichuan Normal University, China. Industrial design (ID) is a subject that rises with modern industry and takes industrial product design as the main research object. It integrates technology and art, science and aesthetics, application and aesthetics, seeking the harmony, unity and coordination of human, product, environment and society. China's industrial design education was set up in the 1980s. Since February 2017, the Ministry of education has actively promoted the construction of Emerging Engineering Education(3E), the traditional ID teaching system shows

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obvious lag. Although there's more than 30 years of efforts, industrial design has been gradually recognized by society which has a huge demand for ID, there is still a huge gap between the demand of enterprises and the talents training, resulted in the failure of enterprises to recruit suitable talents and the poor quality of students' employment. Especially for the ID based on engineering teaching, the talent training is far from meeting the huge demand of society and enterprises [1]. This situation is due to the unclear teaching objectives of the major, the failure to grasp the core and essence of this major, inaccurate training target, unreasonable curriculum, as well as the disconnection between talent training and social-enterprise needs.

II. HISTORICAL CONTEXT, PROBLEMS AND SOLUTION

A. Industrial design and product design

At present, there are two kinds of education backgrounds in industrial design for domestic colleges and universities. In the comprehensive universities or the universities with engineering as the main subject, industrial design is set in the college of mechanical engineering; while in the art academy and universities, industrial design, usually focuses on product design, is set in the colleges of design or art. There are different emphases on the teaching of professional courses between these two cases, while the differences in the ways of implementation are much greater.

B. Problems for industrial design education base on mechanical engineering

At present, the advantage construction of industrial design based on mechanical engineering is not ideal. Thus, in current ID education, how to build the education platform with industrial characteristics basing on the advanced manufacturing technology, equipment, scientific and reality discipline is a key problem [2]. Since the Education Ministry of the PRC (People's Republic of China) ascribes the ID specialty to the mechanical discipline, there are the following works should be the fundamental task for current ID education:

- 1) To cultivate innovative design talents in the background of mechanical discipline;
- 2) Strengthen students' practical ability in the background of mechanical discipline [3];
- 3) Establish the educational characteristics of the ID specialty in the background of the mechanical discipline;
- 4) Highlight the advantages and knowledge system of mechanical discipline.

Due to the lack of ID understanding, the deviation of training target and the general lack of art foundation, the students in ID major based on mechanical engineering often hovers around. The art teachers would suppose the student be poor of aesthetic potential, while the engineering teachers would think students' logical training is not enough. This situation finally leads to poor use of advantage for engineering students.

C. The way to settle this problem

Therefore, focusing on the essence and core of ID, it is of great practical significance to explore the teaching reform of ID major in engineering, as well as construct the ID teaching system which meets the company demand [4]. Based on the background of mechanical discipline to improve the innovation ability, the practical application ability of ID students should be higher than those students in art and design colleges. By reform of the core courses of mechanical structure, mechanical check, materials and forming, it would be easy to form a team with mechanical students in course training, design competition and scientific research, products designing with more innovative practical significance that students ever fear to touch in the past, and let employers discover the advantages of structural design for this students group. Finally such ID reform and practice would set up the advantage in teaching and research based on mechanical background [5].

III. MAIN APPROACHES TO THE ID IN EMERGING ENGINEERING EDUCATION

On the basis of the existing training program, new plan should fully strengthen the composition and ability of students' engineering knowledge as well as skills of product structure design which is required in company work. From simple to difficult, from theoretical knowledge to curriculum design, the foundation should be repeatedly consolidated. In particular, curriculum design requires teachers to have good experience in product structure design, and be able to set up appropriate

curriculum content of product structure design close to the actual work in enterprises.

Further, in courses training, the following content should be emphasized:

A. Product structure and mechanical innovation design ability

The existing training plan is obviously insufficient in the content of engineering courses. The proportion of engineering curriculum design is seriously out of balance, which leads to students' lack of solid foundation in engineering and low quality of employment.

In this case, it is necessary to sort out and reasonably select, organize and arrange the main courses related to mechanical foundation and product structure design. Especially the content of curriculum design, the arrangement of class hours, the arrangement of semester and so on need to be weighed. These courses include: mechanical design foundation, material forming and technology, mechanical drawing, mold foundation, engineering design software Pro/E, structural design, etc [6]. However, in general, it needs to be strengthened in order to adapt to the actual needs of the manufacturing industry, to develop its own characteristics and make it stronger and better.

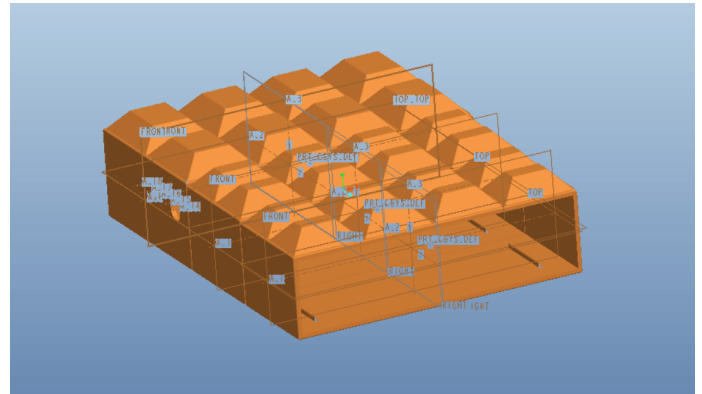


Fig. 1. Pro / E courses to do product structure design

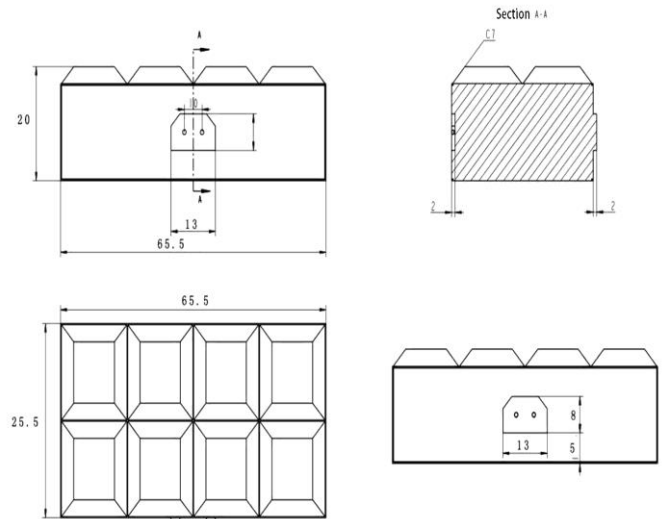


Fig. 2. Using Pro / E to draw three views

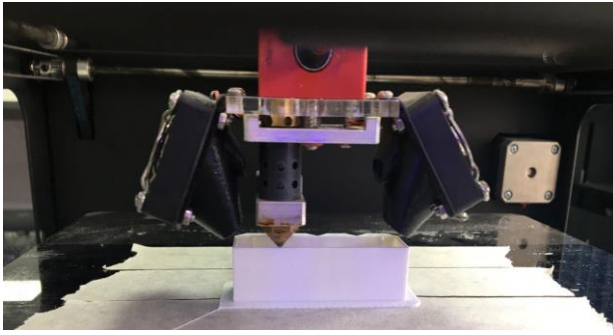


Fig. 3. 3D printing based on Pro / E modeling



Fig. 4. Product designed by student is in using for real

B. Students' ability training of engineering design combine with tutor system and '10 ones'

The implementation of tutor system for undergraduates in Sichuan Normal University is very conducive to improve students' scientific research ability. Taking 'tutor system' as a bridge, teachers can plan their main research direction for a long time, and be able to start students' professional training, quality improvement and career development plan from the first grade[7]. Therefore, under the guidance of engineer education and the overall development plan of 3E, the teacher could act as the student team tutor, introduce scientific research projects containing product structure, material forming, mechanical innovation, etc., to make the scientific and technology research serve life, enterprises and society, as well as make teachers' scientific research improved to a high level. Thus, the improvement of teachers and the development of students' innovation ability are two parallel cores of a major.

C. Specific direction of ID subdivision

There are many directions and fields in ID major, mainly including product form design, product structure design, interactive design, packaging design, environmental design, etc. It is difficult for a student to learn all sections well in four years of undergraduate courses. Thus, early direction selection according to the students' characteristics is conducive to strengthening students' ability, employment and accumulation of achievements. Anymore, it is a necessary work to divide the direction of industrial design as early as possible.

Engineering collages could study the direction of advantageous disciplines, and combine the current situation of ID specialty to make specific definition and direction division, as well as combine with laboratory construction, gradually accumulating professional strength and research platform. For example, ID can be divided into the following directions: product structure design, product form design, interactive design, and visual design. In these directions, product structure design is an essential part of manufacturing enterprises, which includes mechanical design basis, material forming and other contents, which needs to be strengthened; product form design is the traditional direction, which does not need to be adjusted greatly, while its contents can be combined with local cultural, creative and tourism industry to set up its own characteristics; interaction design and visual design mainly involve the content of graphic design, which can be optimized, integrated with the current rapid development of AI product interface design, Internet, mobile Internet and other directions[8]. By combined with the forefront of science and technology, interactive and visual design not only updated its own content, but also provided a good foundation for scientific research and student employment [9].

IV. LABORATORY CONSTRUCTION AND DEVICES

The above multiple directions are developed in parallel. The combination of teaching, laboratory construction and scientific research development promotes the common development of students and teachers, and provides a more appropriate way for the cooperation between majors and enterprises.

For laboratory construction of each direction, the following devices would be needed:

A. Product structure design and mechanical innovation

- 1) Samples of common electronic products or electrical products;
- 2) Multiple sets of basic practical tools that can meet the needs of teaching, including measuring tools, dismantling tools, cutting tools, welding tools, etc.
- 3) Mechanical devices and test benches for structural strength and mechanical properties of experimental products.
- 4) 3D printing equipment and CNC rapid prototyping equipment, as well as small injection molding machines.

B. Product form design

Most enterprises and design companies have CMF (color, material, surface finishing) laboratory, so that it should be set up in collage. Thus, the laboratory needs to widely collect and establish a database and platform of various surface finishing processes, effects and materials that are most commonly used in enterprises. This database and platform is not only conducive to the teaching enrichment and get close to the reality activities, but also conducive to scientific research activities and innovative research development [10]. Meanwhile, it can also provide strong technical support and consultation for the research and development of enterprises.

C. Interaction and visual design

For Interaction and visual design, these devices are needed:

1) Eye tracking system, Eye tracking makes the behavior of human visual access to information explicit, so we have the opportunity to observe how users get information from the web interface, and judge the attention degree of interface elements through the user's gaze behavior track and time on the interface.

2) Wearable physiological recording system, for the interaction design of wearable devices, the trend of emotional design will become the mainstream in the future, and the integration of wearable devices in perception interaction will become more and more obvious.

3) Web server and database system, web server is also known as World Wide Web server. Its main function is to provide online information browsing service. Web server combined with computer web languages, such as Java and JavaScript, it can set up a certain website and show hateful demonstration effect to students.

V. CONCLUSION

This paper focus on the essence and core of industrial design, exploring the teaching reform of ID major in engineering, as well as construct the ID teaching which meets the market demand. Based on the background of mechanical discipline, learning of the core courses of mechanical structure, mechanical check, and materials science and forming, this research tries to form a team with mechanical students in course training, design competition and scientific projects research, products designing with more innovative practical significance that students ever fear to touch in the past. This research also tries to let employers discover the advantages of structural design for this students group. Generally, such ID reform and practice mainly aim to set up the advantage in teaching and research based on mechanical background.

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