

# Discussion of Curriculum Reform Towards Developing Innovative Engineers

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**Abstract**—Engineering and technological development has always been based on demand-driven, and major projects are the basis to develop innovative engineering. China is in the era of rapid development of industrialization, information technology and urbanization, which is of great opportunities to develop innovative engineering. Starting from the goals and objectives to develop innovative engineering, combined with practice - based teaching system of certification courses, this paper explores curriculum reform ways to develop innovative engineers. Practice has proved that the reform of teaching methods is conducive to promoting the development of innovative engineering, so to improve the competitiveness ability of graduates.

**Keywords**—innovative, demand-driven, curriculum reform, training mode

## I. INTRODUCTION

At present, nearly 40 percents of employers around the world are difficult to find the right talents [1] in the market to fill the vacancies, and the scarcest of the first three categories of personnel are business representatives, engineers and technicians. A number of countries such as the UK, Australia, South Africa, Brazil, and Poland have had the problem of shortage of engineers; desperately short of 15,000 engineers in Germany, but also the employers' concerns about the engineering and technical graduates declined year by year. In China, with the internationalization of innovative engineering and technical talent is reflected out of the great competitiveness to attract all types of enterprises competing to “buy”. Internationalization of innovative engineering and technical talent refers both to the tip of the pyramid of senior professionals, but also has made achievements in the field of engineering science and technology at all levels and types of engineering and technical personnel [2,3]; that they could make a significant innovation in a particular area, you can also make a targeted piecemeal reform. To this end, the “National Long-term Scientific and Technological

Development Plan” put forward that total R&D investment would account for 2.5% of GDP in 2010, the contribution rate of science and technology would be increased by more than 60%, and the target of reducing dependence on foreign technology would be less than 30%. Independent colleges are organized by the regular undergraduate institutions according to the new mechanism, the new model at undergraduate level, with the nature of popularization to help application - oriented undergraduate education in educational institutions [4-7]. Based on the traditional evaluation method of natural science curriculum assessment and under the background of the context of culture-oriented engineering and technical personnel, there are many inappropriate places, which are not conducive to the cultivation of engineering and technical personnel. Therefore, in the rapid development of industrialization, informatization and urbanization, it is particularly necessary and urgent to explore the independent curriculum reform for engineer certification in Colleges and universities.

## II. THE BASIC QUALITY OF THE INNOVATIVE ENGINEER

The abilities to apply innovative engineers include not only the natural sciences, but also the knowledge and ability to propose methods, broad technology-based, professional and technical breakthroughs to solve an obvious problem [8-10]. Therefore, the key features of the innovative engineers need not only the analytical ability, practical ability, creativity, communication skills, but also business and management skills, ethics and lifelong learning ability. As to China, we also need to cross the comprehensive ability of theory and practice and multi-disciplinary knowledge.

## III. TRAINING OF INNOVATIVE ENGINEERS

Innovative engineers as the backbone of Industrialization, informatization and the process of urbanization, all countries are actively exploring the training mode of innovative engineers. In western countries, the widespread use of the technology model, technical positions targeted training; this mode is well

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adapted to the needs of the western society on the engineering and technical personnel, to make a positive contribution to the development of the West. However, because of multiple factors such as the uneven development of various industries, the development of the East and the West are not synchronized in our country. Therefore, we should explore the training mode for engineering and technical personnel by our own conditions, in this regard, we propose to engineering and technical training as a platform for research and development, innovation and marketing needs for the module and time needed to expand the innovative engineer training mode (see Fig. 1). Different with the traditional mode of teaching platform add-on modules the innovative engineer training model focuses on the intersection between the platform modules, and module to encourage the training of engineers with multiple modules background composite.

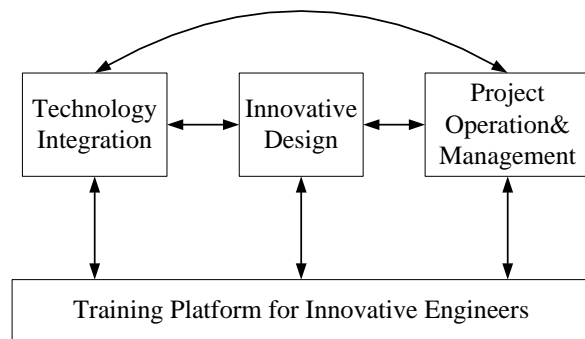


Fig. 1. Training Platform for Innovative Engineers

#### A. Establishment for Innovative Platform of Engineer Training

The theoretical teaching of the innovative engineer training platform is the foundation, and the universal significance of the technology practice for each module is the key. Here the theory of teaching should focus on the cultivation of students' engineering skills, For example, we can do our knowledge teaching combined with the development planning of state, such as Radio Frequency Identification (RFID) based on Internet of things, construction building structure on high-speed railway. Technology practice is above the experimental teaching, and practice teaching should be for clear objectives. This is mainly reflected in the increase of the proportion of integrated design experiments, and requests the instructor on the design of the experimental teaching, it should be based on the current social development on the technical requirements, and updated on a pilot project in a timely manner, so that the students will be able to understand the significance of the course better, to increase interest in learning. In addition, teachers should also reform evaluation methods according to the course characteristics, such as to replace papers in the form of curriculum design or course papers.

#### B. Innovative Engineer Training by type of demand

According to the process of industrialization and

informationization in China, on the basis of summarizing the existing social engineering and technical personnel, combined with the national conditions, the innovative engineers training is divided into three categories, specifically: types of technology integration, creativity and engineering business management. The following three categories of engineering talents are introduced.

#### 1) Training of Technology Integration Innovation Engineer

Technology integration innovation engineers are desperately short in the area of technology development in our country. The key of such engineer training lies in the intersection of the multi-disciplinary knowledge. Engineers should be able to integrate a number of areas of cutting-edge technology, to solve the problems encountered in practice, and to be innovative reuse on this basis. Accordingly, in the training process, we should not be sticking to the professional content itself, and we should to adopt the materials of multi-range of relevant professional content, encourage students to multi-disciplinary course, even interdisciplinary courses. To minor, participate in relevant discussions of the task force to broaden their horizons to develop the ability to solve practical engineering problems.

#### 2) Training of Innovative Design Innovative Engineer

Product Creative Design is the soul of the manufacturing sector; it can bring enormous benefits for business. Mr. Lai said: "Creativity is to see new possibilities, and then the combination of these possibilities in the process of the work." Creative consists of two main aspects: the idea-oriented and implementation-oriented, "Looking" and "Liberation" two-oriented creative work in a deeper level described above. Therefore, the key is the ability of innovative design in the training of such engineers, and our courses should be able to mobilize the interest of students, to stimulate students' inspiration, according to the depth of humanities education, to bring up a good aesthetic.

#### 3) Training of Project Operation and Management Innovation Engineer

Project operation and management innovation engineer should possess a strong entrepreneurial and market ability, and can analysis on market requirements, then promptly adjust business strategy to enable enterprises to be invincible. In the training process of such, engineers should run entrepreneurial thinking through the courses, emphasizing the sensitivity of the market reaction, so we should encourage students to participate in the "Challenge Cup", "Entrepreneurship Competition" game, so as to overcome the disadvantage of students in entrepreneurship, through practical exercise to develop students' entrepreneurial abilities.

#### C. Cross-promotion in a Module

The platform add-on modules of innovative engineer training encourages cross promotion between modules. The three types of modules have their own characteristics and

training purposes, for the three different types of requirements respectively; but if we just stick on the respective modules, it will limit our horizons, sometimes leading to solve the problem not by the best way. Therefore, we should not only encourage to learn from each other between the three types of modules, cross-exchange to produce new modules for the specific needs of the community, and encourage exchanges between the platform and the module, to the needs of the community module, reverse enhance the platform. The eventual realization: platforms to best meet the needs of the module, the module to best meet the needs of the community.

#### *D. The Growth of Innovative Engineers*

The growth of innovative engineers have long-term and team characteristics, therefore, in the training process, the concept of lifelong learning should be running through them, to develop students' self-learning ability; in addition, to develop students' teamwork thinking through the quality of development and the establishment of the task force. This requires us to focus on course systematic, scalability in the teaching process, so that students can along a direction of the subject, do lasting learning and research. In addition, we should encourage the working engineer innovation ability retraining, this is a manifestation of life-long learning, and also is an effective way of practicing engineers to open up horizons of knowledge. The project teams are organizational forms widely used in the modern enterprise management, this way to combine traditional teaching that is chaired by the instructor in teaching and learning by the students under the guidance of autonomous and independent discussion, in order to improve the students' sense of teamwork.

#### IV. SUMMARY

Innovative engineers as the backbone of the modernization, and its training has become one of the important components of the national long-term talent strategy. The rapid development of this stage of

industrialization, innovative engineer training is both an opportunity and a challenge. As universities, especially the application of institutions, it should first study the social demand for qualified personnel, and timely adjustment of the course structure, combined with the characteristics of innovative engineers, individualized, to apply what they have learned to achieve seamless cultivating and social needs.

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