

Practice of CDIO Engineering Education Model in the Process of Implementation of Excellence Program

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Abstract—The plan for educating and training outstanding engineers is higher education strategic planning of our country put forward in 2010, aims to solve the practical problems of talents in China's Higher Engineering Education in the training, to cultivate students' engineering practice ability, ability of engineering design and engineering innovation ability, and the CDIO engineering education model perfectly fit the training goal of excellence program. This paper takes the higher engineering education as the research object, combined with the implementation of the plan of professional excellence in the CDIO engineering education model, study and explore the ways and methods can improve the quality of education of professional engineering excellence program.

Keywords—Excellence plan; CDIO; Higher engineering education

I. THE IDEA OF EXCELLENCE IN ENGINEERING EDUCATION TRAINING PLAN

The plan for educating and training outstanding engineers is higher education strategic planning of our country put forward in 2010, according to the present situation of Higher Engineering Education in China, it puts forward a complete set of mechanism, strengthen the higher engineering education standards, the goal and model. Excellence program more emphasizes the unity of engineering education and service of national development strategy, and the relationship of close cooperation with industry engineering education, pays more attention to the cultivation of students' comprehensive quality and sense of social responsibility, and the cultivation of international engineering talent. In the implementation of the excellence plan, the new mechanism between the higher schools and the industry enterprise, and joints personnel training mode wants to be set, training requirements to strengthen engineering ability and creative ability as the key personnel wants to be reformed, reform and perfection the project of teacher appointment, evaluation system of engineering education are required, opening to the outside world wants to be expanded, and the standards of talents training wants to be formulated by the educational circles and industry circles jointly.

Excellence program points out the direction for China's higher engineering education, clears the goal of our higher engineering education to achieve, that is, to strengthen the active service industries and enterprises demand of national strategic needs, the active service consciousness, to establish the comprehensive development of talents training virtue first

and emphasizing on the ability, to innovate the joint personnel training mechanism of college and industry enterprises, to reform the personnel training mode of engineering education, to enhance the ability, innovation ability and international competitiveness of the engineering practice of students, to build one higher engineering education system in which the layout is reasonable, the structure is optimized, the types are diverse, the contents is adaptive to the socialist modern higher engineering education system needs of economic and social development, the mode has Chinese characteristics.

So, how to implement the better program of excellence in higher engineering education idea? How to speed up our country to the engineering education power forward? This needs that the higher engineering education in China should be based on the summary of the historical achievements of engineering education and the successful experience of other countries for reference, further emancipate their minds, update ideas, deepen reform, accelerate development, and clear the strategic focus of China's engineering education reform and development.

II. THE TRAINING OBJECTIVES REALIZATION OF EXCELLENCE PROGRAM UNDER THE CDIO MODE

As an innovative pattern of international higher engineering education today, CDIO (C-Conceive design, D-Design design, I-Implement implementation, O-Operate operation) , which is advocated by the international top industrial university, the idea of a set of engineering education and the establishment and implementation of the system, has great significance for the reform of our higher engineering education. According to the serious out of line for theory and practice of our country's present in higher engineering education, engineering practice ability of the students, including a professional academic knowledge, lifelong learning ability, team communication and large system control ability, is trained through four links which are conceive, design, implementation and operation respectively under the CDIO higher engineering education mode, and the CDIO mode completely fits the excellence plan to achieve the expected.

One of the goals of excellence program is to industry oriented, facing the world and the future, cultivating a large number of various types of high quality engineering and technical personnel with innovative ability, adapt to the needs of economic and social development, laying a solid advantage of human resources to build an innovation oriented country, to

implement the industrialization and modernization and to enhance the core competitiveness of China and the comprehensive national strength. Industry oriented, is to cultivate the talents according to the actual modern industry and engineering requirements. In the process of personnel training, practical principle should put into effect, getting rid of completely on the book teaching, the pure theory of training mode. Facing the world is to cultivate such engineering and technical personnel who are overall and have the whole world in view, and in turn as the turning point, to promote technological power and the core competence of industrial production in China increased, to accelerate the realization of a modern and powerful socialist country power dream. Facing the future is to cultivate such engineering and technical personnel with the courage to explore and innovate, with a strong forward-looking sense, so to promote the technology progress of our country constantly, not only to catch up with the advanced world level in the science and technology, but also to become the leader of science and technology progress. The core idea of excellence program is to cultivate such technical personnel with powerful engineering and innovation ability, and to cultivate students' innovative spirit and consciousness ahead in the specific engineering practice of CDIO. Visible, CDIO is training model of excellence plan put into practice.

The second goal of excellence program is through the implementation of such a plan to promote the engineering education reform and innovation, and comprehensively improve the quality of engineering education and cultivation of talents in China, construct a socialist modern higher engineering education system with the advanced level in the world and Chinese characteristics, promote our country from a big country to a powerful nation in engineering education. If the higher engineering education can achieve the goal of training, the core lies in whether a set of relatively complete system of engineering education. According to the present status of our higher engineering education, the engineering education system is quite weak. It is because of this, it led to that some engineering and technical personnel of higher education theory is divorced from practice, weak in engineering consciousness, and even harm competent industrial field work as required. CDIO engineering education mode advocated by the international top industrial university is such an idea with a set of system of engineering education and implementation, which has a very similar culture concept to the plan of excellent engineer education and China's culture. Of course, the establishment of engineering education system for excellence program cannot completely copy the CDIO. But the education system of our excellence program in engineering can integrate into our elements on CDIO basis. And then, in the continuous exploration and seeking process a modern socialist the higher engineering education system with the advanced level in the world, Chinese characteristics and suitable for the situation of our country can be set up.

III. EASE OF USE PRACTICE OF CDIO ENGINEERING EDUCATION MODEL IN THE PROCESS OF IMPLEMENTATION OF EXCELLENCE PROGRAM

Based on the background of higher engineering education, CDIO engineering education is a kind of effective higher

engineering education mode through years of practice and test, and adopted by many international education organization. However, how to practice the idea of the system education and the comprehensive ability cultivation in excellence program is worth thinking problem to every engaged in higher engineering educators. The author thinks that the following attentions should be paid during putting CDIO engineering education model into practice in the process of implementing the project for excellence.

A. *It Should Highlight the CDIO Mode of Practice and Innovation Spirit of Excellence in the Implementation of the Plan*

Practice is the sole criterion for testing truth, which is one of the concept of the outstanding program implementation, but also the CDIO philosophy of engineering education, the quality of high-quality talents cultivation is generally be confirmed through practice and social recognition. The theory of classroom teaching is the future development of power source of the indispensable for college students, and the cultivation of practice ability just by classroom teaching theory cannot be achieved, so, how to effectively use the theory teaching to improve the practice ability is a very important ring for the teaching design, here, including both the conceive, namely C, and the design, that is, D. Another important training goal of excellence program is to cultivate student innovative ability. The college students received higher education must have the ability of independent thinking, keen observation, scientific thinking and the ability to continue to pursue new knowledge, and the training of such innovation ability cannot be done without the engineering practice. The problems can only be found and solved in the design and practice process, thus, the improvement of the innovation ability of college students can be realized in the this gradual process. As a qualified college students, he or she should have not only the ability to utilize the knowledge master engaged in design work, but also good innovation consciousness on the basis of this, it is also one of the important goals of engineering education. In communication engineering specialty as an example, communication theory teaching is abstract and boring. However, if the actual engineering realization scheme of even one or several diagram is introduced to explain in the block diagram of communication system, the students can get great inspiration, because they know how the knowledge learnt before is used in engineering practice to solve practical engineering problems.

B. *Excellence in the Implementation of the Plan Should Strengthen Practice Teaching*

Practice teaching is the effective assurance for the implementation of excellent program, thus the practice teaching must be strengthened in process of excellence program implementation. While the CDIO education mode is to emphasize students learn and master knowledge in the implementation and the operating process, namely I and O. General in the personnel training plan, practice teaching is part of the determined, and strengthening practice teaching to cultivate alone in the plan is not scientific. But the practice teaching and extra-curricular activities can not only make the students deepen the knowledge, but also be a good education mode for understanding of society, culture taste, enhance

practical ability, thereby, training the students to create, to promote their own experience, and to find their own ability, to do to learn in order to practice these for excellence, and it is very important for the plan to implement. However, in addition to academic lectures and participate in the social practice organized to guide students to participate in the teacher's scientific research project, the practical teaching should also be strengthened in the course of theory teaching. Still in communication engineering specialty as an example, a complete communication system is as the research object in the theory teaching of communication system, and the content in theory teaching is in block based. However, if one or several diagram layout for homework, and students were asked to design and realize the actual scheme, this will greatly stimulate their curiosity and enthusiasm for learning in the process of design and practice. At the same time, in the design and practice of the process, students can encounter a variety of practical problems to overcome and solve. In this way, through a complete training process, students can consolidate the learned knowledge, stimulate their subjective initiative in learning, enable them to solve practical problems in the face and in the process, broaden their horizons, enhance the use of the knowledge to analyze and solve practical the question ability, and enhance their awareness of innovation, cultivate the spirit of innovation, and learn to unity and cooperation, to cultivate college students' team consciousness and the team spirit.

C. *School Enterprise Cooperation in the Implementation of the Plan of Excellence*

The school enterprise cooperation should be emphasized on more because improving the college students' engineering ability is the main training objectives of excellence plan. Seeing is usually the main content for the traditional enterprise practice, and such the result is often counterproductive. While I and O in CDIO education model are the two links of higher engineering education clearly pointed out. In reality, because of the limit of conditions and circumstance, not every one of the higher schools have school enterprise cooperation condition. In this case, school run enterprises has become the best choice for students of business practice. Whether in school run enterprises or in the non - run enterprises, as long as it can let the students in the enterprise truly do the actual operation, such as telecommunications component screening, welding, assembly, testing, aging, the students can learn from and learned many knowledge and skills which is cannot imparted in the classroom. In the school enterprise cooperation mode of teaching knowledge is imparted, skills are developed as well, and combining the system integrity of industrial production processes with specialized knowledge together, only considering the systematic of the subject and theoretical teaching knowledge in the traditional teaching is broken. Of course, the school enterprise cooperation mode of this kind of teaching method has put forward higher requirements for teachers, the teachers should not only impart professional knowledge, but also can teach personal engineering experience, in other words, only the double type teaching can be competent for this teaching job. Students will get great improvement in the ability of the individual engineering quality, team work ability, communication ability, collaboration of construction products and systems through school enterprise cooperation

mode. Through this teaching method, teachers can more effectively help the students apply the professional knowledge in engineering practice, so as to meet the job requirements to prepare engineers.

D. *To Improve College Students' Innovative Thinking through the Classroom into Engineering Problems*

Over the years, emphasizing the students' innovative consciousness is always constantly thinking things for the higher engineering education. However, how to cultivate the students' innovative thinking effectively is public opinions and divergent. Through the experience of many years of higher education, the author summarizes a more effective way to improve the students' innovative thinking consciousness, and that is the way of engineering problems introduced in the classroom. For example, in the theory teaching of the communication system in communication engineering specialty, according to the needs of teaching contents, several engineering problems could be put forward for college students thinking, such as: how to realize the comparison decision circuit, through which type of circuit to obtain the local carrier, how to restore the bit synchronous signal, and by what means to recover the frame synchronization signal, etc.. With these questions, the students can go to the library, to the network, through a variety of ways to query and search for the answer. In this process, the students deepen the impression of the learned knowledge, broaden their horizons. More importantly, in this process, the students' innovative thinking can get the potential for ascension.

IV. CONCLUSION

Excellence program pays more attention to the service of national engineering education development strategy, pays more attention to the close cooperation of higher school and industry, pays more attention to the cultivation of students' comprehensive quality and the sense of social responsibility, and pays more attention to developing the international engineering talents. While the CDIO model is to organize teaching according to the whole life cycle engineering project requirements, learning, doing. It highlights the relevance between the courses, and avoids unnecessary repetition, so that students can master the knowledge of the contact between the various courses, and use the knowledge to solve practical engineering problems. Obviously, excellence program training objectives can be achieved through the CDIO engineering education mode, training objectives and the use of CDIO engineering education model can achieve the excellence program training goal. The social responsibility the higher schools should bear is to cultivate the engineering and technical personnel of high quality using the limited educational resources. The program of excellence put forward points out the direction for our country's higher education of engineering, while CDIO engineering education mode provides higher engineering education modes of mature. As long as the education target proposed by excellence program is conscientiously carried out, the CDIO education mode must be as a booster to promote the China's higher engineering education personnel training quality to a new height.

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