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The Engineering-based Customized Talent Cultivation Mode and Its Teaching System Reform

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Abstract

With the establishment of the modern industrial system in China, the higher technological education should be changed largely from the schooling management, the educational concept, the target of talent cultivation and the mode of education teaching. The connotation of the engineering-based customized talent cultivation mode is completely explained, and the basic guidance idea of the engineering-based customized talent cultivation mode is established and the teaching system reform of the engineering-based customized talent cultivation is researched in this article.

Keywords: Engineering-based talents, Customized talent cultivation, Teaching system

With the continual development of the market economy system reform, the employment market of the college graduates is largely changed from original "distribution in a unified way" to "independent option and two-way choice", which is a drastic bold and resolute reform in the higher education system of China. The market economy puts forward new requirements for talents' adaptability and competitive strength, and the establishment of the modern industrial system in China will also largely require the change of the higher technological education. The engineering-based customized talent cultivation mode will be the profitable development direction of Chinese higher engineering education.

1. The actual necessity to create the engineering-based customized talent cultivation mode

1.1 The popularization of higher education and the reform of market economy more highly require higher technological talents' adaptability and competitive strength, and the technological college students' structured "difficult employment" appears increasingly

The higher education scale of China had achieved 29.07 million up to the late of 2008, and the gross enrollment ratio was 23.3%, and the higher education of China had quickly completed the transformation from elites to the masses. With the quick development of higher education, the problem of university students' employment is more and more serious, and the college graduates of China will achieve 6.52 million in 2010, and about 40% of them are engineering students, and the structural deviation between the higher technological talents needed by the enterprise and the technological college students cultivated by colleges has occurred, and the technological college students' "employment difficulty" increasingly appears. In the dual transformation background of the popularization of higher education and the reform of market economy, the higher technological education should be changed largely from the schooling management, the educational concept, the target of talent cultivation and the mode of education teaching, and the main cultivation target of higher technological education must be turned to applied talents with occupational quality for the industry, which is the mission endowed by the time to the higher technological education, and the engineering-based customized talent cultivation mode is the effective approach to complete this mission.

1.2 Deep crisis of Chinese engineering education: the quality problem of the engineering education

According to "The Global Competitiveness Report" issued by the Switzerland International Institute for Management

Development, in 2006, the amount of R&D personnel of China ranked second in the competitiveness ranking of 49 countries and regions in the world, but the acquirement degree of eligible engineer ranked 49th (the last one). For China with about 30 million engineering talents, the quality problem has stared it in the face. The survey of the employment enterprises showed that about 300 thousands new "professional persons with high levels" universally lacked in features and individualities, whether the graduates from prestige universities or whether the graduates from common engineering colleges, all have bad practice ability and narrow specialty view, and lack in experiences to solve practical problems. In the day that the competition is more and more drastic, the competitive focus among enterprises has turned to the talent competition from the competition of scale and quantity, and after thirty years' reforming and opening, the identified ability of employment enterprises is better and better, and their requirements about talents are more and more strict, which partly is because of the influence of the enrollment increase, and partly is because of the deficient competitiveness of Chinese technological graduates and the quality of engineering education of China.

2. Connotation of the engineering-based customized talent cultivation mode

Based on relative theories about higher technological education and talent cultivation, the connotation of the engineering-based customized talent cultivation mode can be defined as the systematic integration of a series of education thoughts, education concepts, cultivation targets, course system, practical systems, cultivation process, cultivation methods and education management system established to cultivate the engineers working in R&D, product development, design & marketing, manufacturing, operating and repairing, and face one domain or industry.

2.1 Connotation of the talent cultivation mode

There is no a fixed definition about the talent cultivation mode at present. Therefore, based on general principal of relative mode, the talent cultivation mode can be generalized as such a concept, i.e. the so-called talent cultivation mode is the systematic integration of educational variables such as cultivation target, business standard, cultivation process, cultivation method and education management system under certain guidance of education thoughts or education concept, and it is the basic reference to establish the teaching scheme or the teaching plan. The talent cultivation mode generally has comprehensive, special and generalized characters, and it can answer two basic problems, i.e. "what talent should be cultivated" and "how to cultivate talent". In a word, the talent cultivation mode includes many predominant characters of the direction of the talent cultivation of colleges.

2.2 Connotation of engineering-based talents

At present, Chinese talent scholars and educational theory staffs have basically achieved the commonsense abut the research of the talent type. In the domain of industry, according to the social function of talents, talents can be divided into four types, i.e. academic talents, engineering talents, technology talents and skill talents. The academic talents mean those talents who mainly engage in theoretical researches to develop relative theory and deeply discuss relative practical issues in the practice. The engineering talents mean those talents who mainly turn scientific principles to the design, working plan or operating decisions of the engineering or product, i.e. they mainly engage in relative design and planning, complex technology and management works. The technology talents mean those talents who work in the front line of production or the work locale to figure for direct benefits for the society, can turn the engineering talents' or decision-makers' design, planning and decisions to the form of substance or produce concrete function to the society. The difference between the technology talents and the skill talents is that the latter mainly depends on the operation skills to work, and various skill-type talents and operational-type talents all belong to them. The latter three sorts of talent are called as the application talents. According with the cultivation of talent type, there are four different educations at present, i.e. the academic education, the engineering education, the technical education and the skill education.

2.3 Connotation of customized talent cultivation mode

The customized talent cultivation is not a new topic, and the "order-form" talent cultivation was the most popular concept in the past. The "order-form" talent cultivation means the cultivation mode that colleges confirm some enterprises and public institutions with special talent demand as the cooperative partners based on sufficient survey, and both sides sign the talent consignment cultivation contract together on the bases of equality and mutual benefit, and colleges implement directional cultivation in the regulated time according to the talent standards in the contract, and offer eligible "order-form" talents for the enterprises and public institutions. In the cooperation between industry and school of the knowledge economy time, the role of modern higher education in the talent cultivation should far exceed the limitation of "order-form" talent cultivation to concrete enterprises and posts, and become the cultivation of talents' working ability in certain one domain or industry. Therefore, the difference between the "customized" talent cultivation and the "order-form" talent cultivation can be understood as that first, the corresponding property between the talents cultivated by the former with the concrete posts is more wider than the latter, and the former will face a post group, second, the cooperation domain of the former is wider than the latter, and the former is the cooperation between industry and school, and the latter is the cooperation between enterprise and college. The "customized" talent

cultivation more emphasizes the application talent for one domain or industry, and in the customized talent cultivation mode with the cooperation between industry and school, relative personnel in several enterprises of certain domain or industry will join the establishment of the talent cultivation target of higher colleges and the practice teaching by the form of part-time teacher, and colleges can establish stable relationships such as the practice and employment base with several enterprise, and the practice base may be the employment base, and not only these enterprises can offer the talent demand information and the practice education locale for colleges, but also the industrial personnel will participate in and guide the practice teaching of higher colleges, and the talent cultivation can be implemented by the "dual channels" including college and industry.

3. The basic guidance idea to establish the engineering-based customized talent cultivation

3.1 Strengthening the engineering education, intensifying engineers' basic training and advocating the CDIO concept of engineering education

The engineering education is the most important quality-oriented education in the higher technological education. To cultivate the engineering talents whether emphasizing particularly on the engineering technology type or the engineering science type, or whether emphasizing particularly on the engineering management type, the engineering education should take the engineering practice as the base to cultivate the talents with strong engineering consciousness and technical background. The CDIO (Conceive - Design - Implement - Operate) engineering education mode is the new result of the international engineering education reform in recent years. Up to now, tens of global famous universities have joined CDIO, and their departments of mechanics and the departments of aerospace engineering have completely adopted the engineering education concept and the teaching program of CDIO, and achieved good effects, and the students cultivated by the CDIO mode were very popular by the society and enterprise. Colleges could take CDIO as the background of engineering education, and cultivate engineering students to possess the knowledge, ability and quality about survival and growth in the advanced engineering environments (AEEs), and attempt taking the "project execution" as the organizational principle of the engineering practice education, and cultivate students' communication ability and the grasping consciousness and ability of multidisciplinary and large scale system, and spread the relationship between teachers and students from teachers' single-directional knowledge instruction to the alternative learning based on problem settlement, and lead students' learning giving priority to knowledge inheritance to the learning of actively exploring unknown things.

3.2 Intensifying the practical teaching part and enhancing students' engineering practice ability

The higher technological education gives priority to cultivating applied engineering technology talents, and engineering talents' practice ability emphasizes the design ability, the product development ability, the production organization and operational management ability, and it requires the integration and all-in-one of the teaching part and the practice part, and give prominence to the comprehensive application ability and the engineering creation ability of engineering technology. The practical teaching should be predominantly embodied in the teaching scheme, such as, increasing the period proportion of practical teaching course, establishing comprehensive and designed experiment items, strengthening practice, course design, diploma project, and teaching organization, and building relatively independent experiment teaching system, practical teaching system and design teaching system.

3.3 The cultivation target is guided by the need of the engineering talent market, and takes the post group of professional engineer as the standard of occupation development

The innovational talent cultivation mode should actively adapt the economic development demand of the socialism market economy, take the demand of the engineering talent market as the direction, take the post group of professional engineer as the occupation development standard, and integrate knowledge transfer, ability strategy and quality improvement, and the engineering customized talent cultivation target should be confirmed. Colleges should closely grasp the core issues of the college students' engineering practice ability cultivation in the higher engineering education, establish reasonable professional talent knowledge structure and intellectual structure, and cultivate the superior engineering technology talents who grasp he modern knowledge of science and technology, possess the innovational spirit, and could engage in production, design, technology development, business management, product change and marketing management in relative domains.

4. Establishing the teaching system reform of the engineering-based customized talent cultivation

4.1 Planning and adjusting the subject course system in the modern engineering environment

Colleges should plan and integrate various courses, establish and organize the new course system surrounding the subject. According to cultivation target, colleges can use the CDIO standards to design and plan the cultivation scheme, course system and teaching requirements. In the new revised undergraduate cultivation scheme, the subject system should be emphasized, and colleges could consider the demand of specialty system, and place students' engineering subject education in the modern engineering background in the theoretical education and the practice education, and bring the modern engineers' quality cultivation with students' specialty base knowledge into the teaching construction

of theoretical course and experimental courses. By the adjustment of courses such as elementary course, specialized fundamental course and professional course, combining with many teaching parts such as experimental course, productive practice, graduation practice and diploma project, colleges should emphasize the instruction of the engineering technology knowledge principle and the technical reasoning and tamp students' specialized fundamental knowledge, emphasize the introduction of modern engineering science and technology development and the introduction of multi-subject engineering applied knowledge to make students to know wider basic science principle (wide caliber), emphasize the integration of engineering products/ systematic lifecycle to cultivate students' ability of CDIO. At the same time, colleges should reduce the class hours to ensure students to have more time of independent learning, and let more students to participate in the research plan, the seminar course, and the scientific activities for college students, and pay attention to lead students to cultivate their ability of independent learning, their ability of team communication and cooperation, and their ability of system control.

4.2 Establishing the teaching environment of experience learning

Colleges should set up the engineering practice theory course and the experiment course, establish the project plan of "college student science and technology innovation funds" applied by the form of student team, organize the learning and discussion activities in the comfortable and pleasure atmosphere, establish the theoretical and practical guidance courses about the college student science and technology innovation activities, organize various training lectures of science and technology competition, organize student teams to participate in various science and technology contests after school, and offer the environment of show and communication for students' learning and results. By above designs of the CDIO activity teaching environment, students can experience and develop the whole process and learning of CDIO of the product/system effectively in the environment of team cooperation and modern engineering activity, and students' spirit of team cooperation of survival and growth in the modern engineering environment and their control consciousness and ability about new product, new flow and new system, and their ability of communication can be cultivated.

4.3 Exploring non-traditional learning evaluation method

The instructional testing, the traditional method which is used to evaluate students' learning, is to generate the evaluation of complete proficiency of certain part of knowledge in this course by certain reasonable mode with the testing function such as testing the basic knowledge and the basic steps. However, for engineering students, it is very important to grasp various complex knowledge and skills and achieve a level. The thought of CDIO advocates "real judgment", because the engineering education needs to simulate the real world, but this world should be faced by students when they leave the course education, and man high-level cognitions required by the modern engineering environment can not be tested and predicted only by traditional teaching testing method. The traditional learning evaluation method is still important, and many non-traditional learning evaluation methods such as self-evaluation, peer assessment, oral testing, learning record, work show and paper publishing should be combined. The learning evaluation is not an isolated behavior, and the result of learning evaluation should be fed back in time to adjust the curriculum provision and teaching method.

4.4 Collaborating between industry and school, and establishing the engineering technology education training system with society and enterprise

To make the cultivated engineering application talents to adapt the demand of the society and the economic development, colleges should strengthen the association with the society and enterprises, and often organize teachers to go deep into the forefront of engineering production, and survey the demands of employment enterprise for engineering applied talents' knowledge, ability and quality, and establish the professional teaching guidance committee with enterprise personnel, and retain enterprise leaders or engineering technology personnel to participate in the teaching reform, guide the course design and the diploma project to increase the pertinence of the engineering technology education. And colleges should also actively associate with enterprises, and establish stable practice and training base, and strengthen the cooperation with enterprises.

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